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Quels évènements influencent la capitalisation boursière des entreprises de la Défense ?

Résumé: Cet article vise à mesurer l'influence relative de différents types d'informations sur le cours boursiers d'entreprises du secteur de la Défense, au moyen d'une étude d'évènements systématique sur 58 grandes entreprises de la Défense, sur la période 1995-2005. Dans un premier temps, nous identifions les rendements boursiers anormaux statistiquement significatifs pour chaque entreprise. Dans un second temps, nous procédons à une recherche d'informations susceptibles d'expliquer ces rendements anormaux. Nos résultats montrent que les cours boursiers des entreprises de la Défense sont affectés, comme ceux des autres secteurs, par les annonces de bénéfices et de résultats, par la publication de recommendations d'analystes, *etc*. Le secteur de la Défense possède toutefois plusieurs spécificités, puisque les évènements géopolitiques, les informations liées aux contrats, et celles liées aux opérations de fusion-acquisitions pèsent d'un poids particulier sur les cours de ces entreprises.

Mots-clés : Etude d'évènements, marchés financiers, secteur de la Défense, publication d'informations, modèles GARCH.

Classification JEL : G14, G34, L64.

What Drives the Market Value of Firms in the Defense Industry?

Abstract: This paper investigates the relative importance of different types of news in driving significant stock price changes of firms in the defense industry. We implement a systematic event study with a sample of the 58 largest publicly listed companies in the defense industry, over the time period 1995-2005. We first identify, for each firm, the statistically significant abnormal returns over the time period, and then we look for information releases likely to cause such stock price movements. We find that stock price movements in the defense industry are, in many ways, influenced by the same events as in other industries (key role of formal earnings announcements or analysts' recommendations) but this industry also has some specific features, in particular the influence of geopolitical events and the relevance and frequency of bids and contracts on stock prices.

Keywords: Event study, financial markets, defense industry, information releases, GARCH models.

1. Introduction

This paper investigates the relative importance of different types of news in driving significant changes in firms' market value in the defense industry. Many studies place great emphasis on the changing nature of the defense industry. Since the end of the Cold War, almost all defense firms have been affected by liberalization and far-reaching structural changes and concentration processes, and one can argue that defense firms have now lost their singular status. However, some specific features of the defense industry remain: the oligopoly structure of the market, the close relationships between defense firms and governments, the key role of public budgets devoted to military expenditure, the high level of R&D, the influence on firms of geopolitical events, *etc*.

While many studies focus on the specificities of the defense industry (see, for instance, Markusen and Costigan, 1999; Susman and O'Keefe, 1999), none of them, to our knowledge, examine this issue from the financial market point of view. But as financial markets play an increasingly significant role in resource allocation, there is a need for a better understanding of investor behavior vis-à-vis the defense industry. Therefore, this paper attempts to contribute to the debate by addressing the following question: are the specific features of the defense firms important from the investor point of view? In other words, does the stock market react differently for defense firms than for other firms?

In particular, we analyze the relative impact of rumors, formal announcements, and unforeseeable events on the stock returns of defense firms. We study also whether investors in defense firms react more to firm-specific news or to general news (geopolitical instability, announcements of military expenditures, *etc*.), and whether they react more to financial or to industrial concerns. We finally assess the relative significance of seventeen categories of news (news related to bids, earnings, company restructuring, new contracts, *etc*.) in driving the market value of defense firms.

Given our goals, one would conduct a standard event study. Event study is a tool widely used in finance to investigate the reaction of the stock market to a specific type of news or event (such as mergers, seasoned equity offerings, earnings forecasts, *etc*.). However, we cannot adopt the traditional event study methodology, focusing on a single or even several *a priori* defined types of news because there is no way of being sure to capture the news items that are the strongest stock price movers, all the more so since the defense industry is expected to be

specific. In addition, the results would always be conditional on the initial definition of the categories. We therefore adopt a different research design, based upon a new methodology, following Ryan and Taffler (2004). With this approach, we are not constrained by an *a priori* determined set of information events. We first identify, for a given firm, the statistically significant abnormal stock returns over the time period. We then look for for information releases likely to cause such abnormal returns, focusing on the largest variations (the five largest increases and the five largest decreases). On the methodological side, the contribution of this paper is twofold: we consider time-varying beta estimates by implementing rolling regressions and we use a GARCH process to model the volatility.

Our main results can be summarized as follows. First, changes in the market value of firms in the defense industry are, in many ways, driven by the same forces as in other industries. The most important news categories for explaining abnormal returns are roughly the same (earnings announcements, analysts' recommendations, etc.), and one third of the largest significant stock price changes are not related to an information release (i.e. are unexplained), which is consistent with the results of Ryan and Tafler (2004) on a broad sample of firms. Nevertheless, three specific features of the defense industry must be underlined: i) The high frequency of bid-related news: nearly 15% of our sample of the largest abnormal returns are related to such announcements. ii) The relevance of geopolitical events: 8.1% of our sample of the largest abnormal returns is due to such events. iii) The importance of public military spending: 5.4% of our sample of the largest abnormal returns is driven by this type of news.

The paper proceeds as follows. The next section (section 2) presents the sample selection, while Section 3 is about methodology. Section 4 provides both a quantitative and a qualitative analysis of our results. The final section serves as the conclusion.

2. Data

The first step in conducting the study is to define the sample of defense-related firms. In order to have a representative sample and to avoid any selection bias, we start with the 2003 edition of the "World Top 100 Defense Firms", a ranking published annually since 1991 by Defense News Media Group, a subdivision of *Army Times Publishing Company*. The ranking is based on annual defense sales. The average defense revenue is about USD 2.4 billion and the

standard error is above USD 5 billion (see Table 1 for descriptive statistics). The biggest defense firm is Lockheed Martin[1]; its defense revenue is more than USD 30 billion. At the other end of the spectrum, Baltiisky Zavod has defense revenue of USD 260 million. If US firms represent nearly half of the population (42 firms out of 100 and 5 of the top 6), firms from 18 other countries also figure in the ranking: 19 firms from continental Europe, 11 from the UK, 8 from Japan, 7 from Russia, etc. US firms also account for nearly 2/3 of the total defense revenue (USD 160 billion), followed by UK firms (27 billion).

In order to obtain a coherent sample for our study, we apply some exclusion criteria. As we are only interested in publicly listed companies, we drop out of the sample:

- fully and partly state-owned firms (6 firms: DCN, Israel Aircraft Industries, GIAT Industries, Ruag Suisse, Rafael Armament Development Authority, Israel Military Industries);
- family-owned firms (2 firms: Krauss-Maffei Wegmann and Diehl Stiftung);
- firms with one dominant shareholder or with a low (below 25%) free float rate (3 firms: IZAR Construcciones Navales, Fincantieri, QinetiQ).

As a second criterion, we drop out of the sample all firms with defense revenue below 10% of their total revenue in 2003 (10 firms: General Electric, Bechtel Group, Mitsubishi Electric, Electronic Data Systems, NEC, Ericsson, Toshiba, Komatsu, Ishikawajima-Harima Heavy Industries and Fuji Heavy Industries). After these exclusions, 79 firms were left in the sample.

We use daily stock returns for each firm. The stock prices series are extracted from Datastream (Thomson Financial). After dropping 21 firms[2] for which no data was available in Datastream, we were left with the 58 firms that constitute our sample. The time period extends from January 1995 to May 2005. Stock prices are adjusted for dividend payouts and stock splits. The 58 firms are listed in Appendix 1.[3]

[1] The biggest firm overall in the ranking is General Electric but its defense revenue only accounts for 2.3 % of its total revenue (USD 134 billion).

[2] Hindustan Aeronautics, Korea Aerospace Industries, Engineered Support Systems, MITRE, Denel, The Aerospace Corp., ADI, Aerospace Equipment, Battelle, Irkut, Ufa MPO, Tenix Defence, ARINC, Uralvagonzavod, MMPP Salyut, Baltiisky Zavod, Computer Sciences Corp., Science Applications International Corp., Aviation Holding Company Sukhoi and Booz Allen Hamilton.

[3] Additional statistics about stock market capitalization, traded volume, P/E ratio, book-to-market ratio, etc. extracted from Datastream are available upon request.

Table 1. Descriptive statistics

2003 (USD millions)	Initial sample (World Top 100 Defense)			Final sample (58 publicly listed defense firms)		
	Total revenue	Defense revenue	%	Total revenue	Defense revenue	%
Minimum	310	260	1	460	272	10
Maximum	134,200	30,097	100	50,500	30,097	100
Median	1,968	843	51	2,433	1,111	58
Mean	8,575	2,458	53	7,715	3,591	60
Standard Error	16,926	5,040	32	10,752	4,363	26

3. Methodology

We present in this section the general methodology of event studies, then the methodology we adopted, focusing on the distinguishing features of our methodology compared to the traditional one.

3.1. The general methodology of event studies

The event study methodology is designed to investigate the reaction of the stock market to news or events concerning a firm, an industry or the whole stock market. The basic underpinning of event studies is the efficient market hypothesis (Fama, 1969), which states that as new information becomes available, it is fully taken into account by investors assessing its current and future impact. Under this hypothesis, stock price changes reflect the discounted value of current and future firm performance. Investors' reaction to a given information release (i.e. a news item) can be measured simply by comparing the observed return during a given time period following the event to the expected return in absence of any event; this difference is called the "abnormal return". If investors react (un)favorably to an event, we would expect (negative) positive significant abnormal stock returns. The strength of

the event study approach is that it is based on the overall assessment of many investors who quickly process all available information in assessing each firm's market value.

Event study methodology has been widely used in finance (see Brown and Warner, 1985; MacKinlay, 1997; Binder, 1998; Kothari and Warner, 2005). Kothari and Warner (2005) list more than 565 event studies published between 1974 and 2000 in the 5 leading finance journals. The number of papers per year increased in the 1980's and has been quite stable since then. For instance, numerous event studies have been devoted to the impact of shares distributions, earnings and/or dividends, mergers, technological accidents, massive layoffs, *etc*.

Two critical points in the conduct of an event-study are: the estimation of the expected (theoretical) returns and the selection of the events to be studied. First, one must use a model to estimate the expected returns for each stock. In general, the market model is chosen. Second, one must be careful in defining the nature of the event and the precise date of the information release, which is not necessarily the event date (Henderson, 1990). Moreover, the choice of news source is important: Glascock, Davidson and Henderson (1987) show that the *Wall Street Journal*, often chosen as the news source, does not publish all the news, and publishes some news with a delay, introducing a bias in the sample. Practically-speaking, a lack of precision in dating and selecting the events can cause a loss of power of the statistical tests of significance (Brown and Warner, 1980, 1985).

Since we want to identify the main type of news driving stock price changes and assess the relative importance of this news, the traditional event study methodology is not really suitable, because we cannot content ourselves with one *a priori* defined type of news. Following the methodology introduced by Thompson, Olsen and Dietrich (1987)[4], with twelve *a priori* categories of news, would not be consistent with our goals: with such *a priori* defined categories, there is no way of being sure to capture the news events that are the strongest stock price movers; furthermore, the results would always be conditional on the initial definition of the categories[5].

[4] Same or similar methodology is adopted by Pritamani and Singal (2001) with seven *a priori* categories of news. See also Cutler, Poterba and Summers (1989).

[5] Another concern with this approach is that the authors consider raw returns instead of abnormal returns, that is they do not take into account the general trend on the market and the idiosyncratic risk of each stock.

3.2. A time varying GARCH event study

In this paper, we adopt an alternative methodology to the traditional one. Instead of conducting our study with an *a priori* defined type of event, we investigate all the abnormal returns for each stock during the time period under study. We then search for explanations of these abnormal returns. The advantages of this methodology are that we can really investigate what kind of news is really driving the stock price movements, without any prior framework, and that we are free from selection bias in the definition of events. We follow a two-step estimation strategy. We first perform a set of rolling regressions to estimate expected returns for each stock and each trading day from 1995 to 2005 and compute the daily abnormal returns. Then, we select the dates where the daily abnormal returns are statistically significant and we search for plausible explanations.

Here we closely follow Ryan and Taffler (2004) (see also Lardic and Mignon, 2002), but we improve their methodology in two ways: we take into account conditional heteroskedasticity, and we implement time-varying estimations.

A market model with conditional heteroskedasticity

For each of the 58 firms of our sample, we apply the following method over a (maximum) time period of 10 years (1995 to 2005). We implement a methodology that incorporates time-varying market risk and time-varying heteroskedastic error structure into the baseline market model. For any stock, the market model is estimated on a 120-day window:

$$R_{i,j} = \alpha_i + \beta_i R_{m,j} + \varepsilon_{i,j} \quad \text{with } j = -120,\ldots, -1 \qquad (1)$$

with $R_{i,j}$ the daily stock return of stock i at time j, $R_{m,j}$ the daily market return at time j, α_i and β_i two parameters to be estimated, and $\varepsilon_{i,j}$ the residuals, with a zero mean normal distribution and a $\sigma^2_{i,j}$ variance.

The parameters of the market model are usually estimated using OLS regression. These parameters are then used to calculate abnormal returns. But such a method is based on strong statistical assumptions. In particular, it is assumed that the error term $\varepsilon_{i,j}$ is temporally uncorrelated and follows a normal distribution with constant variance. However, there is

overwhelming evidence that these assumptions are not fulfilled: individual stocks are correlated, with large returns (whatever sign) that tend to be followed by further large returns (of either sign) and variance is heteroskedastic (Henderson, 1990; Campbell, Lo and MacKinlay, 1997). Brown and Warner (1980, 1985) point out that the power of tests can be improved by appropriately modeling the volatility process. A number of studies (Boehmer, Musumeci, and Poulsen, 1991; De Jong, Kemna, and Kloek, 1992; Brockett, Chen and Garven, 1999; Savickas, 2003; Harrington and Shrider, 2006) have proposed event study methodologies that extend the basic market model methodology to include either ARCH or GARCH structures (Bollerslev, 1986).

In this study, a GARCH(1,1) framework is used to estimate the market model (i.e. we assume a non-constant variance during the time period under review). In this framework, equation (1) is the mean equation, and the conditional variance equation is:

$$\sigma^2_{i,j} = a_i + b_i \sigma^2_{i,j-1} + c_i \varepsilon^2_{i,j-1} \qquad (2)$$

with $\varepsilon^2_{i,j-1}$ the lagged squared residuals of equation (1) and a, b and c three parameters which are estimated by the maximum likelihood method.

The rolling regression routine

The aim of the paper is to examine information events that drive significant stock price changes for the defense industry. Prior studies usually assume that the beta is constant over time.[6] However, the beta may change after significant price movements. Accordingly, we adopt a time-varying coefficient market model. More precisely, for each firm in our sample, we compute 120-day rolling regression estimates, incremented by 1 day. That is, for each firm, the market model parameters are estimated on a time-varying window j = [-120; -1] for each day t.

$$R_{i,t+j} = \alpha_{i,t} + \beta_{i,t} R_{m,t+j} + \varepsilon_{i,t+j} \qquad (3)$$

[6] For instance, Ryan and Taffler (2004) used betas from the London Business School Risk Measurement Service which are computed on the previous calendar year, *i.e.* before the beginning of their sample.

We obtain a maximum of 2,575 estimates per firm (2,695 returns between January 1995 and May 2005 minus 120 days), that is, about 125,000 estimates in total.

For the whole time period, the average return of firms included in the sample is above the average market return: in annualized figures, nearly 12% against only 6% for the market (see Appendix 2). The highest return rate is for United Defense Industries (+45.5% per year on average, between 2001 and 2005). At the other extreme, the market capitalizations of Kawasaki Heavy Industries, Mitsubishi Heavy, Silicon Graphics and Bearing Point decreased over the time period. For the whole time period, the annual average volatility, measured by a GARCH(1,1) process, is at a conventional level, from 3.50% for Ultra Electronics to 17.5% for Silicon Graphics. The average systematic risk is 0.66, from 0.16 for VT Group to 1.37 for Bearing Point.

The abnormal returns

Once the parameters of both equations are estimated, one can obtain the expected or theoretical return for each stock *i* on day *t*, just by using the following equation:

$$\hat{R}_{i,t} = \hat{\alpha}_{i,t} + \hat{\beta}_{i,t} R_{m,t} \tag{4}$$

and, as usual, the abnormal returns at time *t* are simply the difference between the expected and the observed returns at this time:

$$\hat{AR}_{i,t} = \hat{R}_{i,t} - \hat{\alpha}_{i,t} - \hat{\beta}_{i,t} R_{m,t} \tag{5}$$

In this study, since our ultimate goal is to determine the events that drive stock prices in the defense industry, we are not interested in cumulative abnormal returns (CAR) or average abnormal returns (AAR). But we still have to compute the *t*-stat indicating the significance of each daily abnormal return. As we use a GARCH structure, the *t*-stat takes into account the fact that the variance is not constant:

$$t\text{-}stat_{i,t} = \frac{\hat{AR}_{i,t}}{\hat{\sigma}_{i,t}} \tag{6}$$

Under the null hypothesis that the abnormal return is zero, this statistic is distributed as the normal standard distribution.

3.3 Matching of largest abnormal returns to news

To explore the information events which drive stock market capitalization in the defense industry, we have to assign abnormal returns to one information release. In this paper, we adopt a conservative approach as we match the 10 largest significant price changes (5 up and 5 down) for each stock to news events. One can interpret our objective as to find, for each abnormal return, a related piece of news or announcement likely to explain it.

The information source we used is the Lexis-Nexis database (Reed-Elsevier), a database of more than 11,000 newspapers and magazines, including some specifically devoted to the defense industry (*e.g*. *Aerospace Daily*, *Air Force Times*, *Aviation Week's Homeland Security & Defense*, *Avionics*, *Defense Daily*, *Defense News*, *Defense and Security*, *IAC Aerospace & Defense*, *Inside the Pentagon*, *etc.*) and all the major world financial newspapers (*Wall Street Journal*, *Financial Times*, *etc*.).[7] Following an usual procedure, we constrain our investigations to an event window of 10 days centered on the day of the stock price movement to avoid potential data mining. To ensure an unbiased and reliable matching, we first collect all the news concerning the firm under review for the relevant time period. Then we analyze the information, searching for all the possible explanations of the stock price movement and excluding general information, such as business history, interviews with the managers in which no new information is provided, etc.[8]

The next step was to create homogenous groups of news, assigning each news release to one of the news categories detailed in Appendix 2. This typology was established following prior research (Thomson, Olsen and Dietrich, 1987; Pritamani and Singal, 2001; Ryan and Taffler, 2004) and extended to specific areas closely related to the defense industry (e.g. geopolitical events, military budget changes, *etc*.). When a news release does not correspond to any existing category, a new category was added to the typology. At the end, there are seventeen

[7] The sample considered by Ryan and Taffler (2004) consists of all industrial companies in the FTSE 100 and FTSE Mid-250 indices (excluding financials) for the two-year period (1st January, 1994 to 31st December, 1995). They use the following data sources: the London Stock Exchange Regulatory News Service, the Financial Times, and McCarthy Information.

[8] Complete results of the matching process are available on request.

news categories including: "information available but non-related to the defense industry" (e.g. Saab announces an increase in its car sales) plus a "no information available" category.[9]

4. Empirical results

Prior to examining what type of news influences stock prices in the defense industry, we first have to investigate the overall distribution of the significant abnormal returns. In a second step, we elaborate a broad typology where we distinguish between i) rumors, announcements and unforeseeable events; ii) general and firm-related events; iii) financial and industrial news. In a third step, we refine the previous typology and use a seventeen item classification to underline the respective relevance of bids, strategic alliances between firms, and company restructuring as stock movers. Finally, we focus on the impact of the September 11 terrorist attacks on defense firms.

4.1. Overall analysis of significant abnormal returns

Table 2 gives some descriptive statistics about the distribution of all daily abnormal returns. We consider three panels: i) abnormal returns significant at 5%, ii) abnormal returns significant at 1%, and iii) the five largest abnormal increases and the five largest abnormal decreases for each firm.

For the whole sample, 7,530 daily abnormal returns are significant at 5% and 3,230 at 1%.[10] Of these 7,530 significant abnormal returns, 56% are positive, 25% are below –4.46% and 25% are above 5.26%. We obtain approximately the same proportions with the abnormal returns significant at 1%. The distribution of the event sample exhibits a characteristic two-peak distribution (see figure 1), since we drop out of the sample all the abnormal returns non-significant at 5%.

[9] This matching between a news release and the category that describes it best was done by hand, by the two authors, independently. In more than 94% of the cases, the two researchers chose the same news category. Nevertheless, the choices for the remaining 6% of cases were not the same. For all these cases, an agreement was found after meeting and discussion between the two researchers; see also Ryan and Taffler (2004). The results detailed and discussed in section 4 remain unchanged if we exclude these cases from the sample.

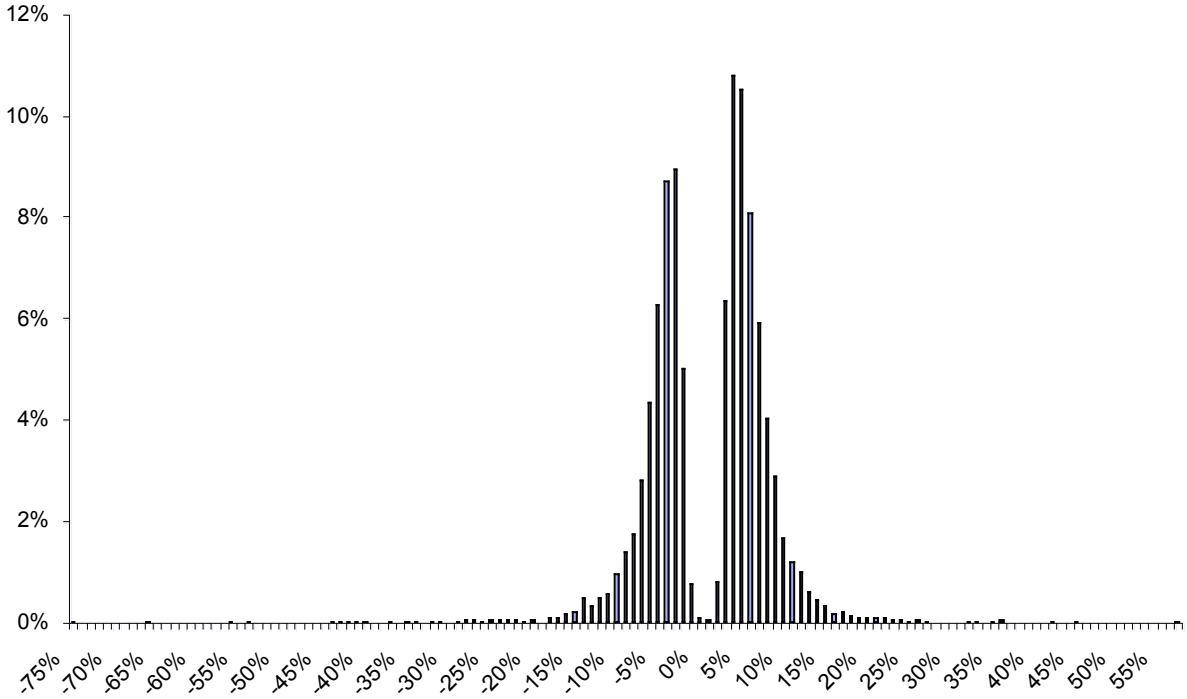
[10] For a total number of observations (number of firms times number of days in the time period) of approximately 150,000. This means that about 5% of the abnormal returns are significant at 5% and 2% are significant at 1%.

Table 2. Frequency and distribution of significant abnormal returns, 1995-2005

	Observed return	Abnormal returns significant at the 5% level			Abnormal returns significant at the 1% level			Largest abnormal returns		
		all	up	down	all	up	down	all	up	down
Mean	0.70%	0.6%	5.8%	– 5.9%	0.8%	7.3%	– 7.8%	– 0.8%	12.1%	– 13.8%
Minimum	– 77.7%	– 75.6%	0.5%	– 75.6%	– 75.6%	0.7%	– 75.6%	– 75.60%	2.6%	– 75.60%
First quart.	– 4.4%	– 4.5%	3.7%	– 6.7%	– 5.7%	4.6%	– 9.0%	– 11.5%	8.0%	– 14.9%
Median	2.7%	2.9%	4.9%	– 4.8%	3.8%	6.3%	– 6.3%	– 0.4%	10.4%	– 11.5%
Third quart.	5.4%	5.3%	6.9%	– 3.6%	6.8%	8.6%	– 4.6%	10.4%	13.8%	– 8.5%
Maximum	56.7%	56.8%	56.8%	– 0.6%	56.8%	56.8%	– 1.0%	56.8%	56.8%	– 3.5%
Nb.		7,530	4,211	3,319	3,230	1,845	1,385	580	290	290
%		100%	56%	44%	100%	57%	43%	100%	50%	50%
By firm (avg.)		121	68	54	52	30	22	10	5	5

Note: Abnormal returns are computed given the market model parameters which are estimated with conditional heteroskedasticity GARCH(1,1) by the maximum likelihood method through the estimation window [-120; -1] in event time. Largest abnormal returns are defined as the five largest abnormal increases and the five largest abnormal decreases for each firm. The sample contains 58 publicly listed firms included in the "World Top 100 Defense firms". The time period extends from January 1995 to May 2005.

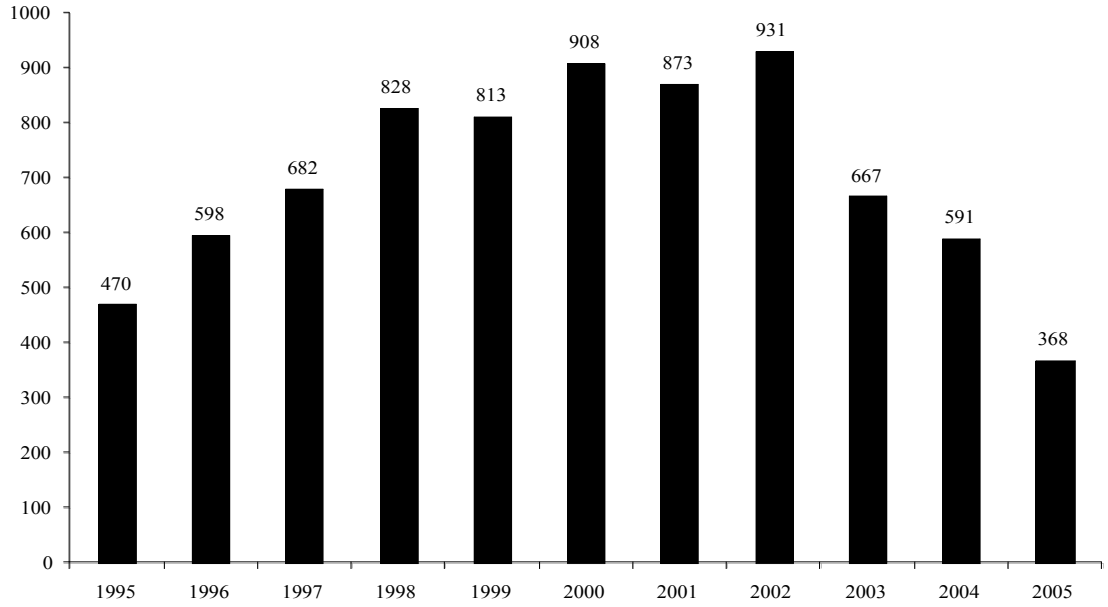
Figure 1. Significant abnormal returns distribution, all sample, 1995-2005



Note: All significant abnormal returns at the 5% level in our sample. Abnormal returns are computed given the market model parameters which are estimated with conditional heteroskedasticity GARCH(1,1) by the maximum likelihood method through the estimation window [-120; -1] in event time. The sample contains 58 publicly listed firms included in the "World Top 100 Defense firms". The time period extends from January 1995 to May 2005.

Concerning the distribution over time, (cf. Figure 2), quite surprisingly, 2001 is not the year with the highest number of significant abnormal returns. But the concentration of the events is consistent with common sense, with 83 abnormal returns in the 10-day period following the 9-11 events (nearly 10% of all the 2001 abnormal returns). The other terrorist attacks are not followed by such a high number of abnormal returns: in the 10 days following the terrorist attack on Madrid train stations (March 2004), there are 12 abnormal returns, less than the average on the year.

Figure 2. Significant abnormal return distribution by year, 1995-2005



Note: Number of significant abnormal returns at the 5% level in our sample for each year. Abnormal returns are computed given the market model parameters which are estimated with conditional heteroskedasticity GARCH(1,1) by the maximum likelihood method through the estimation window [-120; -1] in event time. The sample contains 58 publicly listed firms included in the "World Top 100 Defense firms". The time period extends from January 1995 to May 2005. For 2005, the observed figure for the first half of the year is transformed into an annual figure.

We focus in the following analysis on the five largest abnormal increases and five largest abnormal decreases of the stock price for each firm. This focus was made in order to avoid the data mining problem which would arise if we tried to match each abnormal return with an event. With our restrictive definition of the sample (580 events: 10 events for 58 firms), we are almost certain that these large stock price movements have an explanation, that they are not just noise.

4.2 What type of news influence stock prices?

Table 3 summarizes the results of the matching process between the largest abnormal returns and news. First, we present the percentage of the largest abnormal returns related to publicly available news. Then, we consider three criteria: Is the news a rumor, an announcement or an unforeseeable event? Is the news general or firm-related? Is the news related to financial or industrial concerns? In the following subsection we refine our typology, breaking it down into seventeen categories.

Table 3. What type of news causes a stock price change?

	All events	Good news	Bad news	Good minus Bad
No news	*29.9%*	*25.9%*	*33.8%*	*-7.9%* **
News	*70.1%*	*74.1%*	*66.2%*	*7.9%* **
Of which…				
Rumor	11.3 %	12.5%	9.9%	2.6%
Announcement or news	80.7 %	81.7%	79.9%	1.8%
Unforeseeable event	8.0 %	5.8%	10.2%	-4.4% *
Of which…				
General news	11.1%	9.2%	13.0%	-3.8%
Firm-related news	88.9%	90.8%	87.0%	3.8%
Of which…				
Financial news	60.2%	52.6%	68.8%	-16.2% **
Industrial news	23.8%	33.0%	13.5%	19.5% **
Other news	16.0%	14.4%	17.7%	-3.3%

In columns 2, 3 and 4 we give the percentage of total abnormal returns the category represents. In the last column, we use the following Z-statistics for the difference between two proportions:
$Z = (p_1 - p_2) / \quad [\, p_1(1 - p_1)/N_1 + p_2(1 - p_2)/N_2 \,]$.

** and * indicate significance at the 1% and the 5% level.

To what extent does publicly available news drive abnormal returns? Despite our conservative approach in the selection of abnormal returns, it is striking to note that when analyzing the type of news driving the largest significant stock price changes, the ratio of significant abnormal returns not related to news is very high: nearly a third of all stock price changes remain unexplained. Our results are in line with those of Ryan and Taffler (2004): in their study, 35% of the stock price movements are not related to firm-specific news, this figure increasing to 45% for the smallest firms of their sample (firms listed in the FTSE-Mid250). Two alternative explanations can be proposed to explain the high ratio of significant abnormal returns not related to news. First, one could argue that our methodological approach does not allow us to capture all the pertinent sources of publicly available information about defense products, costs or prospects. It is a well-known fact that disclosure of information is directly related to firm size (Grant, 1980; Atiase, 1985). Indeed, some firms included in our sample are quite small. But, the number of newspapers and other sources of information included in the Lexis-Nexis database seems to invalidate this explanation. Second, given the

size of the significant abnormal returns (the five largest increases and the five largest decreases), it is reasonable to assume the existence of non-publicly available information. The higher percentage of "no news" for the largest negative abnormal returns relative to the largest positive abnormal returns (34% against 26%, a difference that is statistically significant at the 1% level) is also puzzling.

Is the news a rumor, an announcement or an unforeseeable event? In 11% of all the largest abnormal returns that can be related to an information release, the information is provided in the conditional mode, *i.e*. subject to confirmation, not verified or affirmed. This figure, together with the high percentage of unexplained stock price changes, makes it reasonable to assume the existence of private information able to influence stock prices. We also note that 8% of the events are totally unforeseeable, such as the terrorist attacks. Given our sample time period (1995-2005), it is not surprising that negative unforeseeable events are significantly more frequent than positive ones (10% against 6%).

Is the news general or firm-related? Turning to the general characteristics of news influencing the stock prices of defense industry firms, we observe that firm-related news is far more frequent (nine news items out of ten) than news related to the defense industry or to geopolitical or macroeconomic matters (one out of ten).

Is the news related to financial or industrial concerns? More interesting is the predominance of finance-related news (60%) over industry-related news (24%). This result is not the consequence of an initial bias in the news sample because, for a particular firm during a given month, the number of news items related to financial matters is roughly equal to the number related to industrial matters.[11] One explanation can be given in terms of stock market anticipations. Since industrial news consists essentially of announcements of new contracts, new products or new investments, and given that the time period needed to do a deal or to launch a new product in the defense industry is long, this news is more easily anticipated by stock market investors. More difficult to anticipate are, for instance, earnings revisions, analysts' recommendations, or bid announcements.

[11] Given the size of the initial sample of news in Lexis-Nexis, a systematic analysis of this point could not be done. We have only checked the total number of news items related to each firm for a random month during the whole time period under review. Considering all firms, the ratio of financial news to industrial news (neglecting the 'other' news) ranges between 0.70 and 1.5, far below the ratio of 3 between the financial news and the industrial news driving a significant abnormal return (60.2% against 23.8%).

4.3 The relative importance of earnings, bids and other news releases

We analyze in this subsection the precise type of news driving the stock prices of firms in the defense industry (see Table 4).[12]

Table 4. News categories influencing stock price changes

	All events		Good news		Bad news		Good minus Bad	
EARNINGS	66	16.2%	32	14.7%	34	18.0%	-3.3%	
BIDS	59	14.5%	41	18.8%	18	9.5%	9.3%	
CONTRACT	55	13.5%	48	22.0%	7	3.7%	18.3%	*
ANALYST	48	11.8%	24	11.0%	24	12.7%	-1.7%	
WARNING	34	8.4%	0	0.0%	34	18.0%	-18.0%	**
POLITICS	33	8.1%	15	6.9%	18	9.5%	-2.6%	
PUBSPEND	22	5.4%	13	6.0%	9	4.8%	1.2%	
SHAREDEAL	21	5.2%	8	3.7%	13	6.9%	-3.2%	
PRODUCT	15	3.7%	10	4.6%	5	2.6%	2.0%	
PROSPECT	11	2.7%	4	1.8%	7	3.7%	-1.9%	
FINANCE	11	2.7%	6	2.8%	5	2.6%	0.2%	
MANAG	10	2.5%	7	3.2%	3	1.6%	1.6%	
STRAT	7	1.7%	5	2.3%	2	1.1%	1.2%	
LEGAL	6	1.5%	2	0.9%	4	2.1%	-1.2%	
RESTRUCT	4	1.0%	2	0.9%	2	1.1%	-0.2%	
NODEF	3	0.7%	0	0.0%	3	1.6%	-1.6%	
LABOR	2	0.5%	1	0.5%	1	0.5%	0.0%	
Total	407	100.0%	218	100.0%	189	100.0%		

In columns 3, 5 and 7 we give the percentage the category represents of total abnormal returns. In the last column, we use the following Z-statistics for the difference between two proportions: $Z = (p_1 - p_2) / [\, p_1(1 - p_1)/N_1 + p_2(1 - p_2)/N_2 \,]$. ** and * indicate significance at the 1% and the 5% level.

A parsimonious set of news categories explains a high proportion of all the largest abnormal returns. The first category accounts for 16% of all the explained price changes. When looking only at the top 4 categories, the figure goes up to 56%. We find, in this top 4, earnings announcements, bid announcements or published rumors about bids, news related to the conclusion or cancellation of contracts and analysts' recommendations. Our subsequent analysis will mainly focus on the items accounting for more than 5% of the sample (*i.e.* the first eight news categories). The figures for the other items are clearly too weak. Moreover, an

analysis of the differences between the median abnormal return by news category was conducted, but did not produce any clear differences between the various news categories. We therefore do not reproduce these results.

EARNINGS related news releases are the most frequent factor influencing the market value of firms in the defense industry. This category includes all the formal accounting releases, earnings forecast revisions by the firm – excluding earnings forecasts and recommendations published by analysts (ANALYST) and profit warnings (WARNING). If the key role of earnings forecast revisions was expected, it is surprising to note that nearly one third of all the news releases included in the EARNINGS category are formal accounting releases: although they are likely to be anticipated, they have a significant impact on share prices. The key role of profit warnings (WARNING) on share prices can be analyzed in the same way. They represent 18% of the 'bad news' influencing stock prices, the most frequent type of news related to a decrease in a stock price (and no profit warning is associated with an increase in the stock price, following common sense). This demonstrates how formal accounting releases or forecast revisions have a significant effect on the market's consensus forecasts.

The BIDS category accounts for 14.5% of the total number of the largest abnormal returns explained by publicly available information (and 70% of the bid-related news is 'good' news). For the general sample used by Ryan and Taffler (2004) the equivalent figure is only 8.3%. It would appear, then, that bids and take-over related news are more frequently stock price movers in the defense industry than in other industries. This is consistent with the movement of structural change observed over the past 15 years in the defense industry. Besides, for a given firm, the proportion of news releases reporting an announcement or rumor of a bid associated with a significant stock price variation is higher than for every other news category[13]. Note also that private information appears to be prominent in the case of bids.
This category is the one with the highest number of news items reporting speculations or rumors (more than 60%). And for this category, more than 75% of the news releases explaining the stock price change are published some days *after* the change. This proportion is higher than for any other category. The structural changes in the defense industry, analyzed from the investor's point of view, are mainly the work of bids. Company restructurings

[12] News classification and examples are provided in Appendix 3.
[13] On average, a significant stock price variation is associated with more than 40% of the news items relating to a bid announcement or rumor.

(RESTRUCT) or labor force reductions (LABOR) each account for less than 1% of the sample.

Industry-related news is not very frequent in our sample. CONTRACT, that is announcements or speculation about new contracts or cancellation of existing contracts, represents 13% of the total number of cases. PRODUCT, that is news related to new products and expectations regarding product launch or recall, accounts for less than 4%. One should note, however, that these categories do not appear in the principal news categories in Ryan and Taffler (2004), as their respective weight is under 4.7%. Accordingly, we can say that news about contracts and new products has a larger influence on stock prices in the defense industry than in other industries. A plausible explanation is simply that in the defense industry, only a few contracts are concluded each year, each of them worth several USD millions.

The ANALYST category (recommendations and earnings forecasts that do not occur simultaneously with any other news release) is the fourth market mover category. Analysts contribute to the efficiency of stock markets by compiling, analyzing and processing (public or private) information. As the ANALYST category accounts for nearly 12% of the news in our sample, our results confirm that analyst recommendations add value and convey new information to the market. There is no clear difference here in the value added by analysts for investors in the defense industry compared to other industries, as Ryan and Taffler (2004) report a figure of 10.5% with their diversified sample of firms with a comparable definition of the category.

Geopolitical and macroeconomic events (POLITICS), probably due to a strong unforeseeable dimension and the choice of our time period, have a clear effect on defense industry firms. Among the main geopolitical events listed, we find the September 11 terrorist attacks (see next sub-section), the concerns about the war in Iraq and in Afghanistan, and oil price related news. News related to public spending (PUBSPEND) also play a significant role in significant abnormal stock price changes. A skeptical reader may dismiss these results as simply confirming the obvious, given the key role of the government as a customer of the defense industry. We, in contrast, consider this result an important specific feature of the defense industry. Ryan and Taffler (2004), with their heterogeneous sample of firms, do not even mention this category, probably because they consider that firm-specific news are the main market movers. Our results show that macroeconomic and geopolitical news cannot be neglected for understanding market price changes in the defense industry.

The last category which accounts for more than 5% of our sample is SHAREDEAL. This category groups together all information releases related to a significantly larger than average trading volume in a firm's stock that is not related to a bid: for instance, the sale of all the shares owned by the dominant shareholder, or director share dealing. Comparing these results with those of Ryan and Taffler (2004), we see that this category is less important for defense firms than for other firms: 5.2% against 15.3% (8.5% for director share dealing + 6.8% for other share dealings).

4.4 What is the effect of September 11?

Only two firms, out of our sample of 54 top firms in the defense industry[14], were not affected by the September 2001 terrorist attacks: Alvis, a British company ranked 62 in 2003 by *Defense News*, and Kongsberg Gruppen, a Norwegian company ranked 78 in 2003. For all the others, we find significant abnormal returns (either positive or negative) at the 5% level around the date of the terrorist attacks.[15] Table 5 presents these results.

Almost all firms in the defense industry reacted significantly to the terrorist attacks, but the reaction is very different from one firm to another. Indeed, the reaction to the terrorist attacks was positive for half of the 52 firms, and negative for the other half. For the 52 firms, abnormal returns are large: the mean daily abnormal return is +14% for the former and –9% for the latter (Panel A). These results illustrate the widespread co-existence of civil and military activities. No one would be surprised to observe that Boeing and EADS (Airbus), for instance, incurred a loss in their stock market capitalization. Moreover, we observe a strong correlation between abnormal returns and the percentage of revenue from defense. When this percentage is lower than 49%; the mean daily abnormal return is –3% while for the other half, the mean daily abnormal return is 8% (Panel B).

[14] The stock price time-series extracted from Datastream for Anteon, ManTech International, United Defense Industry, and Washington Group International begins after September 2001.

[15] As we compute daily abnormal returns, some firms exhibit several significant abnormal returns in September 2001. For each firm, we only consider the first significant daily abnormal return following the terrorist attacks. Daily abnormal returns following September 11, 2001 are provided in Appendix 4. For more details, see Capelle-Blancard, Couderc and Stachowiak (2006).

Table 5. Daily significant abnormal returns following September 11, 2001

	Daily abnormal returns	Revenue from Defense	Daily abnormal returns	Revenue from Defense
Panel A	**Positive impact**		**Negative impact**	
# of firms	26		26	
Mean	14%	62%	-9%	37%
Median	11%	63%	-7%	32%
SD	8%	24%	6%	21%
Min	3%	12%	-28%	10%
Max	35%	95%	-3%	80%
Panel B	**Revenue from Defense < 49%**		**Revenue from Defense ≥ 49%**	
# of firms	26		26	
Mean	-3%	28%	8%	71%
Median	-5%	26%	8%	71%
SD	12%	12%	14%	16%
Min	-28%	10%	-16%	49%
Max	22%	46%	35%	95%
Panel C	**US + Canada**		**Other countries**	
# of firms	28		24	
Mean	6%	51%	-2%	48%
Median	10%	48%	-4%	48%
SD	16%	27%	7%	25%
Min	-28%	11%	-20%	10%
Max	35%	95%	9%	94%

Another interesting point is the stock market reaction of North American firms compared to the others (Panel C). The mean daily abnormal return is 6% for the US and Canadian firms against -2% for the others (the difference between the median is even larger).[16] Chen and Siems (2004) show that the decline in the U.S. and Canadian capital market, though significantly different from zero, was not as great as eight of the other nine largest world markets.[17] They attribute this result to the depth of the North American stock market, the calming effect of the closing of the U.S. capital markets until September 17 2001, and the stability of the banking and financial sector. Another explanation could be the positive impact of the terrorist attacks on several US firms which might benefit more from the new geopolitical context.

[16] Note that this result cannot be attributed to a different percentage of revenue from defense.
[17] For an examination of the impact of terrorism on stock markets, see also Karolyi and Martell (2005).

5. Conclusion

This study seeks to determine whether defense firms' largest stock price changes are driven by macroeconomic, microeconomic, or non-economic events, or just noise. The distinctive features of the defense industry motivate such a study.

The traditional method of event studies is limited by the necessary *a priori* definition of the categories of events. Therefore, we adopt an alternative methodology to explore the relationship between information events and stock price changes. We first identify, for a given firm, the statistically significant abnormal returns over the time period. Secondly, we look for information releases likely to cause such abnormal returns. Moreover, we consider time-varying beta estimates and a GARCH process to model the volatility. Our sample consists of the 58 largest listed firms in the defense industry. For each firm, we focus mainly on the 10 largest significant abnormal returns (5 up and 5 down) over the 1995-2005 time period.

We show in this paper that the news driving the market value of defense firms is roughly the same as for other industries. Formal accounting releases (earnings announcements, profit warnings, *etc.*) play a key role in explaining the largest stock price changes. There is also some evidence in favor of the existence of transactions motivated by private information, since one third of the largest stock price changes are not related to an information release. Nevertheless, the defense industry presents some specific features that distinguish it from other industries. Firstly, the most striking difference is probably the key role played by bid announcements or rumors, which account for nearly 15% of the stock prices changes. Secondly, public military spending plays a key role as a driving force of stock prices in the defense industry. This role is probably due to the relationship between public spending and the number of contracts to be concluded with the defense industry. And the contract-related news are an important stock price mover. Thirdly, the geopolitical context and geopolitical events clearly influence stock prices of the defense industry in a specific way. In fact, nearly all the firms react to geopolitical events, but the reaction is not uniform. In the September 11 case, the stock price reaction is largely correlated to the relative weight of the military and civilian activities in each firm.

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Appendix 1 – Firms included in the sample

Rank 2003	Company	Country	2003 Defense Revenue (US$)	2003 Total Revenue (US$)	2003 Revenue from Defense (%)	End 2003 FFNOSH (%)
19	Alliant Techsystems	U.S.	2,102.0	2,366.0	89	43
62	Alvis	U.K.	620.7	620.7	100	49
44	Anteon	U.S.	927.0	1,042.0	89	nd.
63	Babcock Internat. Group	U.K.	602.6	753.2	80	44
4	BAE Systems	U.K.	17,159.0	22,359.3	77	65
94	BearingPoint	U.S.	328.5	3,139.3	11	45
81	Bharat Electronics	India	434.2	620.2	70	100
2	Boeing	U.S.	27,360.0	50,500.0	54	67
67	CACI	U.S.	536.3	843.1	64	47
89	CAE	Canada	361.6	835.9	43	87
55	Cobham	U.K.	742.7	1,480.8	50	58
88	Cubic	U.S.	365.1	634.0	58	73
23	Dassault Aviation	France	2,009.1	4,143.8	49	50
43	DRS Technologies	U.S.	940.2	1,001.3	94	38
8	EADS	Netherlands	8,036.5	37,796.6	21	100
82	EDO	U.S.	415.0	460.7	90	56
50	Elbit Systems	Israel	848.0	898.0	94	61
9	Finmeccanica	Italy	5,895.5	10,856.8	54	67
6	General Dynamics	U.S.	12,782.0	16,617.0	77	57
28	GKN Group	U.K.	1,533.7	7,668.7	20	69
34	Goodrich	U.S.	1,300.0	4,383.0	30	51
16	Halliburton	U.S.	2,700.0	16,271.0	17	49
40	Harris	U.S.	1,100.0	2,093.0	53	40
12	Honeywell	U.S.	4,200.0	23,100.0	18	60
65	Indra Sistemas	Spain	567.3	1,232.3	46	100
25	ITT Industries	U.S.	1,790.9	5,626.6	32	55
73	Jacobs Engineering Group	U.S.	494.0	1,884.8	26	50
41	Kawasaki Heavy Industries	Japan	1,096.5	10,986.2	10	89
78	Kongsberg Gruppen	Norway	456.1	991.5	46	36
11	L-3 Communications	U.S.	4,369.2	5,061.6	86	39
1	Lockheed Martin	U.S.	30,097.0	31,824.0	95	35
60	ManTech International	U.S.	639.9	701.6	91	33
95	Meggitt	U.K.	314.6	715.0	44	60
17	Mitsubishi Heavy Industries	Japan	2,667.4	22,473.6	12	93
3	Northrop Grumman	U.S.	18,700.0	26,200.0	71	48
59	Oshkosh Truck	U.S.	657.0	1,926.0	34	48
5	Raytheon	U.S.	16,896.0	18,100.0	93	47
22	Rheinmetall DeTec	Germany	2,014.1	5,334.2	38	26
35	Rockwell Collins	U.S.	1,270.0	2,542.0	50	60
18	Rolls-Royce	U.K.	2,489.9	9,959.6	25	66
30	Saab	Sweden	1,380.0	1,725.0	80	52
96	Silicon Graphics	U.S.	314.0	962.0	33	86
47	Singapore Tech. Engineer.	Singapore	903.6	1,655.1	55	35
26	Smiths Industries	U.K.	1,778.2	4,235.2	42	73
24	Snecma (Sagem)	France	1,845.9	8,036.5	23	49
79	Stewart & Stevenson	U.S.	446.0	1,175.0	38	44

Rank 2003	Company	Country	2003 Defense Revenue (US$)	2003 Total Revenue (US$)	2003 Revenue from Defense (%)	End 2003 FFNOSH (%)
98	Tadiran Communications	Israel	272.2	1,192.1	23	nd.
85	Teledyne Technologies	U.S.	387.0	841.0	46	58
27	Textron	U.S.	1,600.0	9,859.0	16	65
7	Thales	France	8,476.0	13,310.4	64	57
39	ThyssenKrupp Werften	Germany	1,110.0	6,152.9	18	99
38	Titan	U.S.	1,113.0	1,800.0	62	63
83	Ultra Electronic Holdings	U.K.	399.0	505.1	79	48
21	United Defense Industries	U.S.	2,052.6	2,052.6	100	57
10	United Techologies	U.S.	5,300.0	31,034.0	17	65
36	URS	U.S.	1,230.0	3,200.0	38	58
49	VT Group	U.K.	857.8	1,225.4	70	65
42	Washington Group Internat.	U.S.	1,048.0	2,501.0	42	97

Source: 2004 World Top 100 Defense Firms, *Defense News Media Group* and Datastream (FFNOSH, Free Float Number Of Shares). Figures expressed in USD millions. Currency conversions for non-U.S. firms calculated using prevailing rates at the end of each firm's fiscal year.

Appendix 2 – Return and market model results

Company	Time Period	Market Index	$\hat{\beta}$	Annualized price return	Market annualized price return	GARCH(1,1) volatility
Alliant Techsystems	95-05	S&P 500	0.32	17.7%	9.0%	5.6%
Alvis	95-05	FTSE All	0.20	20.5%	4.3%	6.2%
Anteon	02-05	S&P 500	0.83	25.7%	-0.1%	4.3%
Babcock Intern. Group	95-05	FTSE All	0.23	-0.6%	4.3%	6.5%
BAE Systems	95-05	FTSE All	0.81	8.4%	4.3%	7.8%
Bearing Point	01-05	S&P 500	1.37	-26.6%	-3.1%	7.9%
Bharat Electronics	95-05	India BSE	0.24	15.3%	5.6%	11.7%
Boeing	95-05	S&P 500	0.96	9.0%	9.0%	6.9%
CACI	95-05	S&P 500	0.65	26.4%	9.0%	8.8%
CAE	95-05	S&P/TSX	0.71	4.4%	7.8%	8.0%
Cobham	95-05	FTSE All	0.32	13.4%	4.3%	4.5%
Cubic	95-05	S&P 500	0.57	14.9%	9.0%	8.2%
Dassault Aviation	95-05	SBF 120	0.22	28.7%	7.5%	7.3%
DRS Technologies	95-05	S&P 500	0.38	24.9%	9.0%	9.0%
EADS	00-05	SBF 120	1.13	4.8%	-10.4%	6.1%
EDO	95-05	S&P 500	0.57	22.4%	9.0%	9.5%
Elbit Systems	98-05	Israel TA 100	0.90	12.0%	11.3%	4.8%
Finmeccanica	95-05	Milan Global	1.11	2.9%	8.2%	8.7%
General Dynamics	95-05	S&P 500	0.59	15.8%	9.0%	5.6%
GKN Group	95-05	FTSE All	0.95	5.5%	4.3%	6.8%
Goodrich	95-05	S&P 500	0.91	6.4%	9.0%	6.9%
Halliburton	95-05	S&P 500	0.88	9.7%	9.0%	9.9%
Harris	95-05	S&P 500	0.84	11.2%	9.0%	7.2%
Honeywell	95-05	S&P 500	1.18	7.2%	9.0%	7.5%
Indra Sistemas	95-05	Ibex 35	0.55	29.4%	10.5%	10.7%
ITT Industries	95-05	S&P 500	0.75	16.5%	9.0%	5.7%
Jacobs Eng. Group	95-05	S&P 500	0.59	16.8%	9.0%	6.1%
Kawasaki Heavy Indus.	95-05	Topix	1.07	-7.%	-2.9%	9.2%
Kongsberg Gruppen	95-05	Oslo SE	0.54	9.3%	7.3%	6.1%
L-3 communications	98-05	S&P 500	0.53	25.9%	0.6%	6.3%
Lockheed Martin	95-05	S&P 500	0.48	8.6%	8.4%	6.3%
ManTech International	02-05	S&P 500	0.43	10.0%	2.2%	6.6%
Meggitt	95-05	FTSE All	0.35	13.9%	4.3%	5.8%
Mitsubishi Heavy	95-05	Topix	0.94	-8.9%	-2.9%	7.1%
Northrop Grumman	95-05	S&P 500	0.47	9.4%	9.0%	5.9%
Oshkosh Truck	95-05	S&P 500	0.55	32.9%	9.0%	8.4%
Raytheon	95-05	S&P 500	0.55	1.7%	9.0%	7.9%
Rheinmettall DeTec	95-05	Dax 30	0.20	10.6%	6.8%	8.1%
Rockwell Collins	01-05	S&P 500	0.95	17.6%	-1.1%	4.4%
Rolls-Royce	95-05	FTSE All	1.09	3.1%	4.3%	7.7%
Saab	98-05	Affarsvarlben	0.34	4.3%	1.2%	5.3%
Silicon Graphics	95-05	S&P 500	1.33	-22.5%	9.0%	17.5%
Singapore Tech. Eng.	97-05	Singapore ST	0.71	8.2%	3.4%	6.2%
Smiths Industries	95-05	FTSE All	0.72	6.4%	4.3%	5.9%
Snecma (Sagem)	95-05	SBF 120	0.48	6.9%	7.5%	8.2%
Stewart & Stevenson	95-05	S&P 500	0.73	-3.2%	9.0%	9.4%

Company	Time Period	Market Index	$\hat{\beta}$	Annualized price return	Market annualized price return	GARCH(1,1) volatility
Tadiran Com.	00-05	Israel TA 100	0.88	41.9%	4.2%	7.7%
Teledyne Technologies	99-05	S&P 500	1.12	25.0%	-3.3%	9.1%
Textron	95-05	S&P 500	0.87	10.7%	9.0%	6.2%
Thales	95-05	SBF 120	0.81	2.4%	7.5%	8.0%
ThyssenKrupp Werften	95-05	Dax 30	0.79	-0.4%	6.8%	6.8%
Titan	95-05	S&P 500	0.94	12.6%	9.0%	12.6%
Ultra Electronics	96-05	FTSE All	0.16	13.0%	2.2%	3.5%
United Defense Indus.	01-05	S&P 500	0.32	45.5%	0.7%	4.0%
United Technologies	95-05	S&P 500	0.97	18.9%	9.0%	6.3%
URS	95-05	S&P 500	0.60	17.8%	9.0%	8.9%
VT Group	95-05	FTSE All	0.16	7.2%	4.3%	3.9%
Washington Group Int.	02-05	S&P 500	0.42	6.3%	0.7%	3.8%

Note: In this table, market model parameters are estimated with conditional heteroskedasticity GARCH(1,1) by the maximum likelihood method on the whole time period. The sample contains 58 publicly listed firms included in the "World Top 100 Defense firms". The time period extends from January 1995 to May 2005.

Appendix 3 – News categories

We detail in this appendix the news categories used to classify all the information releases which are likely to influence stock prices of defense firms. An example of a news release classified in each category is provided.

Information releases of general interest		**Geopolitical event and macroeconomic news** (POLITICS): News items related to geopolitical, political or macroeconomic events. *Even as the major U.S. equity averages plunged Monday in the wake of the Sept. 11 terrorist attacks, investors bid up shares of companies expected to benefit from a more-security-conscious, less-peaceful world.* **Changes in public spending related to defense** (PUBSPEND): Announcements or rumors related to changes in public spending in defense. *Elbit Systems, a maker of defense electronics, fell 4.5% to NIS 65.80. Defense News said Israeli military exports will drop 40% to $ 2.5 billion this year, citing an official in the defense ministry*
Firm-specific information releases	Industrial	**Company restructuring** (RESTRUCT): Announcements or rumors related to firms' reorganizations and disposal of subsidiaries. This category does not include the announcements related to capital restructuring. *The Harris Corporation, which is moving to concentrate on communications equipment, said late yesterday that it would spin off Lanier Worldwide.* **Labor related issues** (LABOR): News items relating to lay-offs, employees' pay settlements, new incentive schemes, etc. *Textron Inc. will lay off 1,200 employees in its Cessna Aircraft unit, citing a reduction in the order placed by one of its two major business jet customers and worldwide economic concerns.* **Contracts** (CONTRACT): News items relating to negotiation, conclusion or breach of contract. *Harris Corp. received $222 million contract from U.S. Army Communications-Electronics Command (CECOM) for 205 Lightweight Multiband Satellite Terminals (LMSTs), company said.* **Product information** (PRODUCT): News items relating to capabilities, expectations about success, market potentials of existing or news products. *The U.S. Army reports that its next-generation RF electronic combat suite developed by ITT-Industries took its first flight on March 23, 1999. ITT Industries, Avionics Division is the prime contractor for the AN/ALQ-211 SIRFC system.* **Review of company prospects – other than analysts** (PROSPECT): Issues relating to the review of a company's prospects not published by a sell-side analyst. *The Oshkosh Truck Corporation said yesterday that its commercial sales will be lower than expected amid a softening in North America's concrete-placement market.* **Strategic alliance between two firms for developing a new product** (STRAT): News items relating to the announcement or the rumor about a strategic or industrial alliance between firms (this category excludes the case for financial alliances, included in the bid category). *Finmeccanica SpA unit Alenia Difesa said it and Deutsche Aerobus AG unit Dornier signed a memorandum of understanding to jointly develop an anti-submarine MPA aircraft to replace the Breguet Atlantic 1150.*
	Financial	**Bids and speculation about bids** (BIDS): Announcements or published rumors in relation to take-overs, acquisitions and mergers. *DRS Technologies, Inc. today confirmed that it has held discussions with a financial buyout group concerning the possible acquisition of DRS. These discussions have been terminated.* **Financing issues** (FINANCE): News items relating to issuance of shares or bonds, capital restructuring, share repurchase, etc. *The company was in crisis talks with its bank syndicate after it breached its agreed debt level of 3.5 times its cash-flow for a loan worth 358 mln eur.* **Analysts** (ANALYST): Sell-side analysts' recommendations and forecasts. *Cobham advanced 67-1/2 pence to 787-1/2 buoyed by news CSFB had reiterated its 'buy' rating with a 900 pence price target.* **Earnings related news** (EARNINGS): News items relating to a (formal or not) announcement by the firm regarding its current or expected earnings, excluding the special case of a formal profit warning. *CACI said its profits rose 54 percent from the same period in the previous fiscal year.* **Profit warning** (WARNING): Firm announcements regarding expected profits. *Textron Inc. officials announced Sept. 26 that the company is lowering its earnings estimates for the third and fourth quarters of this year.* **Share deals** (SHAREDEAL): News items relating to large trading activity in a firm's shares (institutional purchases or sales). *According to information obtained by Handelsblatt, U.S. investor Guy Wyser-Pratte has acquired 5.054% of Rheinmetall's ordinary shares and 1.1% of its pre-ference shares. A spokesman for Rheinmetall confirmed that Wyser-Pratte had acquired a stake in the group. However, he said it was too early to comment on the matter.*
	Other	**Management issues** (MANAG): News items relating to appointments, dismissals, retirements or compensation schemes of top managers. *Northrop Grumman Corp. stumbled along with other defense firms Thursday, a day after the company announced a change at the top of its executive ladder.* **Legal issues** (LEGAL): Legal issues, trials, penalties. *ManTech International Corp. said yesterday that the Defense Department last month subpoenaed company information related to a contract for security and personnel background checks.*
No relevant information releases		**Firm-specific news, but not related to the defense industry** (NODEF). No news at all (not included in the sample).

Appendix 4 – Daily abnormal returns following September 11 2001

Alliant Techsystems	US	20%	09/17/2001
Alvis	UK	ns.	
Babcock Intern. Group	UK	-8%	09/20/2001
BAE Systems	UK	9%	09/11/2001
Bearing Point	US	-7%	09/19/2001
Bharat Electronics	India	-4%	09/14/2001
Boeing	US	-15%	09/17/2001
CACI	US	23%	09/17/2001
CAE	Canada	-5%	09/11/2001
Cobham	UK	-4%	09/17/2001
Cubic	US	10%	09/17/2001
Dassault Aviation	France	-8%	09/13/2001
DRS Technologies	US	24%	09/12/2001
EADS	France	-9%	09/12/2001
EDO	US	24%	09/17/2001
Elbit Systems	Israel	3%	09/12/2001
Finmeccanica	Italy	-5%	09/11/2001
General Dynamics	US	12%	09/17/2001
GKN Group	UK	-4%	09/13/2001
Goodrich	US	-16%	09/17/2001
Halliburton	US	-8%	09/18/2001
Harris	US	14%	09/17/2001
Honeywell	US	-13%	09/17/2001
Indra Sistemas	Spain	8%	09/12/2001
ITT Industries	US	3%	09/18/2001
Jacobs Eng. Group	US	9%	09/17/2001
Kawasaki Heavy Indus.	Japan	-20%	09/19/2001
Kongsberg Gruppen	Norway	ns.	
L-3 communications	US	35%	09/17/2001
Lockheed Martin	US	16%	09/17/2001
Meggitt	UK	-4%	09/12/2001
Mitsubishi Heavy	Japan	7%	09/13/2001
Northrop Grumman	US	17%	09/17/2001
Oshkosh Truck	US	8%	09/17/2001
Raytheon	US	26%	09/17/2001
Rheinmettall DeTec	Germany	4%	09/11/2001
Rockwell Collins	US	-16%	09/17/2001
Rolls-Royce	UK	-6%	09/14/2001
Saab	Sweden	5%	09/18/2001
Silicon Graphics	US	-15%	09/20/2001
Singapore Tech. Eng.	Singapore	7%	09/12/2001
Smiths Industries	UK	-3%	09/11/2001
Snecma (Sagem)	France	-13%	09/14/2001
Stewart & Stevenson	US	9%	09/17/2001
Tadiran Com.	Israel	-8%	09/11/2001
Teledyne Technologies	US	22%	09/17/2001
Textron	US	-6%	09/17/2001
Thales	France	6%	09/12/2001
ThyssenKrupp Werften	Germany	-4%	09/13/2001
Titan	US	18%	09/17/2001
Ultra Electronics	UK	-3%	09/12/2001
United Technologies	US	-28%	09/17/2001
URS	US	16%	09/17/2001
VT Group	UK	-3%	09/12/2001

Note: Abnormal returns are computed given the market model parameters which are estimated with conditional heteroskedasticity GARCH(1,1) by the maximum likelihood method through the estimation window [-120; -1] in event time. n.s.: non significant at the 5% level.