

**THE IMPACTS OF THE KOSOVO WAR
ON NATO DEFENSE INDUSTRIES**

A Master Thesis

By

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ABSTRACT

THE IMPACTS OF THE KOSOVO WAR ON NATO DEFENSE INDUSTRIES

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The purpose of this study is to examine the effects of the Kosovo War on the NATO countries defense industry stocks. The data set covers daily prices of stocks of 34 U.S., 12 U.K., 7 French and 3 Turkish companies, totaling 56 defense stocks. The analysis is conducted by using both standard event study methodology and multivariate regression model. The study provides evidence that the defense stocks reacted positively and significantly to the Kosovo War. The study shows that there is a significant difference between the abnormal returns of the U.S. defense stocks and European defense stocks. However, the analysis proves that there is no significant difference between the abnormal returns of aerospace stocks and non-aerospace defense stocks.

Keywords: The Kosovo War, event study, defense industry, multivariate regression model

ÖZET

KOSOVA SAVAŞININ NATO SAVUNMA SANAYİLERİNE ETKİSİ

Emin ATEŞ

YÜKSEK LİSANS TEZİ, İŞLETME FAKÜLTESİ

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Bu çalışmanın amacı Kosova Savaşının NATO ülkelerinin savunma sanayi hisselerine olan etkilerini araştırmaktır.Örnekleme 34 Amerikan, 12 İngiliz, 7 Fransız ve 3 Türk olmak üzere 56 savunma sanayi şirketinden oluşmaktadır. Analizler olay etki çalışması ve çok değişkenli regresyon modeli ile yapılmıştır. Çalışma savunma sanayi hisselerinin Kosova Savaşı'na olumlu ve belirgin bir şekilde tepki gösterdiğini bulmuştur. Ayrıca çalışma, Amerikan ve Avrupalı şirketlerin anormal getirileri arasında belirgin bir fark olduğunu göstermiştir. Ancak, havacılık şirketleri ve diğer sektörlerdeki şirketlerin anormal getirileri arasında belirgin bir fark bulunamamıştır.

Anahtar Kelimeler: Kosova Savaşı,olay etki çalışması, savunma sanayi, çok değişkenli regresyon modeli

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CHAPTER 1

INTRODUCTION

In 1989, the first sparks of the Kosovo conflict are seen when the autonomy of the region is removed. After nine years, the conflict turned into an ethnic cleansing. NATO had to intervene the conflict for the stability of the region.

Although the cost of the war was high, it created new opportunities for marketing and selling defense products. Therefore, it is expected that the war affected defense industry firms positively. During the war, the superiority of U.S. products was observed. The feature of the Kosovo War is that it was mainly an air campaign. So it is expected that U.S. firms and aerospace firms benefited more than European firms and the firms that are not in the aerospace industry.

In this study, the impacts of the Kosovo War on NATO member countries' defense stocks are investigated by using event study methodology. This is the first study that investigates the financial impacts of Kosovo War.

Event studies measure the impact of a specific event on the value of a firm by using financial market data (MacKinlay 1997). They are concerned with measuring abnormal returns around the date of the specific event. The role of news as determinant of stock returns has been the subject of interest, because efficient market hypothesis assumes that stock returns fully reflect all available information and adjust immediately to the arrival of new information. (Shapiro 1999) Thus, a measure of the event's economic event impact can be constructed using security prices observed over a relatively short time period.

In order to measure the effects of this war on the defense firms of NATO countries, first the standard event study methodology is employed. The cumulative abnormal returns obtained are used to interpret the general effects of the Kosovo War.

As events, wars are similar to regulatory changes. The first similarity is that there is no single event date like those in merger announcements or stock splits. There are many days until the beginning of the war that increase the expectations of a war. The second similarity is that the event date is same for all firms and all of the firms are in the same industry. Same event date and the same industry issues create statistical problems that challenge the adequacy of using standard event study methodology to examine these types of events. Therefore, ten important dates were chosen and then Jaffe Standardized Residual Test (JSR) and Multivariate Regression Model (MVRM) are employed to deal with these problems.

The results of the analysis show that, defense companies reacted to the Kosovo War. The evidence indicates that the stocks of defense companies reacted positively and significantly to the attack of the Serbian Army to Albania. There is a significant difference in the reactions of U.S. and European firms portfolios to this event. However, the difference in the reactions of aerospace firms and the firms in other sectors is not significant.

CHAPTER 2

THE KOSOVO WAR & NATO DEFENSE INDUSTRIES

This chapter starts with a brief review of the Kosovo War. The rest of the discussion focuses on two major observations regarding the military capabilities of NATO member countries and the importance of the aerospace division within the defense industry.

2.1 The Kosovo War: Review and results

Kosovo lies in southern Serbia and has a mixed population of which the majority is ethnic Albanians. Until 1989, the region had a high degree of autonomy within the former Yugoslavia. In 1989, Serbian leader Milosevic altered the status of the region by removing its autonomy. Then, Kosovar Albanians were exposed to discrimination, since they opposed to the removal of autonomy. After nine years, discrimination turned into a systematic violent ethnic cleansing, and 1,500 Kosovar Albanians were killed and 400,000 people were forced to leave their homes in 1998¹.

These incidents led to the first international meeting for the Kosovo conflict, which was held on 28 May 1998 by foreign ministers of NATO countries. The next meeting was held on 12 June 1998 by the NATO Council. The alternative of solving the problem by a military operation was first consulted in this meeting. Following the deterioration of situation, on 13 October 1998, the NATO council authorized

¹ Source: <http://www.nato.int/kosovo/history.htm>

Activation Orders² for air strikes. At the last moment, the Serbian government agreed to comply and air strikes were called off.

Despite all past efforts, the situation in Kosovo flared up again at the beginning of 1999. Renewed international efforts were made to give new political impetus to the solution of the conflict. For this reason, the six-nation Contact Group³ and NATO declared the agreement on air strikes. Subsequently, the six-nation Contact Group established meetings in Paris, in February and March 1999. At the end of these meetings, the Kosovar Albanian delegation signed the proposed peace agreement, but the talks broke up without the signature of the Serbian delegation. Immediately afterwards, Serbian military and police forces stepped up the intensity of their operations against ethnic Albanians in Kosovo.

After a final ultimatum to Serbia, either to stop attacks or to face imminent NATO air strikes, which the Serbian government refused to comply with, the final order was given to start the air strikes on 23 March.

After an air campaign lasting seventy-eight days, the full withdrawal of Serbian forces from Kosovo began in June 1999. On the same day, the United Nations Security Council passed a resolution welcoming the acceptance by the Federal Republic of Yugoslavia of the principles on a political solution to the Kosovo crisis.

The Kosovo War was the largest combat operation in the history of NATO. Its cost was \$ 49.27 billion. Only military costs reached to \$ 4 billion.

During the conflict, NATO:

² It is an order to be ready to attack when the final order is given.

³ The sixnation Contact Group consists of France, Italy, Germany, Russia, United Kingdom and United States

- Dropped more than 23,000 bombs and missiles
- Spent more than \$ 225 million on fuel in the first week
- Destroyed almost half of the Yugoslavia's industrial production
- Caused \$ 2.61 billion damage to the Yugoslavian economy, according to Serbian experts.⁴

Table 1⁴
Final Cost of Kosovo War

THE WAR	\$ 4.09 bn.
AID	\$ 3.95 bn.
PEACEKEEPING	\$ 9.33 bn.
RECONSTRUCTION	\$ 31.89 bn.
TOTAL	\$ 49.27 bn.

Table 1 decomposes the components of the total cost of the Kosovo War. It shows that the most important cost is reconstruction cost for the Federal Republic of Yugoslavia, and it is approximately 32 billion dollars. The costs for United Nations and other countries are about 13 billion dollars as the sum of aid and peace keeping costs. The cost of the war is approximately 4 billion dollars for NATO.

When the war is reviewed, two important observations can be made. Firstly, the gap between the military capabilities of the U.S. and its allies became clear. Secondly, it was the first instance, in which victory was won only by air forces. These issues will be covered in the next two sections in more detail.

⁴ Source: http://news.bbc.co.uk/hi/english/world/europe/newsid_476000/476134.stm

2.2 U.S. and European Defense Industries Comparison

The Kosovo conflict made U.S. material and technological dominance within the NATO Alliance significantly apparent. In fact, the main reason is not that Europe lacks the military technological talents of the United States. The real causes of the gap are the disparity in their military spendings, and the differential treatment of the defense industry by the U.S. administration.

When the first reason is examined, it will be seen that there is a huge difference between the defense expenditures of the U.S. and European countries. Table 2 displays the annual defense expenditures of the U.S. and Europe as a whole.

Table 2
Annual Defense Expenditures of NATO Members

	1996	1997	1998	1999	2000
Total NATO Europe (US \$)	186.821	172.732	175.306	179.671	164.559
United States (US \$)	271.417	276.324	274.278	280.969	296.373
Total NATO (US \$)	466.681	456.879	457.112	468.960	468.999

Note: Numbers are X 100.000

Total NATO Europe is the sum of 16 European Countries' Expenditures

Total NATO is the sum of Total NATO Europe, United States and Canada Expenditures

According to Table 2, the U.S.'s expenditures are almost twice the sum of 16 European countries' expenditures. It should be taken into consideration that the U.S. spends 60% of this money on research and development (R&D) activities⁵. The money spent by the U.S. on R&D is equal to total military expenditures of all

⁵ http://www.northgrum.com/news/rev_mag/review09_12_3.html

Europe. Therefore, U.S. material and technology is more advanced than those of Europeans. This gives U.S. defense companies an advantage over European defense companies in the international arms market.

The second reason of the gap is the governmental support to the defense industry companies in the U.S. If it is investigated, it can be noticed that unlike its intension to limit mergers in other industries through the use of the antitrust law, U.S. government encourages mergers in the defense industry. Because U.S. Department of Defense is both the principal buyer and the main regulator of the defense industry, mergers in the defense industry raise complex competition policy issues that are not easily resolved by applying conventional antitrust merger analysis techniques. (Kovacic and Smallwood 1994). Therefore, the issue that the U.S. pays attention to is not the cost, but the competence and technological superiority of the materials. This stimulates the companies to manufacture innovative products.

Table 3 shows the major arms used in the Kosovo War. Although we do not have data on how \$ 4.1 billions spent on weapons is allocated among the defense companies of different countries, we can predict that the U.S. encouraged the use of weapons produced by its own companies.

Depending on the disparities mentioned above, it is likely that there is a difference between U.S. and European defense industry companies regarding the impact of the Kosovo War on them.

Table 3
Major Arms Used In The Kosovo War

Name	Type	Producer
E-3 Sentry	C3 ^a Aircraft	U.S.
F-117 A	Stealth Fighter Aircraft	U.S.
F-16	Fighter Aircraft	U.S.
F-15	Fighter Aircraft	U.S.
B-52	Bombardment Aircraft	U.S.
B-1 BOMBER	Bombardment Aircraft	U.S.
B-2	Bombardment Aircraft	U.S.
Tomahawk	Cruise Missile	U.S.
AGM-65 Maverick	Guided Missile (ATS) ^b	U.S.
AGM-86 C	Guided Missile	U.S.
AGM-88	Guided Missile (ATS)	U.S.
GBU-15	Glide Weapon	U.S.
AGM-130 A	Guided Missile (ATS)	U.S.
GR-7 Harrier	Fighter Aircraft	U.K.
Sidewinder	Guided Missile	U.K.
L-1011 TriStar	Cargo Aircraft	U.K.
Jaguar	Fighter Aircraft	U.K. & France
Tornado	Fighter Aircraft	U.K.
KC-130	Tanker Aircraft	Spain
KC-10	Cargo Aircraft	Spain

Source: http://abcnews.go.com/sections/world/DailyNews/kosovo_costs990326.html

a. Command, control and communication

b. From Air To Surface

2.3 Aerospace Industry

The Kosovo War became exclusively an air campaign⁶. Unlike a traditional military conflict, there was no direct clash of massed military forces. Air attacks lasted 78 days on selected strategic targets to degrade the ability of the Federal Republic of Yugoslavia (FRY) military to perform its functions. The Kosovo War, therefore, became the first instance in which victory had been realized through the exclusive application of air power.

The developments and changes in technology affected warfare strategies and tactics. The most important component of military power is the air forces in our age. Therefore, it can be observed that the aircraft development absorbs much of the defense spending of countries⁷. This directly influences aerospace industry financial figures.

Depending on the structure of the Kosovo War, it is likely that there is a difference between the aerospace industry companies and the companies in non-aerospace industries regarding the impact of the Kosovo War on them.

⁶ Table 3 demonstrates the arms used in the Kosovo War and it can be easily seen that it consists of aircrafts and missiles.

⁷ <http://www.fool.com/dripport/1999/dripport990929.htm>

CHAPTER 3

LITERATURE REVIEW

In this chapter, the market efficiency concept is covered first as a background for event studies. Next, a brief discussion of event study literature is presented. A review of the event studies examining the impacts of wars and military actions concludes the chapter.

3.1 Market Efficiency

Market efficiency implies that stock prices reflect all available relevant information in the market. A capital market is said to be efficient, if it fully and correctly reflects all relevant information in determining security prices.

Fama (1970) presented three strictly increasing degrees of information processing efficiency, based on how much of the available public and private information market prices are expected to reflect.

In the weak-form efficiency, asset prices incorporate all historical information. This form of efficiency implies that trading strategies based on analyses of historical pricing trends or relationships cannot consistently yield excess returns to investors. Since prices are “memoryless”, they are unforecastable, and will only change in response to the arrival of new information. This implies that asset prices follow a random walk, meaning that there is no correlation between subsequent price changes, and the asset prices fluctuate randomly and unpredictably.

In semi-strong form efficiency, asset prices incorporate all publicly available information. The level of asset prices should reflect all relevant historical, current and forecastable future information that can be obtained from public sources. Also in this form of efficiency, asset prices should change fully and instantaneously in response to the arrival of relevant new information. The key point about this form of efficiency is that it only requires information that can be collected from *public* sources to be reflected in asset prices.

In strong-form efficiency, asset prices reflect *all* information – public and private. This is an extreme form of market efficiency, because it implies that important company-specific information will be fully incorporated in asset prices with the very first trade after the information is generated and before it is publicly announced. In strong-form efficient markets, most insider trading would be unprofitable.

Fama (1991) renamed the market efficiency categories: tests for return predictability, event studies, and tests for private information instead of weak form, semi-strong form and strong form, respectively. While the coverage of semi-strong and strong form efficiencies are the same as before, Fama added dividend yields and interest rates to the coverage of weak form efficiency.

In this study, markets are accepted as semi-strong form efficient, and price adjustments to public information (the Kosovo Conflict) are investigated in an event study framework.

3.2 Event Studies

Event studies measure the impact of a specific event on the value of a firm by using financial market data (MacKinlay 1997). They are concerned with measuring abnormal returns around the date of an event that is specified. The role of news as determinant of stock returns has been the subject of interest, because efficient market hypothesis assumes that stock returns fully reflect all available information and adjust immediately to the arrival of new information. (Shapiro 1999) Thus a measure of the event's economic impact can be constructed using security prices observed over a relatively short time period.

Event studies have emerged as the single most important tool of empirical finance research due to their ease of use, clarity of purpose, flexibility, and absence of confusing influences (Megginson 1997). Event studies have a long history. According to MacKinlay, perhaps the first published study belongs to James Dolly (1933). Over the decades from the early 1930s until the late of 1960s, the level of sophistication of event studies increased. The improvements included removing general stock market price movements and separating out confounding events. The methodology that is essentially the same as that which is in use today was introduced in late 1960s.

Event studies have several major strengths. First, a researcher is able to gain an unbiased assessment of stock prices reaction to a given event by averaging out random noise over many different observations. Second, event studies are very clean tests that yield unambiguous results. Third, event studies provide a direct test of semi-strong form market efficiency, since they allow one to determine if information is incorporated fully and instantaneously into stock prices. (Megginson 1997)

The event study has many applications. In accounting and finance research, event studies have been applied to a variety of firm specific and economy wide events. Some examples include mergers and acquisitions, earning announcements, issues of debt or equity, regulatory changes and announcements of macroeconomic variables such as the trade deficit, and political events such as wars. In majority of applications, the focus is the effect of an event on the price of a particular class of securities of the firm, most often common equity. (MacKinlay 1997)

Event studies can be used for different purposes: *Market efficiency studies* assess how quickly and correctly the market reacts to a particular type of information. *Information usefulness* studies assess the degree to which company returns react to the release of a particular bit of news. In a *metric explanation* study, the metrics are explained by splitting the sample into different subsamples and examining whether the unusual element of returns differed among the subsamples. The types of event studies can be classified as market efficiency, information value and metric explanation studies.

Besides those three types, methodology studies of event study design can be accepted as a fourth type. (Henderson 1990) The methodology studies consider how best to run event studies. MacKinlay (1997) describes and discusses the procedures of standard event study methodology. He defines models and brings up some problems shortly. Henderson (1990) differs from MacKinlay in that he focuses in a detailed way on the problems and the approaches to deal with those problems in event studies. Binder (1998) discusses the statistical power of the standard methodology in different applications and explicates the multivariate regression framework. Collins and Dent (1984) make a comparison of alternative testing methodologies in event studies by means of simulation.

3.3 Studies Examining The Impacts Wars And Military Actions

Previous studies examine a wide variety of news events and their effects on aggregate stock prices. The discussion in this section is limited to studies dealing with the impacts of wars.

McDonalds and Kendall (1994) examined the effects of political events in the stock market. The stock price behavior of 16 U.S. defense industry firms was examined before and after 17 unforeseeable political events involving military forces. Their findings reveal that stock prices for defense firms tend to rise as a result of military actions. The events, as expected on the whole, appear not to have been anticipated. The most important effect on the U.S. defense industry stocks was observed for those events involving the former Soviet Union. Actions undertaken by the USSR were accompanied by dramatic increases in the U.S. defense industry stock prices.

Attia (1998) investigated the impact of the Iraqi invasion of Kuwait, and the Persian Gulf War on the stock prices of petroleum companies operating in the Gulf countries. His results provide evidence that the OPEC production had statistically significant influence on the average monthly index of multinational petroleum companies. In addition, average stock prices of multinational petroleum companies are significantly higher during August 1990 (the month of Iraqi invasion of Kuwait) than those during months before and after August. However, he could not find a significant difference between the average stock prices during the overall war period and the average stock prices before and after the war period.

Shapiro (1999) used a portfolio approach to examine the response of defense shares to war –and peace – related news. Consistent with other studies, the majority of the evidence confirms that the outbreaks of war, or announcements that increase the probability of a war commencing, are accompanied by positive abnormal returns. His study included a larger number of firms than those in previous studies. He built defense portfolios according to companies' R&D levels and found that the companies with high levels of R&D realized higher positive abnormal returns. Although he did not justify his results about R&D, it is supposed to be because R&D-oriented companies have more chance to introduce and promote new products when the market for defense products grows.

Cantener (2000), like Attia (1998), chose the intervention of the U.S. to the Gulf Crisis as the major event and investigated the impact of this event on U.S. defense stocks by using event study methodology. His sample included thirty-nine defense firms selected from the U.S. Department of Defense top contractors list. His analysis of the abnormal returns on defense stocks showed that the U.S. military intervention to the Gulf crisis affected those stocks significantly and positively in both short and long terms. He extended his study to find if there was a difference in the reactions of firms according to companies' defense dependency ratio (the ratio of military sales to total sales) and market value. He found a positive relationship between defense dependency ratio and abnormal returns of defense firms, controlling for the size of the firm.

CHAPTER 4

METHODOLOGY AND DATA

4.1 Hypotheses

The role of news (events) as a determinant of stock returns is our subject of interest because the efficient market hypothesis assumes that stock returns reflect all available information and adjust immediately to the arrival of new information. The first hypothesis checks whether the returns of NATO member countries defense stocks react to the Kosovo War.

The Kosovo War proved that there is a considerable difference between U.S. and European military capabilities due to supremacy of U.S. technology and application. During the Kosovo War, superior U.S. products must have been used. Therefore, U.S. companies must have gotten the lion's share from new orders. It is expected that there would be a difference between the abnormal returns of U.S. and European companies. Thus, it is hypothesized that there is no difference between abnormal returns of U.S. and European defense industry companies as the second hypothesis of the study.

The Kosovo War took its place in history as the first battle executed and accomplished only by air forces. Therefore, the air forces captured the biggest slice from the defense spendings during this war. It is expected that the aerospace companies react to this event differently than the non-aerospace companies. So the last hypothesis is that there is no difference between the abnormal returns of aerospace companies and other defense companies.

Table 4 depicts the summary of hypotheses that will be tested in this study.

Table 4
Summary of the Hypotheses

-
- **H₁₀** : NATO countries defense industry stocks do not react to the Kosovo War
H_{1A} : NATO countries defense industry stocks react to the Kosovo War

 - **H₂₀** : Average reactions (abnormal returns) of U.S. defense companies are equal to the average reactions (abnormal returns) of European defense companies during the Kosovo War.
H_{2A} : Average reactions of U.S. defense companies are not equal to the average reactions of European defense companies during the Kosovo War.

 - **H₃₀** : Average reactions of aerospace companies are equal to the average reactions of non-aerospace companies during the Kosovo War.
H_{3A} : Average reactions of aerospace companies are not equal to the average reactions of non-aerospace companies during the Kosovo War.
-

4.2 Methodology

In this section, standard event study methodology and its problems are reviewed first. Then, due to the similarity of the Kosovo War to regulatory changes, the problems encountered in conducting event studies to examine regulatory changes are covered. Finally, two methods proposed to deal with these problems, namely Jaffe Standardized Residual Test and Multivariate Regression Model are discussed.

4.2.1 Standard Event Study Methodology

While there is no unique structure for conducting event studies, there is a general flow of analysis. Henderson (1990) and MacKinlay (1997) define the event study steps similarly. These steps are as follows:

1. Defining the event date.

2. Measuring normal and abnormal returns.
3. Statistically testing the abnormal returns.

4.2.1.1 Defining the Event Date

After defining the event, it must be determined when it took place. This may seem simpler than it is. The issue is not when an event occurred, but when the market, that is, its most interested and well informed segment, could have reasonably anticipated the news.

The same holds for the Kosovo War. There are eight incidents including meetings and negotiations until the last day of the Kosovo War. Table 5 provides a list of events included in the analysis. Selection of these dates is based on the belief that occurrences on these dates provided information concerning the probability that war would begin. In addition, the last day of the war is included to the analysis to see the effects of the end of the war.

Table 5
Chronology of Important Days for The Kosovo War

Date	Event
12 June 1998	NATO Meeting At Defense Ministry Level First Time For Consideration Of Military Options To Kosovo
13 October 1998	Authorization Of "Activation Orders" For Air Strikes
30 January 1999	NATO And Contact Group Decision For Air strikes
06-23 February 1999	1 st Round Of Paris Negotiations Between Albanians And Serbians
15-18 March 1999	2 nd Round Of Paris Negotiations Between Albanians And Serbians
20 March 1999	US Ambassador Flew Belgrade To Warn For Air Strikes
23 March 1999	Air Strikes Began
10 June 1999	Air Strikes were Terminated

On 12 June 1998, the NATO Council, meeting at Defense Minister level, asked for an assessment of possible further measures that NATO might take for the Kosovo crisis. This led to the consideration of a large number of possible military options. On 13 October 1998, following a deterioration of the situation, NATO Council, authorized Activation Orders for air strikes. This move was made to support diplomatic efforts, and it worked out. The Serbian government agreed to comply and the air strikes were called off. On 29 January 1999, Six Nation Contact Group agreed to convene urgent negotiations between parties to the conflict, under international mediation. NATO supported Contact Group efforts by agreeing on January 30 to the use of air strikes if required, and by issuing a warning to both sides in the conflict. As a result of NATO's warnings, on dates 6-23 February and 15-18 March 1999, Paris negotiations were organized. As the final attempt, on 20 March 1999, the U.S. Ambassador flew to Belgrade to warn for air strikes. Serbia refused to comply and on 23 March 1999 air strikes began. On 10 June 1999, air strikes were terminated.

4.2.1.2 Measuring Normal and Abnormal Returns

In order to calculate normal and abnormal returns, event window and estimation window must be determined. The estimation window is the period chosen to generate expected returns during the event window. The event window is the period over which security prices of firms involved in this event will be examined. The event window is the event day plus and minus some number of days, weeks or months observed to see if anything unusual happened.

The event windows and estimation windows in previous studies differ from each other. Cantenar (2000) defined his event window as 253 days, which included the event day and 252 days (one year) after the event. He used an estimation window of 250 days, which ends 20 days before the event date. Shapiro (1999) focused on a fairly short window: event day and next five trading days. Shapiro used 180 trading days until 40 days before the headline date as his estimation window. MacKinlay (1997) employed a 41-day event window, comprised of 20 pre-event days, the event day and 20 post-event days. He used 250 trading days period prior to the event window as the estimation window. Megginson (1997) proposed a very narrow event window to determine what the immediate reaction to the event is. He suggested the period from 150 days to 20 days before the event day as the estimation window. McDonalds and Kendall (1994) defined their event window as 181 days around (90 days before the event date, event day and 90 days after the event day) the event day. They used 200 days period before the event window as their estimation period. It can be easily seen that there is not a precise consensus on the periods.

In this study, there is not a single event and single event window. There are multiple events and the event windows are three days – one day before the event, event day and one day after the event – for each event. In order to examine the short-term effects of events, event windows are taken as three days.

It is typical for the estimation window and the event window not to overlap. Estimation window must be before, after or both before and after some times the event window. Including the event window in the estimation of the normal return parameters could lead to the event returns' having a large influence on the normal return measure. In this situation, both normal returns and abnormal returns would capture the event impact. This would be problematic, since the methodology is built

on the assumption that the event impact is captured by the abnormal returns (MacKinlay 1997).

Therefore, estimation window which is taken as 180 days, ends three days before, 12 June 1998, the first important event date for The Kosovo War, in order to prevent event and estimation windows to overlap.

For the discussion of the methodology, some terms need to be defined. Normal return is defined as the return that would be expected if the event did not take place. Abnormal return is the mathematical difference between observed return and normal (expected) return for that day, week or month.

There are several approaches for describing a firm's normal returns. Some common ones are: mean returns, market adjusted returns and market returns. In the mean returns approach, a company's returns in the estimation period are averaged. In the event window, the company is expected to generate the average return as the normal return. In the market adjusted returns model, a company, in the absence of news, is expected to generate the same returns as the market during event window. The method is used especially to examine the effects of initial public offerings since this it does not require an estimation window. The abnormal return for market adjusted model is calculated as follows:

$$AR_{it} = R_{it} - R_{mt} \quad (1)$$

where R_{it} and R_{mt} are the period- t returns on security i and the market portfolio, respectively.

The market model that is used in this study is a statistical model, which relates the return of any given security to the return of the market portfolio. This

method considers the risk of the security and the movement of the market during the event period. For any security i the market model is:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_i \quad (2)$$

where R_{it} and R_{mt} are the period- t returns on security i and the market portfolio, respectively. α_i and β_i are the parameters of the market model and ε_i is the prediction error. α_i and β_i parameter estimates are obtained from the regression model in equation (2) using estimation period data. Given the market model estimates, the abnormal returns are found for the event period. Using the market model to measure the normal return, the sample abnormal return is:

$$AR_{it} = R_{it} - \alpha_i - \beta_i R_{mt} \quad (3)$$

4.2.1.3 Statistical Tests of the Abnormal Returns

Before testing, abnormal returns must be aggregated both across firms and across time. Aggregation over time is a simple accumulation over the event window. In event studies, all time is kept relative to the event date. The cumulative abnormal return (CAR) is the sum of all the abnormal returns between the event date and day T . CAR is computed for each firm as of time T as follows:

$$CAR_{iT} = \sum_{t=1}^T AR_{it} \quad (4)$$

Aggregation across firms involves the averaging of CARs for all firms in the sample on a given day in the event window. The average cumulative abnormal return (\overline{CAR}) on a day T for N securities is defined as:

$$\overline{CAR}_T = \frac{1}{N} \sum_{i=1}^N CAR_{iT} \quad (5)$$

where CAR_{iT} is the cumulative abnormal return for the i th security until day T starting from the event day.

The last step in the event study is statistical testing of aggregated returns. Early event studies often used graphics as the primary method of interpretation. CAR plots were presented to show the reader how the firms reacted to an event. Such pictures are still routine in event studies. But now, the results should be supported by statistical tests.

To test the null hypothesis that the mean cumulative abnormal return is equal to zero for a sample of N firms, t statistic is employed as described in Barber and Lyon (1997):

$$t_{CAR} = \left(\frac{\overline{CAR}_T}{\sigma_{CAR_T} / \sqrt{N}} \right) \quad (6)$$

where \overline{CAR}_T is the average cumulative abnormal return and σ_{CAR_T} is the cross-sectional sample standard deviation of cumulative abnormal returns for the sample of N firms. When the sample is drawn randomly from a normal distribution, this test statistic follows a Student's t -distribution under the null hypothesis. The Central Limit Theorem guarantees that if the measures of abnormal returns in the cross-section of firms are independent and identically distributed drawings from finite variance distributions, the distribution of the mean abnormal return measure converges to normal as the number of firms in the sample increases. (Barber and Lyon 1997)

The method discussed to this point is parametric, in that specific assumptions have been made about the distribution of abnormal returns. However, non-parametric approaches, which are free of specific assumptions concerning the distribution of returns, are also available.

Typically, non-parametric tests are not used in isolation but in conjunction with their parametric counterparts. The inclusion of the non-parametric tests provides a check of the robustness of conclusions based on parametric tests.

In this study, Wilcoxon Signed Rank test is used to examine the significance of cumulative abnormal returns. This test is based on ranks. The hypothesized median (zero in our case) is subtracted from each observation. After subtraction, any result of zero is discarded. And then the absolute values of remaining non-zero differences are ranked. If two or more absolute differences are tied, the average rank is assigned to each. The ranks corresponding to positive differences are summed to find the Wilcoxon statistic R_t . Expected value and standard deviation for sum of ranks are defined as:

$$E(R_t) = \frac{N(N+1)}{4} \quad (7)$$

$$\sigma(R_t) = \frac{N(N+1)(2N+1)}{24} \quad (8)$$

For $N > 12$ the distribution of the following statistic can be adequately approximated by the standard normal:

$$Z_t = \frac{R_t - E(R_t)}{\sigma(R_t)} \quad (9)$$

4.2.2 Event Study Problems

In this section, event study problems will be discussed in two parts. In the first part, standard event study methodology problems will be covered. In the second part, the problems of regulatory event studies will be discussed due to the Kosovo War's similarity to regulatory events.

4.2.2.1 Standard Event Study Problems

After defining the event, a researcher must determine when it took place. Misidentification of an event date can obscure an issue. Early merger studies used the date of a merger and found no significant evidence of shareholder return effects. Later studies, on the other hand, used the date on which the intent to merge was announced, and, they found significant abnormal and cumulative abnormal returns.

Having decided on the event date, the estimation period must be determined. There are three choices for the estimation period: before, after and around the event window. The majority of studies used an estimation period before the event. The problem with the estimation window is that it should not overlap event window to eradicate event's effects on the normal return calculation.

In addition to these procedural issues, there are some econometric problems. Regression models are based on a number of statistical assumptions. Specifically, the models assume that the residuals: are normally distributed with a mean of zero, are not serially correlated, have a constant variance, and are not correlated with the explanatory variables. Further, when regression system is used, it is also assumed

that there is no correlation between residuals for the different firms. However, there is reason to be concerned about each of these assumptions.

Non-normality: the non-normality problem is potentially more troublesome for studies using daily data, because daily returns are non-normal. Fortunately, the same is not true for residuals, since the distribution of residuals should be close enough to normal.

Autocorrelation and Non-synchronous trading: there may be statistically significant autocorrelation in the residuals.⁸ Non-synchronous trading – the mismatching of the values for R_{mt} and R_{it} owing to trading frequencies – creates bias in betas of individual securities. The result is that the betas of infrequently traded securities are downward biased, while shares trading with more than average frequency have upward biased betas. (Henderson 1990) Unfortunately, the extra work for autocorrelation and non-synchronous trading does not seem to strengthen event study results.

Variance shifts: when the method of cumulating abnormal returns across firms and then aggregating in time is used, it is assumed that the variance does not change during the event window. When there are variance shifts, this assumption does not hold. In order to solve problems about variance shifts, the use cross-sectional variance is suggested, but there are costs to using such cross-sectional measures. Such a calculation implicitly assumes that the variance for every firm is the same on day t and the estimates ignore estimation period data.

Event (calendar) clustering and correlation between residuals: calendar clustering refers to events occurring at or near the same time. Industry clustering refers to events concentrated in the same industry. Both event and industry

⁸ The autocorrelation of residuals are found insignificant in this study.

clustering cause to reject the hypotheses more often in standard event study methodology by leading to correlation between residuals.

This problem will be discussed in a more detailed way in the next section.

4.2.2.2 Problems of Regulatory Event Studies

Three features of regulatory events make them more difficult to analyze than other types of events. (Binder 1985b) First, for many important regulations it is not accurately known when expectations change. Unlike stock splits or similar simple events, regulatory events usually involve no single well-defined announcement; rather there are multiple announcements, such as committee or senate approval during the legislative or administrative process. Regulatory announcements are also more likely to be anticipated than are corporate announcements. Because of the size of potential wealth transfers, there are extensive negotiations between interest groups and politicians of regulation before the actual voting; therefore the outcome is likely to be known ahead of time.

Second, it is not clear *a priori* that the effects of regulation are consistently positive or negative: in the same industry some firms may gain while others lose. Protective regulation can take a variety of forms and choice of form may affect differently the welfare of industry members. When there is this asymmetry, the usual tests of the significance of average or cumulative average returns will often falsely reject the hypothesis that regulation has an effect.

Finally, unlike other events that are most often studied, regulation often affects firms in the same industry during the same calendar time periods. Therefore,

when significant excess returns are found, it is not certain that whether these are due to regulation or to some other industry-specific shock.

These characteristics are valid for the Kosovo War as well. There are many negotiations and meetings that possibly changed the expectations and anticipations before the beginning of the war⁹. It is expected that firms react differently to the war. All firms are in the defense industry and the event date is same for all firms.

The event clustering and industry clustering lead to cross-sectional correlations of the dependent variable of interest (Collins and Dent 1984). Testing procedures, which fail to take cross-sectional correlations into account, can lead to unwarranted inferences. In order to provide some insights into the potential severity of the cross-sectional correlation problem, Collins and Dent (1984) computed the degree of bias for different sample sizes and levels of correlations. Table 6, taken from this study, illustrates that both sample size and the level of cross-correlation affect the degree of bias in the standard deviations of the sampling distribution of average portfolio abnormal returns.

Table 7 shows the distribution of correlations between abnormal returns of securities in this study. This information can be used for estimating the degree of bias. The mean level of cross-correlations is 0.057 and the sample size is 56 securities, estimation procedures yield estimates of σ_x (average standard deviation of abnormal returns of sample securities), which are approximately 60% of the true or correct value¹⁰. The statistical tests of standard event study methodology based on σ_x can lead to biased test results due to understating the standard deviation. Therefore, Jaffe Standardized Residual Test (JSR) and Multivariate Regression Model (MVRM) will be employed to deal with the cross-correlation problem.

⁹ Table 5 shows the important dates for the Kosovo War.

¹⁰ 60% is calculated via interpolation by using Table 7.

Table 6
Ratio of σ_X (Independence) / σ_X (Dependence) for Various Levels of Cross-Correlation and Sample Sizes

Level of Correlation	Sample Size						
	5	10	20	40	60	80	100
0.00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
0.10	0.8452	0.7255	0.5872	0.4518	0.3807	0.3352	0.3029
0.20	0.7454	0.5976	0.4564	0.3371	0.2795	0.2440	0.2193
0.30	0.6742	0.5199	0.3863	0.2806	0.2312	0.2012	0.1805
0.40	0.6202	0.4663	0.3410	0.2454	0.2016	0.1751	0.1569
0.50	0.5774	0.4264	0.3086	0.2209	0.1811	0.1571	0.1407
0.60	0.5423	0.3953	0.2840	0.2024	0.1657	0.1437	0.1287
0.70	0.5130	0.3701	0.2644	0.1880	0.1538	0.1333	0.1193
0.80	0.4879	0.3492	0.2485	0.1762	0.1440	0.1248	0.1117
0.90	0.4663	0.3315	0.2351	0.1664	0.1360	0.1178	0.1054

$$\sigma_X \text{ (Independence)} = (1/N) \sigma^2$$

$$\sigma_X \text{ (Dependence)} = (1/N) \sigma^2 + ((N-1)/N) \sigma_{ij}$$

where:

N = number of securities in sample

σ^2 = average variance of abnormal returns of sample securities

σ_{ij} = average covariance of abnormal returns of sample securities equal to $\rho \sigma_i \sigma_j$

$$\sigma_X \text{ (Independence)} / \sigma_X \text{ (Dependence)} = 1 / \sqrt{1+(N-1) \rho}$$

Table 7
Distribution of Pairwise Correlations Between Abnormal Returns of Sample Securities

Mean	Median	StDev	t-statistic							
0.0566	0.045	0.1026	4.12							
Deciles										
Min.	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	Max.
-0.211	-0.058	-0.025	0.001	0.023	0.045	0.065	0.092	0.132	0.190	0.969

4.2.3 Jaffe Standardized Residual (JSR) Test

This testing methodology uses a portfolio approach in the estimation of abnormal returns. In order not to be influenced by the correlations between abnormal returns of securities, the residual variance of an equally weighted portfolio of securities is measured. The residual variance of this portfolio is measured over an estimation period and it is used in testing the significance of the abnormal returns in the event window as follows: for each point, t , in the estimation period the abnormal returns from equation (3) are aggregated across the N securities to form average abnormal return (AAR) of portfolio in period t :

$$AAR_t = \frac{1}{N} \sum_{i=1}^N AR_{it} \quad \text{for } t = 1, \dots, T \quad (10)$$

The variance of the average abnormal returns is then computed as:

$$\text{var}(AAR) = \frac{1}{T-1} \sum_{t=1}^T (AAR_t - \overline{AAR})^2 \quad (11)$$

where

$$\overline{AAR} = \frac{1}{T} \sum_{t=1}^T AAR_t \quad (12)$$

and (1,T) is 180-day estimation period.

For the case where all securities in the sample experience the critical event at the same point in calendar time, the JSR test is:

$$\frac{AAR_t}{S_{AAR}} \sim t_{N-1} \quad (13)$$

where $S_{AAR} = \sqrt{\text{var}(AAR)}$.

4.2.4 Multivariate Regression Model

Rather than modeling abnormal returns as prediction errors from the market model equation, the sample period can be extended to contain the event period and (when there is only one event) a zero-one variable D_t can be included in the return equation:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \gamma_i D_t + u_{it} \quad (14)$$

The coefficient γ_i is the abnormal return for security i during period t and is directly estimated in the regression. That is, this approach parameterizes the abnormal return in the market model regression equation. This model can be adapted to equally weighted portfolio of firms, all of which experienced the events during the same calendar periods:

$$R_{pt} = \alpha_p + \beta_p R_{mt} + \gamma_p D_t + u_{pt} \quad (15)$$

When an equally weighted portfolio is used as the dependent variable, γ_p gives the estimate of the average abnormal return across the stocks in the portfolio. Alternatively, when there are multiple events, different dummy variables can be used for each event.

Tests of the hypothesis that the event affected security prices, based on the estimated gammas in equation (15), will not be very powerful when abnormal returns differ in sign across the sample firms. This asymmetry can be modeled by disaggregating equation (15) into a multivariate regression model (MVRM) system of equations with one equation for each of the N firms experiencing the A events:

$$\begin{aligned}
R_{1t} &= \alpha_1 + \beta_1 R_{mt} + \sum_{a=1}^A \gamma_{1a} D_{at} + u_{1t} \\
R_{2t} &= \alpha_2 + \beta_2 R_{mt} + \sum_{a=1}^A \gamma_{2a} D_{at} + u_{2t} \\
& * \\
& * \\
& * \\
R_{Nt} &= \alpha_N + \beta_N R_{mt} + \sum_{a=1}^A \gamma_{iNa} D_{at} + u_{Nt}
\end{aligned} \tag{16}$$

This methodology, which allows the coefficients to differ across firms, appears to have been first implemented by Binder (1985a) and Schipper and Thompson (1983).

The system of equations can be written in the form:

$$R = X\Gamma + \varepsilon \tag{17}$$

$$\begin{bmatrix} R_1 \\ R_2 \\ \cdot \\ \cdot \\ \cdot \\ \cdot \\ \cdot \\ \cdot \\ \cdot \\ R_N \end{bmatrix} = \begin{bmatrix} X_1 & 0 \\ \cdot & X_2 \\ \cdot & \cdot \\ \cdot & \cdot \\ \cdot & \cdot \\ \cdot & \cdot \\ \cdot & \cdot \\ \cdot & \cdot \\ \cdot & \cdot \\ 0 & 0 \end{bmatrix} \begin{bmatrix} 0 \\ 0 \\ \cdot \\ \cdot \\ \cdot \\ \cdot \\ \cdot \\ \cdot \\ \cdot \\ X_N \end{bmatrix} + \begin{bmatrix} \alpha_1 \\ \beta_1 \\ \gamma_{11} \\ \cdot \\ \gamma_{1A} \\ \cdot \\ \alpha_N \\ \beta_N \\ \gamma_{N1} \\ \cdot \\ \gamma_{NA} \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \cdot \\ \cdot \\ \cdot \\ \cdot \\ \cdot \\ \cdot \\ \cdot \\ \varepsilon_N \end{bmatrix} \tag{18}$$

where $R_i = T \times 1$ (570 days \times 1) vector,

$X_i = K \times T$ (12 parameters \times 570 days) matrix of independent variables,

$\Gamma = a K \times N \times 1$ (672 \times 1) vector of coefficients,

$\varepsilon_i = a T \times 1$ vector of disturbances.

The efficient estimator is generalized least squares. The model has a particularly convenient form. For the t th observation, $N \times N$ covariance matrix of disturbances is:

$$\Sigma = \begin{bmatrix} \sigma_{11} & \sigma_{12} & \cdot & \cdot & \cdot & \sigma_{1N} \\ \sigma_{21} & \sigma_{22} & \cdot & \cdot & \cdot & \sigma_{2N} \\ & & \cdot & & & \\ & & \cdot & & & \\ & & \cdot & & & \\ \sigma_{N1} & \sigma_{N2} & \cdot & \cdot & \cdot & \sigma_{NN} \end{bmatrix} \quad (19)$$

so in equation (17),

$$V = \Sigma \otimes I \quad (20)$$

where \otimes denotes the Kronecker product

and
$$V^{-1} = \Sigma^{-1} \otimes I \quad (21)$$

GLS estimator is found as follows:

$$\hat{\beta} = [X' V^{-1} X]^{-1} X' V^{-1} R_i \quad (22)$$

The preceding discussion assumes that Σ is known, which is rarely the case. However, feasible generalized least squares have been devised (Greene 1990). The least squares residuals are used to estimate consistently the elements of Σ with:

$$\hat{\sigma}_{ij} = s_{ij} = \frac{e_i' e_j}{T} \quad (23)$$

and the estimate of Σ is:

$$S = \begin{bmatrix} S_{11} & S_{12} & \cdot & \cdot & \cdot & S_{1N} \\ S_{21} & S_{22} & \cdot & \cdot & \cdot & S_{2N} \\ & & \cdot & & & \\ & & \cdot & & & \\ & & \cdot & & & \\ S_{N1} & S_{N2} & \cdot & \cdot & \cdot & S_{NN} \end{bmatrix} \quad (24)$$

When Σ is unknown, S is used in the generalized least squares estimation.

A standard assumption in the system of equations (16) is that the disturbances are independent and identically distributed within each equation, but their variances differ across equations. It is also assumed that across equations the contemporaneous covariances of the disturbances are nonzero, but that noncontemporaneous covariances all equal zero. These assumptions, which evidence indicates fit stock return data fairly well, place a particular structure on the variance-covariance matrix Σ of the disturbances in the stacked generalized least squares regression used to estimate the parameters of the system.

The MVRM is obviously different from ordinary least squares. In MVRM, the equations are linked by their disturbances. If the equations are actually unrelated, there is no efficiency gain from using the MVRM. The greater the correlation of disturbances, the greater the efficiency gain accruing to MVRM. In the more general case, with unrestricted correlation of the disturbances and different regressors in equations, the results are complicated and depend on data. (Greene 1990) However, tests of hypotheses in this framework explicitly control for the contemporaneous correlation and heteroskedasticity problems discussed in Section 4.2.2.2 above by employing the estimate of Σ . Thus, a number of statistical problems that are of concern in the standard event study methodology are solved directly in the regression framework as long as the disturbances in each equation have the assumptions

mentioned above. Moreover, the real advantage of the MVRM framework over the standard methodology lies in its ability to allow the abnormal returns to differ across firms and to easily test joint hypotheses about the abnormal returns. Table 8 shows some examples of joint hypotheses.

Table 8
Hypotheses Testing in the MVRM

Hypothesis	Description
$H_1: 1/N \sum_i \gamma_{ia} = 0$	The average abnormal return during announcement period a equals zero
$H_2: \gamma_{ia} = 0 \forall i,$	All abnormal returns for announcement period a equal zero

While a number of different hypotheses about abnormal returns can be tested, the two hypotheses in Table 8 seem to be of primary interest in this literature (Binder 1985a). The test of H_1 is similar to standard event study methodology hypothesis. H_2 is joint hypothesis that the abnormal returns equal zero for all firms a given announcement.

Test of H_2 will be more powerful tests of whether an event affects the sample firms than tests of H_1 when the abnormal returns differ in sign (Binder 1985b). The joint hypothesis is the benefit of MVRM especially when some firms lose while others gain.

Like Schipper and Thompson (1983), the Wald test, which is asymptotically distributed as chi-squared due to the use of a consistent estimate of covariance matrix, is used in testing the linear restrictions. Binder (1985a, b) warns that asymptotic statistics are biased in tests with as many as 60 monthly returns or 250

daily returns. In this study, to deal with this problem, 570 daily returns are used in estimation.

4.3 Data

The sample in this study is limited to the defense companies of NATO member countries, which have a so called defense sector on their stock markets. This is the case for only three markets: New York, London and Paris. The use of this constraint resulted in a sample of 57 companies. One French and three U.S. firms are removed from the sample due to problems like missing or unreliable data. In addition to these companies, 3 Turkish companies are added to the sample. Although there are more than 30 companies in the contractors list of Turkish Defense Ministry, only three of them are traded on the Istanbul Stock Exchange (ISE). The overall sample contains 56 companies.

Daily prices of 56 securities and indices of four markets between 10 February 1998 and 18 April 2000 (totaling 570 trading days) are obtained from *DataStream*. *DataStream* adjusts prices for dividend payments and stock splits. Market indices used in the analysis are *DataStream* equal-weighted market indices. Also financial statements of the sample companies are obtained from *DataStream*.

Table 9 displays some characteristics of the sample. First column shows from which country the companies are. Second column depicts the companies' lines of business. Third and fourth columns show the market values and sales as of December 1999, respectively.

There are 34 U.S., 12 U.K., 7 French and 3 Turkish companies in the sample. Main lines of business for these defense companies are aerospace and electronics

sectors including 18 and 20 companies, respectively. Weapon, automotive and chemicals sectors have 7, 11, and 6 companies, respectively.

Mean market value of U.S. companies is 11.65 billion dollars, while it is 2.26 billion dollars for European companies. When the sales of U.S. and European companies are compared, it can be seen that mean sales are 9.51 billion dollars for U.S. companies and 1.42 billion dollars for European companies.

Compared to others, the aerospace sector has the highest mean market value of 14.7 billion dollars. The mean market value of non-aerospace companies is 5.24 billion dollars. Sales figures display a similar pattern. Aerospace sector mean sales is 12.05 billion dollars, while mean sales of non-aerospace companies is 4.01 billion dollars.

Table 9
Sample Companies List

Name	Country	LOB	Market Value	Sales
Aim Group	UK	A	59	109
Alliant Techsystems	US	B, D	1,143	1,090
Alvis	UK	D	250	377
Amer.Pacific	US	E	93	73
Arvin Inds.	US	D	2	3,101
Aselsan	TR	B	478	144
Bae Systems	UK	A, B, C	21,046	11,359
Boeing	US	A, B, C	42,003	57,993
Chemring	UK	B, E	100	106
Cmp.Sciences	US	B	8,934	7,660
Cnim (Ca)	FR	C	11	61
Cobham	UK	C	1,336	702
Dassault Aviation	FR	A	167	445
Eaton	US	E	5,180	8,402
Fmc	US	D	2,983	4,111
Gen.Dynamics	US	A	11,434	8,959
Gen.Elec.	US	A, B, E	618,677	111,108
Gencorp	US	A, D, E	593	1,071
Gfi Industries	FR	D	42	71
Gkn	UK	A, D	11,696	5,980
Gte	US	B	91,835	25,336
Hampson Inds.	UK	A	142	231
Harris	US	B	3,843	1,744
Harsco	US	F	1,223	1,717
Health Net	US	F	756	855
Hercules	US	E	6,348	3,248
Honeywell Intl.	US	A, C	48,604	23,735
Intl.Shiphldg.	US	F	471	326
Johnson Controls	US	F	7,277	16,139
Kaman 'A'	US	F	246	982
Latecoere	FR	A	22	29
Lockheed Martin Corp.	US	A, B	20,160	25,530
Ltv	US	F	1,592	4,120
Martin Mrta.Mats.	US	F	2,553	1,259
Meggitt	UK	A, B	1,210	559
Netas Telekomunik	TR	B	848	168
Northrop Grumman Corp.	US	B	5,840	8,995
Oshkosh Truck 'B'	US	D	501	1,165
Otokar	TR	D	192	88
Raytheon	US	A, B	21,081	19,530
Rockwell Automation	US	B	10,788	7,043
Rolls-Royce	UK	D	6,337	7,651

Name	Country	LOB	Market Value	Sales
Sagem	FR	B, C	841	525
Sequa 'A'	US	F	904	1,700
Smiths Group	UK	A, B, F	4,219	2,135
Technofan	FR	A	5	5
Tenneco Autv.	US	C	1,867	3,279
Texas Insts.	US	B, F	7,663	9,468
Textron	US	A, D	18,040	11,579
Trw	US	B	14,659	19,969
Ultra Electronics Hdg.	UK	B	444	311
Umeco	UK	F	79	86
Unisys	US	B	10,434	7,545
United Technologies	US	A	34,931	24,127
Wash.Gp.Intl.	US	E, F	506	2,248
Zodiac	FR	C	197	129

Notes:

1. Countries are US: United States of America, UK: United Kingdom, FR: France and TR: Turkey
 2. Values are as of 12.31.1999, Million US Dollars
 3. LOB: Line of Business
- A: Aerospace B: Electronics and Communication C: Weapon and Military Equipment
D: Automotive and Military Vehicle E: Chemicals F: Other: Building, Health, Transportation etc.

CHAPTER 5

RESULTS

This chapter discusses the results of testing the hypotheses mentioned in the previous chapter. Initially, the market model is used in the estimation of abnormal returns. For 46 out of 56 stocks in the sample, the coefficient estimates were insignificant. That being the case, the market adjusted model is used in conducting the standard event study methodology.

5.1 Graphical Results

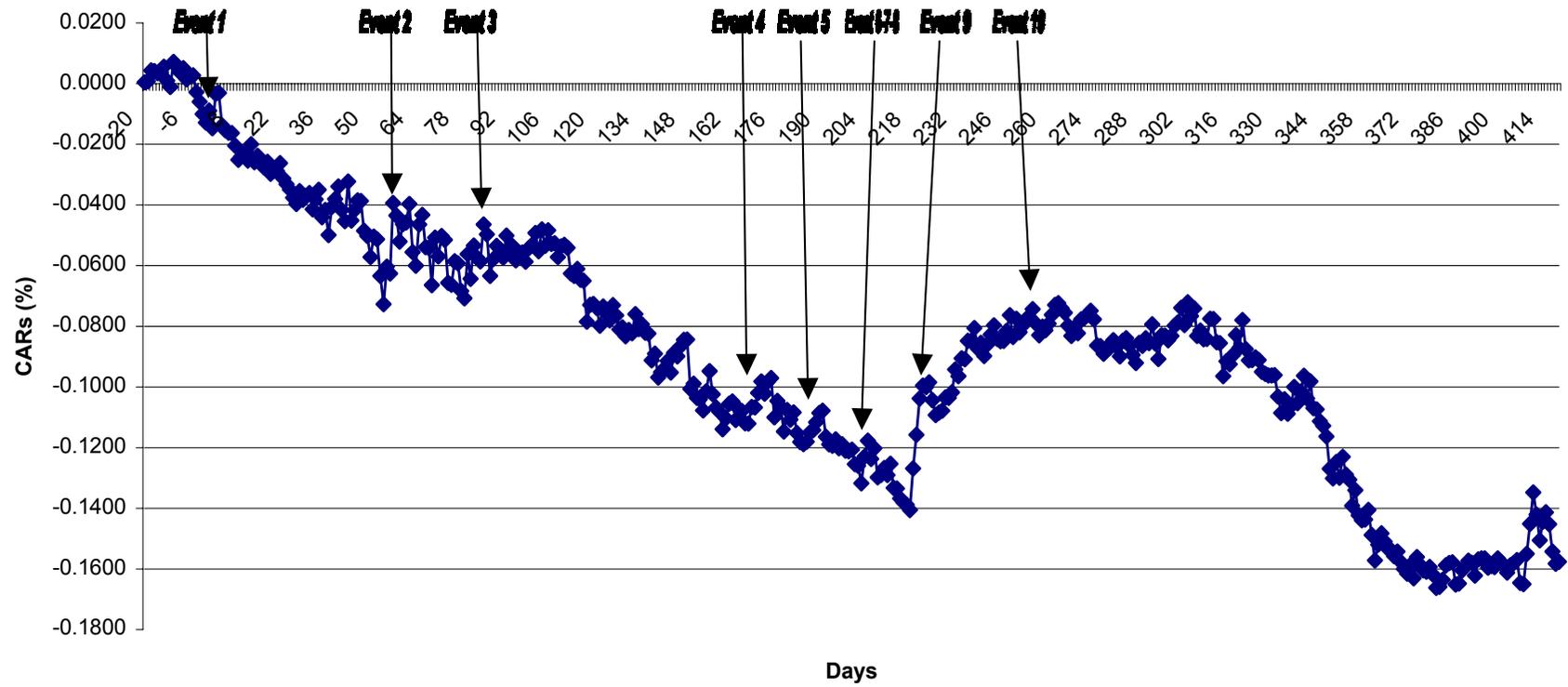
Before analyzing the statistical tests, Figure 1 presents CARs for the overall sample in order to give some feeling about the data.

Figure 1 shows the CARs beginning from 20 days before the first event in Table 5 (12 June 1998, the first international meeting on the Kosovo conflict), which is taken as day 0. In Figure 1, it can be seen that there is a downward trend in the CARs of defense stocks. After the end of Cold War, stocks of defense companies have not soared for more than a decade.¹⁴ There were a clearly defined enemy and high spending on defense fuelled by the Cold War on those days. Now the U.S. and European armies have fewer personnel and defense budgets have shrunk by 100 billion dollars. As a result of this, the downward trend has been observed since the end of the Cold War.¹¹

¹¹Source: Economist, 7/20/2002, Vol. 364 Issue 8282, p3

Figure 1

CARs of All Firms Portfolio



In Figure 1, there are apparent abnormal returns around days 57 and 219. On the 57th day, 30 August 1998, the U.S. market index decreased dramatically. By the effect of this decrease, European market indices decreased on 01 September 1998. Although market indices decreased dramatically, defense stock prices did not move with the markets. Since the abnormal return is the difference between the real return and the market return, there occurred high levels of abnormal returns for that time period.

On 219th day, 13 April 1999, the Serbian Army attacked Albania. Until that day, the expectation was that Serbian forces would not resist to NATO attacks. But after that day, it was understood that the war would last longer than expected. So the defense stocks reacted positively to this event.

Two events identified with the help of Figure 1 are added to the event list. Table 10 presents the extended list of events used in the rest of the analysis.

Table 10
Chronology of Important Days for The Kosovo War

Event	Exp.Reaction	Date	Definition
1	+	12.06.1998	First international meeting on the Kosovo Conflict considering military solutions
2	+/-	30.08.1998	Dramatic decrease in market indices
3	+	13.10.1998	Authorization Of "Activation Orders" For Air Strikes
4	+/-	30.01.1999	NATO And Contact Group Decision For Air strikes
5	+/-	23.02.1999	1st Round Of Paris Negotiations Between Albanians And Serbians
6	+	18.03.1999	2nd Round Of Paris Negotiations Between Albanians And Serbians
7	+/-	20.03.1999	US Ambassador Flew Belgrade To Warn For Air Strikes
8	+	23.03.1999	Air Strikes Began
9	+	13.04.1999	Serbia Attacks to Albania
10	-	10.06.1999	End of Air Strikes

The first column of the Table 10 shows the expected reactions to these events. After the events 4 and 7, the change in the probability of the war depends on the response of the sides. For event 5, it is not known what the exact result of the meeting is. So, in these cases the sign of the reactions is ambiguous.

The effects of the events listed on Table 10 are investigated for all firms and for four portfolios. The companies are grouped according to their countries of origin and sectors. The first two portfolios are the U.S.-companies portfolio and the European-firms portfolio. The U.S.-companies portfolio consists of 9 aerospace, 8 electronics, 5 automotive, 5 weapon producer companies and 7 companies from other sectors, totaling 34 companies. Mean market value and sales for this portfolio are 11.65 and 9.51 billion dollars, respectively. The European-firms portfolio includes 9 aerospace 4 electronics, 4 automotive, 3 weapon producer companies and 2 companies from other sectors, totaling 22 firms. Mean market value and sales for the European-firms portfolio are 2.26 and 1.42 billion dollars, respectively.

The remaining two portfolios are the aerospace-firms portfolio and the portfolio of the firms in non-aerospace sectors. There are 9 U.S. companies and 9 European companies in the aerospace-companies portfolio. The mean market value and sales for aerospace firms are 14.7 and 12.05 billion dollars, respectively. The non-aerospace-firms portfolio consists of 25 U.S. firms and 13 European firms. Mean market value is 5.24 billion dollars and mean sales are 4.01 billion dollars for the other firms portfolio.

5.2 Statistical Tests Results

In this section, statistical test results of the hypotheses mentioned in Chapter 4 will be presented.

5.2.1 Tests of Hypothesis 1

Table 11 shows the results for the tests of the first hypothesis that the Kosovo War had no impact on defense stocks. The first two columns show the results of the

standard event study methodology. The second two columns show the results of non-parametric Wilcoxon test. The third two columns presents the results of JSR test. The fourth two columns depict the test of MVRM for average effects. The last two columns show that the test of MVRM for individual effects.

Table 11 shows that almost all events are significant according to t-test results. Besides, some results are contradicting to expectations about the reactions of the defense firms to the events. For example, event three is the authorization of Activation Orders for air strikes on 13 October 1998, and this event must have increased expectations of a war and affected the defense firms positively. However, the CARs obtained by the standard event study methodology, have negative sign.

WSR results are similar to t-test results. This is not surprising given that the test statistics assume independence of observations. So WSR test should be suffering from the same problem as the t-test, and therefore are not that reliable. The rest of the analysis will continue with only JSR, average and individual reaction tests of MVRM.

Table 11
Tests of H_{10} that the Kosovo War Had No Impact on the Defense Stocks

EVENT	t-Test		WSR		JSR		MVRM Avg. Reaction		MVRM Ind. Reaction	
	CAR	T	Wil. St.	P Val.	CAR	t	Wald	P Val.	Wald	P Val.
1	-0.0046	-1.98**	562	0.06	-0.0046	-0.43	6.21	0.00	52.32	0.62
2	0.0168	6.70***	1432	0.00	0.0168	2.29**	0	0.99	91.07	0.00
3	-0.0115	-2.81***	398	0.00	-0.0115	-0.13	2.67	0.10	72.08	0.08
4	-0.0049	-1.43	558.5	0.05	-0.0049	0.93	1.15	0.18	125.74	0.00
5	-0.0074	-2.63**	458	0.01	-0.0074	-0.48	0.26	0.61	68.02	0.13
6	-0.0045	-1.97*	543	0.04	-0.0045	-0.13	0.07	0.80	61.67	0.28
7	-0.0111	-5.01***	254.5	0.00	-0.0111	-0.29	0.38	0.54	74.42	0.05
8	0.0025	1.13	924	0.31	0.0025	-0.46	0.56	0.46	70.09	0.10
9	0.0368	9.38***	1541.5	0.00	0.0368	2.94**	27.4	0.00	139.66	0.00
10	0.0038	1.71*	1061	0.03	0.0038	0.54	0.11	0.74	63.14	0.24

*** Significant at the 1 percent level

** Significant at the 5 percent level

* Significant at the 10 percent level

Note: CARs are computed over the time period between one day before and after the event days. Wald test is distributed as chi-square with 1 and 56 degrees of freedom, respectively.

The third two columns in Table 11, which present the JSR test results show that CARs for the all-firms portfolio are significant at the 0.05 level only for events 2 and 9. According to the fourth two columns, the average reactions in MVRM are significant at the 0.01 level for events 1 and 9. In the fifth two columns of Table 11, there are significant abnormal returns for events 2, 4 and 9. For these three events, the individual reactions in MVRM are significant at the 0.01 level.

While JSR test and the first test of MVRM check results for the average reactions to the events, the second test of MVRM checks individual reactions to them. Table 12 shows the individual parameter estimates for each firm. % negative shows the portion of negative parameter coefficients for each event. % negative measure is useful for the interpretation of MVRM tests. Because, the individual reaction test of MVRM is more likely to detect the effects of an event when some firms gain and others lose than is the test of average effects, the reverse is true when the abnormal returns for all firms have same sign.

Table 12 shows that 77% of parameter coefficients are negative for event 1 and 86% of parameter coefficients are positive for event 9. Since the most of the parameter estimates have the same sign, first test of MVRM that deals with average effects detect abnormal returns easily for events 1 and 9. For events 2 and 4, the numbers of positive and negative coefficients are almost equal. In this situation, second test of MVRM detects the reactions for events 2 and 4. So, having complementary two tests is the main advantage of MVRM while other methods focus on average effects.

Table 12
Individual Parameter Estimates of MVRM

COMPANY	α	β	γ_1	γ_2	γ_3	γ_4	γ_5	γ_6	γ_7	γ_8	γ_9	γ_{10}
Alliantt	0.0000	-0.0678	0.0011	-0.0009	0.0002	-0.0006	-0.0025	-0.0022	0.0004	-0.0074	0.0071	-0.0037
Amerpaci	0.0001	0.0832	-0.0034	0.0038	-0.0158	0.0021	0.0017	0.0102	0.0008	-0.0063	-0.0032	0.0002
Gencorp	-0.0002	0.0249	-0.0072	-0.0076	0.0057	-0.0064	-0.0012	-0.0036	0.0031	-0.0090	0.0196	-0.0005
Gendynam	0.0002	-0.1584	-0.0030	-0.0020	0.0033	0.0001	-0.0032	-0.0017	-0.0048	0.0046	0.0044	-0.0065
Martinmr	0.0001	0.0042	-0.0077	0.0095	-0.0015	-0.0015	0.0027	0.0043	-0.0125	0.0042	0.0077	-0.0045
Oshkosht	0.0009	0.1183	-0.0106	-0.0002	-0.0092	0.0002	-0.0030	-0.0013	-0.0009	-0.0017	0.0025	0.0032
Northrop	-0.0006	-0.0576	-0.0065	-0.0017	0.0029	0.0169	0.0038	0.0008	-0.0096	0.0010	0.0144	-0.0066
Intlship	-0.0005	0.0932	-0.0015	-0.0044	0.0005	0.0002	0.0035	-0.0043	0.0104	-0.0147	0.0045	-0.0071
Raytheon	-0.0008	-0.0588	-0.0056	-0.0139	0.0016	-0.0023	0.0005	0.0028	0.0024	0.0020	0.0137	0.0032
Healthne	-0.0009	-0.2032	-0.0027	0.0115	-0.0143	-0.0044	-0.0026	0.0107	-0.0173	0.0205	0.0119	-0.0023
Lockheed	-0.0008	-0.0468	-0.0003	0.0092	-0.0005	0.0085	0.0082	-0.0008	-0.0051	-0.0031	0.0186	-0.0243
Ltv	-0.0008	0.0241	-0.0108	-0.0007	-0.0009	-0.0088	-0.0233	0.0011	-0.0066	0.0054	0.0199	-0.0033
Kamana	-0.0005	0.0285	0.0074	0.0079	-0.0083	0.0035	-0.0022	0.0086	-0.0097	-0.0089	0.0193	0.0021
Cmpscien	0.0004	0.0320	0.0029	0.0179	0.0065	-0.0032	-0.0002	-0.0102	-0.0112	0.0026	-0.0048	-0.0076
Washgpin	-0.0003	-0.0441	-0.0021	0.0016	0.0066	0.0081	0.0004	-0.0038	-0.0020	-0.0034	0.0128	0.0001
Rockwell	-0.0002	-0.1620	-0.0091	0.0068	0.0046	0.0076	0.0040	-0.0018	-0.0064	-0.0060	0.0120	0.0021
Fmc	-0.0001	-0.0769	-0.0082	0.0025	0.0002	-0.0006	-0.0057	-0.0036	0.0000	-0.0011	0.0194	0.0007
Tennecoa	-0.0008	-0.0167	-0.0057	0.0068	-0.0041	-0.0032	0.0154	-0.0007	-0.0119	0.0116	0.0063	-0.0022
Hercules	-0.0011	-0.1662	-0.0044	0.0121	0.0012	0.0097	0.0018	-0.0003	-0.0025	-0.0027	0.0331	0.0023
Textron	-0.0002	-0.0115	-0.0003	-0.0005	0.0078	0.0019	0.0010	-0.0041	0.0045	-0.0063	0.0163	-0.0086
Unisys	0.0000	0.1356	0.0049	0.0147	0.0146	-0.0049	-0.0014	0.0073	-0.0074	-0.0034	0.0067	-0.0014
Unitedte	0.0003	-0.0537	-0.0025	0.0052	0.0018	0.0052	-0.0016	0.0050	0.0015	-0.0086	0.0101	-0.0128
Trw	0.0000	-0.1589	-0.0046	0.0061	0.0043	-0.0076	-0.0007	-0.0007	0.0060	-0.0076	0.0009	0.0029
Texasins	0.0013	0.0105	-0.0142	0.0082	0.0021	0.0004	0.0120	0.0028	-0.0276	0.0084	0.0038	0.0114
Harsco	-0.0005	-0.0840	0.0007	0.0012	0.0037	0.0099	-0.0005	-0.0006	-0.0028	0.0004	0.0251	0.0007
Genelec	0.0006	-0.0895	-0.0032	-0.0052	0.0098	-0.0024	0.0007	0.0025	-0.0011	-0.0074	-0.0082	-0.0024
Sequaa	-0.0002	0.0554	-0.0027	-0.0010	0.0001	-0.0016	-0.0014	-0.0086	-0.0046	0.0027	0.0126	-0.0046
Boeing	-0.0003	-0.0486	-0.0061	0.0161	0.0072	-0.0014	0.0003	-0.0076	-0.0040	0.0040	0.0197	-0.0038
Arvinind	-0.0005	0.0710	-0.0065	0.0058	0.0150	-0.0044	-0.0015	-0.0033	-0.0011	-0.0051	0.0168	0.0003

Company	α	β	γ_1	γ_2	γ_3	γ_4	γ_5	γ_6	γ_7	γ_8	γ_9	γ_{10}
Gtdeadm	0.0003	-0.1880	-0.0038	-0.0053	0.0057	-0.0012	0.0031	0.0004	-0.0199	0.0138	0.0035	-0.0022
Harris	-0.0005	0.0191	-0.0068	0.0078	0.0061	0.0079	-0.0113	0.0052	0.0027	-0.0058	0.0367	0.0010
Honeyw	0.0002	-0.0005	-0.0069	-0.0059	0.0015	0.0009	-0.0005	0.0004	-0.0025	0.0038	0.0089	-0.0024
Johnsonc	0.0000	-0.0851	-0.0063	0.0012	0.0143	-0.0035	0.0058	0.0065	-0.0048	-0.0034	0.0087	0.0010
Eaton	-0.0001	-0.1545	-0.0099	0.0016	0.0054	-0.0106	-0.0002	0.0025	-0.0026	0.0004	0.0167	-0.0041
Gkn	0.0001	0.1313	-0.0135	-0.0009	0.0089	0.0143	-0.0041	-0.0048	0.0072	-0.0111	0.0124	0.0041
Baesyste	-0.0004	-0.0614	-0.0113	0.0000	0.0265	0.0052	0.0139	0.0011	-0.0079	0.0103	0.0068	0.0022
Aimgroup	-0.0008	0.1987	-0.0029	-0.0115	0.0417	0.0143	0.0073	-0.0005	0.0049	-0.0114	0.0005	0.0008
Alvis	-0.0004	0.3111	0.0004	0.0027	-0.0038	-0.0003	-0.0030	-0.0018	0.0084	-0.0023	0.0121	-0.0026
Chemring	0.0002	0.1466	0.0083	-0.0071	-0.0014	0.0213	-0.0040	-0.0007	0.0022	0.0051	-0.0023	-0.0008
Cobham	0.0001	0.0551	-0.0078	-0.0120	0.0028	0.0171	-0.0077	0.0136	-0.0116	0.0050	-0.0001	-0.0012
Hampsoni	-0.0004	0.1615	0.0013	-0.0018	-0.0009	0.0012	-0.0013	-0.0072	0.0099	-0.0060	0.0002	0.0004
Meggitt	-0.0003	0.3388	-0.0121	0.0010	0.0034	0.0175	0.0040	-0.0082	0.0094	-0.0086	0.0121	0.0119
Rollsroy	-0.0001	0.0558	-0.0117	-0.0057	0.0139	0.0227	0.0106	-0.0094	0.0144	-0.0150	0.0114	0.0013
Smithsgr	-0.0001	-0.1459	-0.0148	0.0037	0.0171	0.0175	0.0032	-0.0259	0.0055	-0.0109	0.0105	-0.0016
Ultraele	0.0001	0.1460	0.0006	0.0007	-0.0008	-0.0007	-0.0080	-0.0018	-0.0052	-0.0010	-0.0012	-0.0005
Umeco	0.0004	0.1491	-0.0049	-0.0146	-0.0016	-0.0010	-0.0038	-0.0048	0.0141	-0.0194	0.0083	-0.0021
Cnimca	0.0005	0.1386	0.0031	-0.0071	-0.0008	-0.0014	-0.0004	-0.0005	-0.0063	0.0002	0.0025	-0.0012
Sagem	0.0013	0.3407	0.0030	-0.0011	0.0005	0.0051	0.0004	-0.0071	0.0000	-0.0035	0.0004	-0.0012
Dassault	0.0002	0.2731	0.0030	-0.0042	0.0203	0.0021	0.0098	-0.0055	-0.0103	-0.0052	-0.0019	0.0044
Gfiindus	-0.0003	0.4319	-0.0083	-0.0124	-0.0053	-0.0130	-0.0037	-0.0028	0.0021	-0.0024	0.0074	-0.0056
Latecoer	-0.0003	0.1644	0.0012	-0.0093	0.0086	-0.0171	0.0091	-0.0035	0.0096	-0.0071	0.0118	0.0062
Technofa	0.0003	0.0913	-0.0101	-0.0058	-0.0014	0.0066	0.0018	0.0027	0.0048	-0.0017	-0.0003	-0.0077
Zodiac	-0.0001	0.3101	-0.0054	-0.0055	-0.0082	-0.0038	0.0022	-0.0007	-0.0049	-0.0014	0.0136	0.0078
Aselsan	0.0021	0.0408	-0.0075	-0.0021	-0.0051	-0.0046	0.0051	0.0188	-0.0141	0.0054	0.0236	0.0158
Netastel	0.0015	0.0289	-0.0215	-0.0175	-0.0153	-0.0031	0.0054	0.0082	-0.0061	-0.0032	0.0211	0.0041
Otokar	0.0013	-0.0046	-0.0154	0.0038	0.0009	0.0023	0.0169	-0.0025	0.0213	-0.0043	0.0243	0.0090
Average	0.0000	0.0369	-0.0049	0.0000	0.0032	0.0021	0.0010	-0.0006	-0.0018	-0.0021	0.0102	-0.0006
% Negative	55%	43%	77%	54%	34%	48%	48%	59%	79%	64%	14%	57%

To sum up the results for the all-firms portfolio, according to Table 11, there are significant negative reaction to event 1 and significant positive reaction to event 9 as a whole. There are significant reactions to events 2 and 4 differing in sign and in extent for each company. Consequently, the first hypothesis that the defense stocks do not react to the Kosovo War can be rejected.

5.2.2 Tests of Hypotheses 2 and 3

In order to test the second and third hypotheses, for which events the comparisons will be made must be determined. Table 13 is a summary of Table 12 for the portfolios. It shows the percentage of the companies that reacted negatively.

Table 13
% Negative Reaction of Portfolios

Event	U.S. Firms	European Firms	Aerospace Firms	Other Firms
1	89%	71%	63%	85%
2	40%	69%	67%	45%
4	53%	41%	38%	58%
9	8%	19%	32%	5%

Table 13 shows that there is no homogeneity in the reactions of portfolios for events 2 and 4. So it will not be healthy to include these events for testing the average effects. Besides, Table 13 presents that the reactions of the portfolios to event 1 are negative and contrary to the expectations that war-related events affect defense stocks positively. As a result, event 9 is chosen to test the second and third hypotheses.

The second hypothesis of this study states that the average reactions of U.S. defense companies are equal to the average reactions of European defense companies during Kosovo War.

Table 14
Results of JSR Test and Average Effect Test of MVRM for Event 9

		U.S. Firms	European Firms	Aerospace Firms	Other Firms
<i>JSR Test</i>	CAR	0.046	0.023	0.030	0.040
	t-st.	3.61***	1.93**	3.34***	3.70***
<i>Avg. Test of MVRM</i>	Wald	22.42	11.29	13.63	27.64
	P	0.00	0.00	0.00	0.00

*** Significant at the 1 percent level

** Significant at the 5 percent level

Wald test is distributed as chi-square with 34, 22, 18 and 38 degrees of freedom.

Table 14 shows the results of JSR test and average effect test of MVRM for event 9. As mentioned before, both of these methods test the hypothesis that average reaction of firms in each portfolio equals zero. According to table, both tests show that the U.S. firms portfolio reacted positively and significantly to event 9 at the 0.01 level. The reaction of the European firms portfolio is significant at the 0.05 and 0.01 levels for JSR test and average reaction test of MVRM, respectively.

Table 14 shows that, as expected, the CARs of the U.S. firms portfolio is higher than the CARs of the European firms portfolio. CARs for U.S. firms and European firms are 0.046 and 0.023, respectively. In order to see if the difference is significant, two-sample t-test and MVRM test are employed. So, Table 15 shows that the hypothesis that the CARs of U.S. defense companies are equal to the CARs of European defense companies during event 9 can be rejected at the 0.01 significance level. A similar hypothesis that average abnormal returns of U.S. firms portfolio equal to those of European firms during event 9 can be rejected at the 0.01 level as a result of MVRM test.

Table 15
Results for the Comparison of U.S. and European Firms' Reactions

t-Test Results for CARs:

	<i>US</i>	<i>EURO</i>
Mean	0.0457	0.0230
Variance	0.0008	0.0007
Hypothesized Mean Difference	0	
t Stat (two-tail)	3.09	
P	0.00	

MVRM Result for Average Abnormal Returns are Equal:

Chi2(1)	=	4.57
Prob > chi2	=	0.00

Although there are political reasons for different reactions of the U.S. and European firms portfolios, market values, sales and profits of these two portfolios are also compared. Table 16 shows the results for market value comparison of portfolios. Table 16 shows that market values of U.S. firms are significantly higher than European firms market values. This can be also interpreted as another source of the difference in reactions. Because there is not any significant difference is in sales and profits of these portfolios, those comparisons are not reported.

Table 16
Results for Market Value Comparison of U.S. and European Firms Portfolios

t-Test: Two-Sample Assuming Unequal Variances

	<i>US</i>	<i>EUROPE</i>
Mean	11.65	2.26
Variance	112.3	25.7
Observations	34	22
Hypothesized Mean Difference	0	
Df	33	
t Stat (two-tail)	1.62	
P	0.05	

Mean and variances are in billion dollars

The third hypothesis of this study states that the average reaction of the aerospace industry companies is equal to the average reaction of the non-aerospace companies during the Kosovo War.

According to Table 14, both tests show that the aerospace firms portfolio reacted positively and significantly to event 9 at the 0.01 level. Table 14 shows that the reaction of the non-aerospace firms portfolio is found significant at the 0.01 level for event 9 in with both tests. In Table 14, the CARs of aerospace and non-aerospace firms are 0.030 and 0.040 respectively. The third hypothesis that average abnormal returns of aerospace companies are equal to the average abnormal returns of other defense companies.

Table 17
Results for the Comparison of Aerospace and Other Firms' Reactions

<u>t-Test: Two-Sample Assuming Unequal Variances</u>		
	<i>AERO</i>	<i>OTHER</i>
Mean	0.0304	0.0398
Variance	0.0007	0.0009
Hypothesized Mean Difference	0	
T Stat (two-tail)	-1.19	
P	0.12	

<u>MVRM Result for Average Abnormal Returns are Equal</u>		
Chi2(1)	=	1.57
Prob > chi2	=	0.21

Table 17 shows the results for the comparison of the aerospace firms portfolio and other firms portfolio. Contrary to our expectations, the CARs of non-aerospace firms portfolio is higher than those of the aerospace firms portfolio, but the difference between the reaction of these portfolios to event 9 is insignificant. MVRM test confirms this result. So the hypothesis that average abnormal returns of

aerospace companies are equal to the average abnormal returns of other defense companies cannot be rejected. Because there is no significant difference between reactions of these two portfolios, firm characteristics, which are market values, sales and profits are not compared.

In the tests of the second and third hypotheses, univariate tests are employed. In order to confirm the results of those tests, a regression model is employed. In the regression model, CAR is taken as the dependent variable. Country of origin, sector, market values and profits are chosen as independent variables. Country of origin and sector are dummy variables. Country of origin dummy equals one for U.S. firms and zero for European firms. Sector dummy equals one for the aerospace firms and zero for the non-aerospace firms.

Table 18
Regression Results For Comparisons

Model: $CAR = \alpha + \beta_1 \text{Country} + \beta_2 \text{Sector} + \beta_3 \text{Market Value} + \beta_4 \text{Profit}$

Variable	Coefficient	t-statistic
Constant	0.00	3.31***
Country	0.43	3.18***
Sector	-0.03	-0.21
Market Value	0.27	2.07**
Profit	0.06	0.40

*** Significant at the 1 percent level
** Significant at the 5 percent level

Table 18 shows the regression results for comparisons. The coefficient of the country of origin variable is positive and significant at the 0.01 level, meaning that U.S. firms realize higher CARs. The coefficient of market value is also positive and significant, showing that the firms with higher market values have higher CARs. The coefficients of the sector dummy and profit are found insignificant. So these results confirm the results of the second and third hypotheses testings.

To sum up, the defense companies reacted to several unexpected events during the period between the first meeting on the Kosovo conflict and the last day of The Kosovo War. The reactions change in sign and in extent for each event and each firm. A specific event, the Serbia's attack to Albania, to which majority of the firms in the sample showed positive reaction is examined in detail. The results show that there is a significant difference in average reactions of U.S. firms and European firms portfolios. However, the difference in average reactions of aerospace firms and other firms portfolios is not significant.

CHAPTER 6

CONCLUSION

This study explores the impacts of the Kosovo War on the NATO countries' defense industry stocks by examining abnormal returns with three different models; standard event study methodology, Jaffe Standard Residual Test, and Multivariate Regression Model. It confirms the findings of previous studies stating that war-related events positively affect defense industry stocks. Furthermore, the study extends the analysis to find whether certain stocks are more responsive to the Kosovo War.

The poor performance of defense stocks relative to the market characterizes the period of time used in the analysis. The returns of these stocks increase by the effect of the Kosovo War. After the end of the Kosovo War, the decline in defense industry continues.

The data confirms that it is inappropriate to employ standard event study methodology when there are event clustering and industry clustering. The correlations between abnormal returns and t-test results confirm this issue.

Out of many possibly unexpected events, the defense stocks reacted positively and significantly to the Serbia's attack to Albania on the seventeenth day of the Kosovo War.

The study shows that there is a significant difference between the average abnormal returns of the U.S. defense stocks and European defense stocks for the Serbia's attack to Albania, consistent with the expectations. Moreover, the study

provides evidence that there is a significant difference between the market values of these two portfolios for period of Kosovo War.

However the analysis proved that there is no significant difference between the abnormal returns of aerospace stocks and non-aerospace defense stocks.

There are some limitations of this study. First, the impacts of firm specific events that happened during the event windows are ignored. These specific events such as earning announcements, might affect the returns on individual firms. Second, limitation is the lack of some accounting data such as research and development expenditure, which was proved a significant explanatory variable, to explain the differences in reactions of the securities.

Defense is not like any other industry. Its output is used for killing and destruction in the name of deterrence. There must be conflicts for demand of the defense products. This study, like other studies examining the impacts of war-related events, shows that defense companies benefit from wars and conflicts.

BIBLIOGRAPHY

- Attia, A.M. and HassanElnaby, R.A., 1998, “ The Oil Stock Market Reaction To The Gulf War”, *Southwest Review of International Business Research*, 98: 206
- Barber, B.M. and J.D. Lyon., 1997, “Detecting Long Run Abnormal Stock Returns: Empirical Power and Specification of Test-statistics”, *Journal of Financial Economics*, 43(3): 341-372
- Binder, J.J., 1985, “On the Use of Multivariate Regression Model in Event Studies”, *Journal of Accounting Research*, 23 (1): 370-383
- 1985, “Measuring the Effects of Regulation with Stock Price Data”, *The RAND Journal of Economics*, 16 (2): 167-183
- 1998 “The Event Study Methodology Since 1969”, *Review of Quantitative Finance and Accounting*, 11: 111-137
- Cantener, O.F., 2000, “The Impacts of the Gulf War on the U.S. Defense Industry”, *A Thesis Submitted to the Faculty of Management and the Graduate School of Business and Administration of Bilkent University*
- Collins, D.W. and Dent, W.T.,1984, “A Comparison of Alternative Testing Methodologies Used in Capital Market Research”, *Journal of Accounting Research*, 22 (1): 48-84
- Fama, Eugene F., 1970, “Efficient Capital Markets”, *The Journal of Finance*, 25 (1): 383-417
- 1991, “Efficient Capital Markets: II”, *The Journal of Finance*, 46 (5): 1575-1617
- Greene, William H., 1990, *Econometric Analysis*, New York, Macmillan Pub. Co.
- Henderson Jr, Glenn, 1990 ,“Problems and Solutions in Conducting Event Studies”, *Journal of Risk & Insurance*, 57 (2): 282-307
- Kovacic, W.E. and Smallwood, D.E., 1994, “Competition Policy, Rivalries, and Defense Industry Consolidation”, *The Journal of Economic Perspectives*, 8 (4): 91-110
- MacKinlay, Craig A., 1997, “Event Studies in Economics and Finance”, *Journal Economic Literature*, 35: 13-39

McDonald, J.E. and Kendall, W.R., 1994, "Measuring the Economic Effects of Political Events: War and the U.S. Defense Industry: 1988-1992", *Journal of Applied Business Research*, 10 (1): 57-62

Meggison, William L., 1997, *Corporate Finance Theory*, New York, Addison Wesley

Shapiro, D.M. and Switzer, L.N., 1999, "War add Peace: Reaction of Defense Stocks", *Journal of Applied Business Research*, 15 (3): 21-37

Schipper, K. and Thompson, Rex, 1983, "The Impact of Merger-Related Regulations on the Shareholders of Acquiring Firms", *Journal of Accounting Research*, 21 (1): 184-221

----- 1985, "The Impact of Merger-Related Regulations Using Exact Distributions of Test", *Journal of Accounting Research*, 23 (1): 408-415