

**THE IMPACTS OF PROCUREMENT POLICY CHANGES ON DEFENSE  
STOCKS: EVIDENCE FROM THE US DEFENSE INDUSTRY**

The Institute of Economics and Social Sciences

of

Bilkent University

By

Feyzi MINTAŞ

In Partial Fulfillment of the Requirements for the Degree

of

MASTER OF BUSINESS ADMINISTRATION

in

THE DEPARTMENT OF MANAGEMENT

BİLKENT UNIVERSITY

ANKARA

September 2003

I certify that I have read this thesis and have found that it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Business Administration.

.....  
Assist. Prof. Aydın YÜKSEL

I certify that I have read this thesis and have found that it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Business Administration.

.....  
Assist. Prof. Aslıhan SALİH ALTAY

I certify that I have read this thesis and have found that it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Business Administration.

.....  
Assist. Prof. Aslı BAYAR

Approval of the Institute of Economics and Social Sciences

.....  
Prof. Kürşat AYDOĞAN  
Director

## **ABSTRACT**

### **THE IMPACTS OF PROCUREMENT POLICY CHANGES ON DEFENSE STOCKS: EVIDENCE FROM THE US DEFENSE INDUSTRY**

Mintaş, Feyzi

M.B.A., Department of Management

Supervisor: Assist.Prof. Aydın Yüksel

September 2003

The purpose of this study is to examine the relative stock market performance of US defense stocks over different time periods and analyze the impact of changes in Federal Acquisition Policy on defense stock returns. The data set covers monthly returns of 67 defense stocks during the period 1945-2000. The analysis consists of two parts. Relative performance analysis and the event study analysis. The results of the relative performance analysis showed that defense stocks portfolio is both more profitable and riskier than the size based benchmark. However, the difference was not found to be statistically significant. On the other hand, the event study analysis indicates that defense firms significantly reacted to nine major regulatory changes that occurred during the sample period. Only two of the nine regulatory changes examined resulted in statistically significant average excess returns. For other regulations, the sign and the magnitude of the reaction varies across firms.

**Keywords:** Defense industry, defense procurement, event study, multivariate regression model.

## ÖZET

# TEDARİK POLİTİKALARINDAKİ DEĞİŞİKLİKLERİN SAVUNMA SANAYİNE ETKİLERİ: AMERİKA ÖRNEĞİ

Feyzi MİNTAŞ

YÜKSEK LİSANS TEZİ, İŞLETME FAKÜLTESİ

Tez danışmanı: Yrd. Doç. Dr. Aydın YÜKSEL

Eylül, 2003

Bu çalışmanın amacı Amerikan savunma sanayii hisselerinin değişik periyotlardaki rölatif performansını ve tedarik politikasında meydana gelen başlıca değişikliklerin savunma sanayii hisselerine olan etkilerini araştırmaktır. Data seti, 67 savunma sanayii şirketinin 1945-2000 yılları arasındaki aylık getirilerini kapsamaktadır. Analizler iki parçadan oluşmaktadır: Rölatif performans analizi ve olay etki analizi. Rölatif performans analizleri savunma sanayii şirketlerinden oluşan portföyün benzer bir piyasa değerine sahip olan diğer bir portföyden daha karlı ve daha riskli olduğu sonucuna varmıştır. Fakat iki portföy arasındaki fark istatistiksel olarak belirgin bulunmamıştır. Olay etki analizi, savunma sanayii şirketlerinin 9 ana kanunsal düzenlemeye belirgin olarak reaksiyon gösterdiğini bulmuştur. 9 kanunsal düzenlemeden yalnızca ikisinde istatistiksel olarak ortalama anormal getiriler belirgin bulunmuştur. Savunma sanayii firmaları diğer kanunsal düzenlemelere heterojen bir reaksiyon göstermiştir; reaksiyonun büyüklüğü, pozitif veya negatif oluşu firmadan firmaya farklılık göstermiştir.

**Anahtar kelimeler:** Savunma sanayii, Savunma tedariki, olay etki analizi, çok değişkenli regresyon modeli

## **ACKNOWLEDGMENTS**

I am very grateful to Assist. Prof. Aydın Yüksel for his supervision, constructive comments, and patience throughout the study. I also wish to express my thanks to other committee members for their comments on the study. Finally, I am very grateful to my family members; my mother, my wife, my brother and my sister, for their patience and support. I dedicate this thesis to my father, who passed away in 1997.

## TABLE OF CONTENTS

Abstract.....	iii
Özet.....	iv
Acknowledgments.....	v
Table of Contents.....	vi
List of Tables.....	viii
List of Figures.....	x
CHAPTER 1:Introduction.....	1
CHAPTER 2: Defense Industry.....	3
2.1 Military Power.....	3
2.1.1 Buying Weapons from Other Countries.....	5
2.1.2 Developing a National Defense Industry.....	6
2.1.3 Military Cooperation through Alliances.....	7
2.2 Defense Industry.....	9
2.2.1 Structure of Defense Industries.....	9
2.2.2 Characteristics of Defense Industry.....	10
CHAPTER 3: Defense Procurement and Regulation in the US	
3.1 US Defense Industry.....	13
3.2 US Defense Procurement.....	15
3.3 Regulation and Defense Profits in US Defense Industry.....	18
CHAPTER 4:Literature Review.....	22
4.1 Studies Related to Relative Profit Performance of Defense Firms.....	23
4.2 Studies Related to Defense Procurement and its Efficiency.....	25
4.3 Cost Shifting Hypothesis.....	26

CHAPTER 5: Methodology And Data.....	29
5.1 Relative performance analysis.....	29
5.1.1 Classification and Periods examined.....	30
5.1.2 Methodology Used in the Relative Performance Analysis.....	35
5.2. The Impact of Regulatory Changes.....	40
5.2.1 Event Studies.....	40
5.2.2 Multivariate Regression Model in Event Studies.....	43
5.2.3 Methodology of the analysis examining the impact of. ....	46
regulatory changes	
5.3 Data and the Sample.....	53
CHAPTER 6: Results.....	59
6.1 Relative Performance Analysis Results.....	59
6.2 Results of the Analysis Examining the Impact of Regulatory Changes.	67
CHAPTER 7: Conclusion.....	74
BIBLIOGRAPY.....	76

## LIST OF TABLES

TABLE 1	Top 15 Countries in Military Expenditures (2002).....	4
TABLE 2	Top 15 Countries in Exports of Conventional Weapons.....	6
TABLE 3	Summary of Studies Related to Relative Performance of Defense Firms.....	28
TABLE 4	Major Periods In Defense Acquisition History.....	31
TABLE 5	Delisting Codes.....	37
TABLE 6	Hypotheses.....	45
TABLE 7	The sample of Regulatory reform Initiatives.....	51
TABLE 8	Major Reforms in Federal Acquisition.....	52
TABLE 9	Sic Codes.....	55
TABLE 10	Sample Securities List.....	56
TABLE 11	Distribution of Sample Firms across Deciles.....	58
TABLE 12	Market Values for Decile Portfolios.....	58
TABLE 13	Risk and return measures for the portfolios (1945-1999).....	62
TABLE 14	Statistical Test Results for the comparison of the Sample Portfolio and the Benchmark Portfolio (1945-1999).....	62
TABLE 15	Statistical Test Results for the comparison of Sample Portfolio and Market Index (1945-1999).....	63
TABLE 16	Risk and Return Measures for the Two Portfolios (1948-1961, 1970-1989).....	64
TABLE 17	Statistical Test Results for the Comparison of Sample Portfolio and Benchmark Portfolio (1948-1961, 1979-1989).....	64



TABLE 18	Statistical Test Results for the Comparison of Big Firms' Portfolio and Benchmark Portfolio (1948-1961, 1970-1989).....	65
TABLE 19	Results for the Comparison of Big firms' Portfolio and Market index (1948-1961, 1970-1989).....	65
TABLE 20	Risk and Return Measures for the Big Firms' portfolio and the Benchmark Portfolio (1952-1956, 1976-1980).....	66
TABLE 21	Statistical Test Results for the Comparison of Big Firms' Portfolio and Benchmark Portfolio (1952-1956, 1976-1980).....	66
TABLE 22	Statistical Test Results for the Comparison of Big Firms' Portfolio and Market Index (1952-1956, 1976-1980).....	67
TABLE 23	Tests with monthly returns of the hypothesis that average excess returns equal zero.....	71
TABLE 24	Results for the Individual Parameter Estimates ( $\gamma_{ia}$ ).....	72
TABLE 25	Tests with monthly returns of the hypothesis that all excess returns equal zero.....	73

## LIST OF FIGURES

Figure 1	Average Monthly Excess Returns per Year (Figure1).....	60
----------	--	----

## **CHAPTER 1**

### **INTRODUCTION**

The presence of a large defense industry in an economy, as the one in the US, traditionally raises the issue of whether such an industry profits from the misery of others. That is why defense industries are sometimes called as ‘merchants of dead’ or ‘war profiteers’. In the US, there has frequently been a great deal of discussion in private and official circles about the profitability of defense business over time. A popular opinion that defense profits are excessive is based largely on occasional public reports of wastes and inefficiencies over different time periods. According to Bohi (1973) the issue is of critical importance, for if profit rates are too high the nation is wasting resources, while if profit rates are too low, resources will flow out of defense business and jeopardize the quantity and quality of sources of supply.

Defense industry distinguishes itself from a typical industry in several ways: an unusual product market, heavy use of quickly changing technology, multiproduct firms, and regulation. This final characteristic will be addressed in this study.

The purpose of this study is to examine the long-run stock market performance of US defense stocks over different time periods and analyze the impact of changes in Federal Acquisition Policy on defense stock returns. Acquisition policy, which is the focus of this study, is just one of the factors that affect defense industry profits. Other factors can be the general demand for weapon systems, which may change due to political considerations and wars, the level of competition in the defense industry or the speed of technological improvements. This type of a study that measures the impact of specific events on the firm value is called ‘event study’ in the literature.

The empirical analysis consists of two parts: Examination of the relative profit performance of defense stocks and the event study analysis. To address the issue of excess defense profits, relative performance of defense stocks is examined over the period 1945-1999. This period is divided into five major sub-periods. A size benchmark portfolio is used to measure long-run excess returns. For the event study analysis, a version of the Multivariate Regression Model (MVRM) is used to measure the impact of regulatory changes on defense firms. MVRM is a popular way to deal with the clustering problem in standard event studies. Another advantage of MVRM compared to the standard methodology is that it allows the testing of a richer set of hypothesis.

The results of the relative performance analysis show that, in the long run (1945-1999), defense firms do not earn statistically significant excess profits. However, there is evidence that for specific and relatively short time periods, big defense firms are able reap excess profits. The results of the event study analysis indicate that defense firms reacted significantly to the regulatory changes examined in this study. However, out of nine regulatory changes examined, the reaction was homogenous in only two. These two changes affected the defense firms negatively. For other regulatory changes the sign and the magnitude of the impact varies across firms.

## **CHAPTER 2**

### **DEFENSE INDUSTRY**

This chapter is organized as follows: First, the military power concept and the means to obtain military power are explained. Second, the structure and major characteristics of defense industries are covered. The chapter concludes with the discussion of the US defense procurement.

#### **2.1 Military Power**

Military power is a crucial tool in dealing with conflicts in international relations, together with political and economic power. The decision about having a strong military power, and a strong army depends on the following factors:

- The perceived threats to the nation and a desire for security,
- A desire for national power and international status,
- The size of national income and wealth,

These factors consequently affect the military expenditure decisions, which varies a lot across countries. Table 1 depicts the top 15 countries regarding military expenditures. The five countries with the highest military expenditures are USA, Japan, UK, France and China. These countries (US alone) accounted for 62 (48) percent of world total in 2002. Military expenditures consist of operating costs, procurement and construction costs and research and development costs related to acquisition of defense products.

**TABLE 1****Top 15 Countries in Military Expenditures (2002)**

Country (%)	Size	World share
USA	335.7	43
Japan	46.7	6
UK	36.0	5
France	33.6	4
China	31.1	4
Sub-total top 5	483.1	62
Germany	21.1	4
S. Arabia	21.6	3
Italy	21.1	3
Iran	17.5	2
South Korea	13.5	2
Sub-total top 10	584.5	75
India	12.9	2
Russia	11.4	2
Turkey	10.1	1
Brazil	10.0	1
Israel	9.8	1
Sub-total top 15	638.7	82
World	784	100

Note: Numbers for size are in US Billions dollars  
Source: Military expenditure: *Stockholm International Peace Research Institute (SIPRI) Yearbook 2003.*

Military power can be obtained by forming a strong army, making use of alliances, or both. A strong army requires necessary weapons. In order to obtain these weapons, countries have two alternatives. One is buying weapons from other countries; the other is developing a national defense industry. Military cooperation through alliances may lead to great savings in military expenditures. Each of them will be briefly discussed in the following sections.

### **2.1.1 Buying weapons from other countries**

Today, the international arms market is a buyers' market in which modern tanks, fighter aircrafts, submarines, missiles, and other weapons are, in general, available to any nation that can afford them. Increasingly, sales of major weapons also include the transfer of the underlying technologies necessary for local production, resulting in widespread proliferation of modern weapons and the means to produce and even develop them. For example, the Gulf War (1990-1991) showed that although Iraq had little or no defense industrial capability, it had been able to obtain a vast arsenal of modern weapons from the Soviet Union, Western Europe, China, Eastern Europe.

Although feasible, buying weapons from other countries can be too costly. In addition, the lack of a national defense industry leads to increasing dependence to other countries. There is an optimal point for each country related to production of weapons systems. Some arms products will inevitably be purchased from other countries, and some will be produced by the country. The difficulties related to forming a national defense industry will be discussed later.

Table 2 displays the total exports of conventional weapons over the period 1997-2001 by country. Conventional weapons are the weapons, which are not nuclear, biological or chemical. The figures in Table 2 show that the US has a dominant role in the weapons market. The US exceeds other important players in the market, namely Russia, France, the UK and Germany, by a wide margin.

**TABLE 2**

**Top 15 Countries in Exports of Conventional Weapons**

Country	Total Sales (1997-2001)
USA	44.82
Russia	17.35
France	9.80
UK	6.70
Germany	4.82
Ukraine	2.62
Netherlands	1.86
Italy	1.67
China	1.55
Belarus	1.52
Sweden	1.2
Israel	0.97
Spain	0.87
Canada	0.64
Australia	0.62

Note: All figures are US Billion Dollars.

Source: Stockholm International Peace Research Institute (SIPRI)

**2.1.2 Developing a National Defense Industry**

A large number of governments support the indigenous development and production of weapons for several reasons. First, a high level of domestic production of arms is perceived as an important factor for guaranteeing autonomy in foreign policy. This factor can be called as the basic security value of self-reliance. No country wishes to be dependent on weapons from abroad if it can be avoided. Not surprisingly, the countries that have gone furthest in developing defense industries from scratch during the last decades are also the ones that have felt their security most acutely threatened. Israel, North Korea and Pakistan are examples of



these countries. Israel-Arabian, North Korea-South Korea and Pakistan-India conflicts forced these countries to form a defense industrial base.

Second, arms production is also believed to add to economic autonomy through its contribution to overall economic output, employment, and technological innovation. Moreover, spin-off from military technology to civilian industry has also been viewed as an essential driving force of national innovation and competitiveness.

Finally, a domestic defense industrial base can also be used as a tool in foreign and trade policies. A well-developed arms industry grants a government influence in military alliances and cooperative arms projects. Arms transfers can be used to support allies and to win friends as well as to improve the balance of payment.

Today, two major difficulties exist related to arms production. First one is the rapid development of military technology and the increasing R&D costs of advanced weapon systems. These factors have led to a high level of international interdependence in armaments production. Second one is the increasing competition especially after the end of cold war. The end of the Cold War has brought profoundly decreased demand for weapons by the United States, the Soviet Union, and most European governments. As a result of worldwide overcapacity in defense production, competition is fierce.

### **2.1.3 Military Cooperation through Alliances**

The issue of obtaining military power and the means to obtain necessary weapons, as discussed in previous sections, is a difficult task for any country.

Cooperation among countries may ease the task. For that purpose, many countries in the world seek alliances to ensure and safeguard their freedom and security in a more effective and less costly way. International security organizations like the North Atlantic Treaty Organization (NATO) and the Warsaw Pact have been important organizations in this respect. The former is a successful example while the latter is an unsuccessful one.

NATO is an alliance of 19 countries from North America and Europe and was established on 4 April 1949. In accordance with the Treaty, the fundamental role of NATO is to safeguard the freedom and security of its member countries by political and military means. During the last fifteen years, NATO has also played an increasingly important role in crisis management and peacekeeping. All member countries that participate in the military aspect of the Alliance contribute forces and equipment, which together constitute the integrated military structure of the Alliance. These forces and assets remain under national command and control until a time when NATO requires them for a specific purpose (i.e. conflict or crisis, peacekeeping).

The Warsaw Pact alliance was set up in 1955 by Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Romania, and the Soviet Union. The organization was the Soviet block's equivalent of the North Atlantic Treaty Organization. A unified military command, with headquarters in Moscow, directed the united forces, which included Soviet divisions stationed in some of the member nations prior to the signing of the treaty. The 1989 collapse of the Communist governments in Eastern Europe made the treaty superfluous, as the new governments repudiated their former ally, the Soviet Union. The Warsaw Treaty Organization dissolved in June 1991.

An attempt to form a new military alliance appeared in Europe recently. On 20 November 2000, European Union Defense Ministers met in Brussels and agreed to the creation of a EU Rapid Reaction Force. The EU force is not a standing army. It follows a similar character to NATO's Allied Command Europe (ACE) Rapid Reaction Corps (ARRC) where certain elements of member states armed forces are earmarked for rapid deployment if the need arises.

## **2.2 Defense Industry**

This section starts with a brief explanation regarding the structure of the defense industry. The rest of the discussion focuses on the characteristics of defense industries.

### **2.2.1 Structure of Defense Industries**

A significant portion of defense industry in major arms-producing countries were managed and owned by national governments during the 20th century. In the structure of defense industry, the share of public sector and private sector changes according to a country's political and economic structure in addition to the level of industrialization. In a country without a sufficient capital accumulation and a strong industrial base, it is unlikely to observe private firms. Even in those that met those criteria, governmental support is needed for the success of private firms. Only if enough incentives offered by the government to the private sector, will the private defense industry operate and grow.

Generally defense industries in the world display a mixed structure. Government undertakes the production especially when the demand and profitability is low and when it is strategically undesirable to leave some products to private sector. Especially the production of weapons like rockets and ammunition cannot be orientated to private sector, thus it is supported by the government due to demand changes in time of war and peace.

There are three main models used in this field:

- 1.GOGO (Government Owned Government Operated): Ownership and operation belongs to the government.
- 2.GOCO (Government Owned Contractor Operated): Ownership belongs to the government but the operation of the establishment is left to the private sector. Such institutions do not operate when there is no demand but they are kept operatable.
- 3.COCO (Contractor Owned Contractor Operated): These are the production lines operated when the government needs specific defense products. When there is an industry campaign they can be completely allocated to military production.

### **2.2.2 Characteristics of Defense Industry**

There are four important characteristics of defense industry (Demski and Magee (1992)): an unusual product market, heavy use of quickly changing technology, multiproduct firms, and regulation.

First, the product market is unusual on the demand side because it is dominated by a single customer: national government. There are also other customers, such as foreign countries, but the government dominates the market. Governments, in all parts of the world, generally exert complete control over the size

and timing of demand and indeed, whether there will be a market. Products usually do not even exist before they are needed or demanded by the government. Therefore the amount of risk and uncertainty involved in the defense business has often been considered higher than those in comparable commercial business. This demand side uncertainty depends on changes in the external threat, changes in the availability of substitute weapons or simply changes in governments' willingness to purchase certain weapons.

Second, technology plays an important role in the industry. Heavy use of quickly changing technology increases the importance of research and development (R&D), which is a costly process. Therefore it is important to spread such high fixed costs over a large level of output. Moreover, there is uncertainty regarding the cost, the performance characteristics of the product as well as the feasibility of underlying technology. This product side uncertainty (internal uncertainty) further increases the total risk of defense industry.

Third, producers are usually multiproduct firms. Commercial products are present as well as various defense products. Some are developed for military purposes, such as combat aircraft, combat ships, armored vehicles, and guns. Others are produced for military purposes but can also be used for civilian purposes as well. Certain transport and communications equipment, logistical services and a wide range of general-purpose goods—such as food, clothing, fuel, and office equipment are examples.

Finally, the defense industry is heavily regulated. Governments regulate accounting practices, procurement standards, pricing and sourcing procedures and even the industry profits.

To sum up, defense industry differentiates from non-defense sector in several aspects. In the following chapter, the focus will be on the US defense industry and the US procurement system.

## **CHAPTER 3**

### **DEFENSE PROCUREMENT AND REGULATION IN THE US**

The structure of this chapter is as follows: The first section presents a brief explanation related to the US defense industry. The second section covers the US procurement system. The chapter concludes with the discussion the regulation and defense profits in the US.

#### **1.1 US Defense Industry**

As was suggested by Table 2, the US has a large and strong defense industry. Several laws and regulations give the president and congress extensive authority regarding the development, production and procurement of defense systems. The laws in the US hinder the sale or merger of critical defense systems to foreign firms. In addition, Buy American Act is valid. For military products that is procured by the government, it means a foreign ask should be at least 50 percent lower than a domestic ask to be accepted.

Nonetheless, the US Department of Defense supports international partnerships by American defense companies, where they coincide with US security policy goals or allow US production lines to remain open. US global partnerships can be divided into three groups: Wholly owned subsidiaries, Joint ventures and Government to government programs.

*Wholly owned subsidiaries:*

In countries where foreign ownership of defense companies is permitted, the establishment of wholly owned subsidiaries is a popular route for US defense companies seeking a local presence. This allows them to claim "local identity" in competitions with national leaders of defense industry, without having to enter into complex joint venture arrangements.

*Joint ventures:*

In many countries (e.g. Middle Eastern countries), the outright foreign ownership of defense interests is prohibited. These restrictions have forced American defense companies to enter into joint ventures with local companies. Most of these programs have their origin in the Cold War era and many US companies have had mixed results from them in recent years. As defense spending has declined over the last decade, US government aid and local funding for co-production projects has dried up.

*Government to government programs:*

It is increasingly common for governments to pool resources with allies to fund the development of hi-tech defense equipment. The most important example of this is the Joint Strike Fighter (JSF), which has brought several foreign governments on board as partners and observers.



### **3.2 US Defense Procurement**

Procurement can be described as the process of obtaining services, supplies, and equipment in conformance with applicable laws and regulations in the Federal Government. Procurement is widely used by government agencies and private firms to perform their research, development and production projects. The relationship between the buyer and the seller is in general partly governed by a contract.

The aim of Defense Procurement in the US is to ensure Department of Defense (DOD) contracts and business arrangements provide the best quality weapons, equipment, and services for defense in a timely manner at the lowest affordable cost to the taxpayer, consistent with public laws. The Department of Defense is the only authority in defense procurement.

Defense Procurement has several informational and incentive problems arising out of the complexity of products purchased. Firstly, defense contractors possess private information on technology and cost parameters. This gives them an informational advantage that they would use to extract rents. This problem is called as the self-selection problem. Secondly, contractors' actions are highly costly to monitor. Hence, appropriate incentives must be provided to elicit the best actions for the purchaser to avoid the moral hazard problem. Thirdly, huge uncertainties exist, both on the demand and supply sides, so that risk-taking is a major entrepreneurial problem. Fourthly, R&D is a major output and hence a major measurement challenge for the purchaser. Finally, appropriate incentives must be provided to the firms engaged in unique projects. This problem is called the hold-up problem.

The life cycle of a defense procurement program can be divided into three phases. In the design phase, multiple firms pursue competing designs. This process often begins with five or more firms, and then decreases to a smaller number. DOD funds most of this research directly. The second phase is selecting the sole source for production. In this phase, firms submit prototypes and final design plans to DOD and typically bid on the next increment of work, which involves finalizing the design, establishing the production line, and producing the first items. Contracts are made in this phase with the firms. The third phase is production, which may last a decade or more. Prices in the production phase are generally cost-based.

Before a discussion of the contracting mechanism in defense procurement, it is useful to review two major contract types described in Federal Acquisition Regulations (FAR, 1984). Federal Acquisition Regulations cover all kinds of government acquisitions.

*Fixed-Price Contracts:*

Fixed-price contracts require the contractor to deliver the supplies on time and within the price restraints of the contract. These contracts place most of the burden of risk on the contractor. Therefore, contractors will not be interested in fixed-price contracts unless the uncertainties associated with performance are at a manageable and predictable level.

*Cost-Reimbursement Contracts:*

The Government pays all allowable contract costs when contracts in this category are used. These contracts are primarily used when there is no valid basis for estimating performance costs. Negotiations establish an estimated cost that will be the basis for obligating funds and will act as a ceiling that the contractor may not

exceed without risk. This means the contractor incur expenses in excess of the established cost estimate. Cost-reimbursement contracts impose an administrative burden on both the Government and the contractor, requiring careful surveillance and auditing of costs. These contracts are appropriate for research and development because of the technical and price uncertainty.

In defense procurement, DOD currently uses a version of the cost-reimbursement contracts. This contract type is described in Truth in Negotiation Act (TINA). In a TINA contract, the firm estimates the cost for production and signs a certificate to its accuracy. If the firm produces the product below estimated costs, it must refund the difference to the government. Therefore TINA contract functions like a cost-reimbursement contract. The firm is subject to audit for accuracy and can face criminal prosecution if there is an unreported discrepancy favorable to the firm. The reason for these stringent policies within the TINA contracting process is “asymmetrical information.” The contractor doesn’t know the exact price of manufacturing a product, the firm most likely does. TINA is designed, therefore, to protect DOD from overpricing due to this lack of information.

Nonetheless, TINA contract has also been subject to criticism. For example, Rogerson (1999) argues that through its protective mechanisms for accurate pricing, TINA inhibits incentives for firm efficiencies. DOD cannot monitor a firm’s “unobservable effort:” how efficiently and with what quality a firm works on the product. Because all under-expenditures must be refunded to the government, the firm has no incentive to work harder and lower production costs. If a fixed-price contract option is given to the contractor, the manufacturing of the product would be more efficient. In a fixed-price contract, DOD would price low, but still high enough for firms to capture gains by increasing their efficiency. Because the price is fixed,

the firm keeps profits made through its unobservable efforts. If the firm chooses not to take the fixed-price contract, it can still turn back on the cost-based TINA contract.

Obviously, defense procurement, which is subject to Federal Acquisition Regulations, affects the profits of defense firms. This fact points to the significance of regulation in defense industry. Therefore, in the next chapter regulation and profits in defense industry will be reviewed.

### **3.3 Regulation and Defense Profits in US Defense Industry**

Since the defense industry is a regulated industry it can be expected that the regulatory changes affect the future expected cash flows of related defense firms. There is indeed empirical evidence in the literature that such regulatory activities have considerable impacts on the market value of defense firms. A good example can be the study by Pownall (1986). He examined the shareholder wealth effects of accounting changes made by Cost Accounting Standards Board. Stock prices of defense firms reacted negatively to the debates of changes in legislative standards. It means that market perceived these changes as a deterrent to their profits. Every reform or act that is brought up about the acquisition process aims to make the process more efficient, thus, has a potential to reduce directly firms' operating cash flows. On the other hand, these regulatory changes may have positive impacts as well. The impact may change according to the properties of the legislation.

There is a strategic importance for the US to have a leading defense industry. On the other hand, large amounts of money spent on military equipment naturally attracts public attention. According to Bohi (1973) the issue is of critical

importance, for if profit rates are too high the nation is wasting resources and taxpayers are overburdened, while if profit rates are too low, resources will flow out of defense business and jeopardize the quantity and quality of sources of supply.

Throughout the history there has always been a natural discussion about the profits of defense contractors. After World War 2, it was said that defense firms had earned excess profits due to urgent demand for weapons and other military products during the war. These discussions led to the foundation of the renegotiation board. The renegotiation board was established under the renegotiation act of 1951. The aim of the board was to insure that contractors do not reap unusual profits.

To understand what the renegotiation board does, there is a need to clarify the profit-limitation process in the defense sector. Rogerson (1994) points to two phases of profit limitation. The first phase is the negotiation of individual contracts by the procurement agencies and the contractors. At this point the profit on each contract is established ex ante, usually as a component of the total estimated cost (price) of the contract. Disputes that arise at contract settlement over allowable costs and fees are usually settled by negotiation. In some cases this fails and parties go to the Armed Forces Board of Contract Appeal. The second phase is profit renegotiation, an ex post review of a contractor's total profit from all contracts during his fiscal year. This is the responsibility of the Renegotiation Board, which is independent of procurement agencies. When the board finds excess profits in its review, it recaptures them, either by agreement or by order. Contractors may petition the United States Court of Claims for a redetermination of the issue if they feel that the conclusion is unfair.

To perform its function, legislation that established the board must necessarily determine whether unusual (or excess) profits exist. Agapos and

Galloway (1970) discuss the criteria that the board considers in order to determine this issue. These criteria can be summarized as follows:

- The reasonableness of costs to the government
- Contractor profits based on net worth and the amount of capital employed in the productive process
- The extent of the risk entailed in the activity
- The character and complexity of the techniques used to produce the product
- Considerations of the public interest

The effectiveness of the board was evaluated empirically by Agapos and Galloway (1970) and rationale of the board as a regulatory device in the aerospace industry has been found debatable.

The debate did not stop after the establishment of the renegotiation board and there appeared a need for more efficient acquisition policies that will neither lead to waste of public resources nor eliminate all the profits in the defense industry. This accelerated the efforts for reforming the federal acquisition policy. As explained in the previous chapter, federal acquisition is a more general concept. It comprises the regulations related to non-defense acquisition as well as defense acquisition. However, in federal spending on goods and services, the Department of Defense plays a dominant role, accounting for two-thirds of all federal acquisition spending.

There have been several major acquisition reform initiatives in history and these are likely to affect the profits of defense industry. These reforms have been motivated by several factors. The first factor is the perceived contractor waste, fraud and abuse that led to regulations regarding the contracting mechanism. The second factor is the efforts to centralize the acquisition decision-making process. This factor

is motivated by the complexity and confusion surrounding the procurement system. Finally the last factor is the desire for increasing the competition in the acquisition environment. The major reforms will be discussed in chapter 5.

To sum up, defense industry has been the focus of discussions in private and official circles. The question was whether excess profits exist in the industry. The next chapter gives a review of literature on defense procurement and profits of US defense contractors.

## **CHAPTER 4**

### **LITERATURE REVIEW**

There are several studies related to the defense industry, the defense procurement and specifically to the profits of US defense contractors. These studies point to different aspects of the topic and vary in terms of scope. The question of whether defense contractors earn greater returns than other companies is controversial, and despite numerous studies the issue remains unsettled. The disagreement is not surprising because studies in the literature are not comparable. They consider different groups of firms and different time periods, and they employ different measures of profitability (Trevino and Higgs 1992). These studies can be divided into three groups. The first group of articles directly tests the hypothesis that profitability of defense contractors is higher than that of other firms. The second group of articles examines the procurement process and offer alternative strategies for efficiency. Finally, the third group of studies investigates the reason why there may be excess profits in the defense industry. The reason for excess profits can be the procurement process itself. Thus, the process itself poses some problems. These studies test the so-called cost-shifting hypothesis, which is a result of joint costs problem in defense procurement.



#### **4.1 Studies Related to Relative profit performance of Defense Firms**

Before 1970, there are two important studies related to defense profits in the US. The first study is Weidenbaum (1968), which examines the profit rates (profits as a percentage of net worth) of six aerospace contractors doing more than 75 percent of their total business with the Department of Defense or NASA. The study compares sample firms with six commercial firms having similar total sales volumes based on profits over two time periods: 1952-1955 and 1962-1965. Weidenbaum study concludes that the defense business is more profitable than nondefense business and, argues that the defense industry is becoming more concentrated and as a result less competitive. The second study is that of Logistics Management Institute (LMI, 1969) for the Department of Defense. The LMI study concludes that, between 1962 and 1968, profit rates of defense firms (as a percentage of net worth) are consistently lower than profit rates of a broad sample of commercially oriented firms. Moreover, the study finds a downward trend in industry profits since 1962 and argues that this is the result of increasing competition in the industry.

Agapos and Gallaway (1970) investigate defense firms' profits over the period 1942-1967 to see the effect of the renegotiation board. Their empirical model that explains profits includes a dummy variable to measure the effect of the renegotiation board. The coefficient of the renegotiation board dummy variable is insignificant showing that the presence of the renegotiation board does not affect the profits of defense firms.

Stigler and Friedland (1971) examine the profitability record of the defense business with regard to stock market performance over two periods, 1948-61 and 1958-68. They find that during the first period defense firms outperformed the

market by a large margin, and the difference disappears in the second period. Therefore they conclude that the popular view of unusual profits of defense contractors is correct for the 1950s and incorrect for the 1960s.

Bohi (1973) examines the profit performance of defense industry firms to determine whether the profit rates of firms engaged heavily in defense contracting differ significantly from profit rates of non-defense oriented firms between 1960 and 1969. On the basis of the sample of 36 defense contractors considered, he concludes that there is no evidence for arguing that the defense industry is more or less profitable than other industries in general.

Greer and Liao (1986) analyzed defense firms' profits and risks between 1963 and 1982. The study concludes that defense business has generally been less profitable than commercial business even though the risk level is higher.

Trevino and Higgs (1992) examine the profits of the top 50 defense contractors and compare them with the profits of comparable non-defense companies. They find that profit rates of defense contractors exceeded those of comparable non-defense companies during the period 1970-1989. Their conclusion holds regardless of whether profits are measured by the firms' accounting rate of return or by the stock market payoff to shareholders in the form of dividends and capital gains. They also conclude that investing in defense contractors was not significantly riskier than investing in comparable non-defense companies.

Using longitudinal data on almost 9,300 industry segments from the compustat file, Lichtenberg (1992) tests and finds strong support for the hypothesis that government contractors (especially defense contractors) are more profitable than other firms. According to his estimates, from 1984 to 1989, the average annual profit

rate (return on assets) of these contractors as a whole is 68 to 72 percent higher than that of other segments.

#### **4.2 Studies related to defense procurement and its efficiency**

Pownall (1986) examines the impact of regulatory changes that arise from the Cost Accounting Standards Board (CASB). In general, his results indicate that, at least for the less competitive defense contractors, security returns declined at the time of the initial debates concerning regulation of contractors' cost accounting practices, indicating anticipated decreases in profitability associated with defense contracting activities. These results suggest that market agents viewed the accounting standard-setting agency as a deterrent to at least some firms' abilities to extract excessive cost reimbursements from the government.

Rogerson (1989) argues that informational and incentive constraints inherent in the innovation process require that regulatory institutions in defense procurement create prizes for innovation. He claims that since the quality of an innovation is difficult to describe or measure objectively, the most natural method for awarding prizes is to allow firms to earn positive economic profit on production contracts. He uses stock market data to estimate the size of the prize that firms compete for. His basic idea is to calculate the change in market values of firms competing for a prime contract award around the day it was announced which firm won. The values of the prizes on 12 major aerospace projects are found to be large.

Kovacic and Smallwood (1994) discuss the issue of mergers and acquisitions in the defense industry over the period 1992-1994. They discuss how DOD could preserve important rivalries through a competitive analysis of mergers. According to

them, if DOD would not develop an effective capability for analyzing the competitive effects of consolidation events, then either contractors would have free rein to determine the structure of the defense supplier base, or the task would fall to other government institutions, such as the antitrust agencies and the federal courts.

Karpoff *et al.* (1999) examine the market and legal penalties imposed on firms suspected or accused of procurement fraud between 1983 and 1995. They find that on average, firms investigated for procurement fraud suffer statistically significant in market value around the announcement dates. The negative reaction is less pronounced for firms ranked among the top 100 military suppliers.

### **4.3 Cost Shifting Hypothesis**

It may be argued that a major reason for the interest in defense profits is the so-called cost-shifting hypothesis. Rogerson (1992) claims that the cost allocation rules used in government contracting enable and encourage contractors to shift some of the costs of their commercial operations to the government. He argues that the methods used by defense firms for calculating the cost of products- in particular, the allocation of overhead in proportion to directly charged labor use- enable these firms to shift overhead from commercial to defense business.

Thomas and Tung (1992) argue that government contractors are able to reduce their cost of doing nongovernmental business by overfunding pension plans when employees work on defense contracts (these contributions are reimbursed by the government) and withdrawing excess pension assets when employees work on commercial business. They empirically examine the relation between funding levels and proportion of revenue from defense contracts for a sample of 80 major

Department of Defense contractors between 1971 and 1980. They also compared the pension funding empirically between defense and non-defense samples. The study suggests that the ability to shift costs from commercial to defense business should allow 'mixed' firms to be more profitable than purely commercial firms.

A recent study about the cost-shifting hypothesis is the one by McGowan and Vondryk (2002). They test the conjecture from prior research that defense contractors' excess profitability stemmed from their ability to shift common overhead costs to government contracts that typically allow cost reimbursement or price renegotiation. Although they confirm that defense contractors enjoyed abnormally high profits on their government work over the 1984-1989 period, they find no evidence that these excess profits are attributable to cost shifting.

Table 3 displays the summary of studies related to relative profit performance of defense firms. Most of the studies used accounting data for the analysis while a few of them relied on stock data. These studies cover different time periods from 1952 to 1989 and most of them find abnormal returns for defense firms.

**TABLE 3****Summary of Studies Related to Relative Performance of Defense Firms**

Author	Date of publication	Period Examined	Findings	Measure
Weidenbaum	1968	1952-1955	High	Accounting
		1962-1965	High	Accounting
LMI (Log.Man.Ins.)	1969	1962-1968	Low	Accounting
Agapos&Gallaway	1970	1942-1967	Normal	Accounting
Stigler&Friedland	1971	1948-1961	High	Stock
		1958-1968	Normal	
Bohi	1973	1960-1969	Normal	Accounting
Greer&Liao	1986	1963-1982	Low	Accounting
Lichtenberg	1992	1984-1989	High	Accounting
Trevino&Higgs	1992	1970-1989	High	Accounting& Stock
McGowan& Vendrzyk	2002	1984-1989	High	Accounting

## **CHAPTER 5**

### **METHODOLOGY AND DATA**

The purpose of this study is to examine the long-run stock market performance of US defense stocks over different time periods and analyze the impact of changes in Federal Acquisition Policy on defense stock returns. Acquisition policy, which is the focus of this study, is just one of the factors that affect defense industry profits. Other factors can be the general demand for weapon systems, which may change due to political considerations and wars, the level of competition in the defense industry or the speed of technological improvements. This type of a study that measures the impact of specific events on the value of firms is called ‘event study’ in the literature. The structure of this chapter is as follows: The first two sections describe the methodology used in measuring the relative performance of defense stocks and conducting the event study. The third section describes the data

#### **5.1 Relative performance analysis**

In chapter 3, the literature on defense firms’ profits was discussed. These studies differ in several ways: sample formation, the period of the analysis, and the measure of profitability. Not surprisingly, their findings also varied.

In this study, relative performance of defense stocks is examined over the period from 1945 to 2000. This is a long enough period and includes the periods analyzed by other papers in the literature.

### 5.1.1 Classification and Periods examined

The sample period is examined by focusing on sub periods based on the structure in the Defense Acquisition History project<sup>1</sup> of the US Department of Defense. The aim of this ongoing project is to examine the evolution of defense acquisition process over time. It divides US defense acquisition history into five major sub-periods. Table 4 depicts these sub-periods, and the events that start them. The major characteristics of each sub period can be summarized as follows:

#### *Into the cold war, 1945-1958*

This period starts with the end of World War 2, which can be called the beginning of the cold war era. The international role of the US has been very important during the first decade of the Cold War. Acquisition organizations, policies, and processes were important to support the country in this respect. In an atmosphere of intense rivalry, the Armed Services applied new organizational structures and management theories to the development of increasingly complex weapon systems, such as the Atlas intercontinental ballistic missile and the Polaris submarine-launched ballistic missile. To a greater extent than ever before in peacetime, the Armed Services came to rely on the resources of the private sector to fulfill their material requirements as the scope, scale, and complexity of acquisition increased.

Not very much effort was exerted to reform the acquisition system in this period. Moreover, there was an increasing political tension with Soviet Union and it led to development of complex weapon systems. These features make this period suitable for defense firms to earn excess profits.

---

<sup>1</sup> <http://www.army.mil/cmh-pg/acquisition/>



**TABLE 4**

**Major Periods In Defense Acquisition History**

Name of the Period	Date	Event That Starts the Period	Date of the Event
Into the Cold War	1945-1958	The end of world war 2	September 2, 1945
Centralization and Systematization	1958-1968	Enactment of Defense Reorganization Act	April 3, 1958
Retrenchment and Reform	1968-1980	Election of Nixon as president	November 5, 1968
From the Reagan Buildup to the end of the Cold War	1980-1989	Election of Reagan as president	November 4, 1980
The Post-Cold War Era	1989-2000	The end of cold war (Fall of Berlin Wall)	November 9, 1989

Source: Defense Acquisition History Project, US Department of Defense

*Centralization and Systematization, 1958-1968*

This period starts with the Defense Reorganization Act of 1958, which gave the Office of Secretary of Defense (OSD) significantly greater control over the acquisition process. Several changes in the acquisition process occurred during the tenure of Secretary of Defense Robert S. McNamara. Utilizing his authority, McNamara introduced a new program to ensure that weapons procurement supported the Kennedy Administration's new national military strategy, which emphasized flexible nuclear response and the strengthening of conventional force capabilities. Drawing from his business experience in the private sector, McNamara moved to control costs by employing cost-effectiveness calculations and new methods of

contracting. By the time he resigned from his post in 1968, McNamara's strategies and methods in the field of acquisition had become the focus of considerable criticism within and outside the U.S. Government. Nonetheless, several of McNamara's reforms have had far-reaching effects.

In summary, the new national military strategy for nuclear and conventional weapons created new opportunities for the defense industry to increase its sales to the government. However, the reform efforts may have negative impacts for the defense industry profits.

#### *Retrenchment and Reform, 1968-1980*

The election of Nixon as president is the starting point for this period. The first important characteristic of this period is Davis Packard's efforts. David Packard, the Deputy Secretary of Defense in the Nixon Administration, initiated the overview of the reforms upon his assumption of office in 1969. Packard's efforts focused on changes in the acquisition process that were intended to reduce dependence on concurrent development. He emphasized competition to improve system performance. Moreover, Packard initiated the development of a group of government acquisition professionals. Foundation of the Defense Systems Management School is an example of this effort.

The second important characteristic of this period is the budget reductions of the 1970s. Popular opposition to the Vietnam War led to pressure for reduced U.S. defense spending, which consequently resulted in a lower state of operational readiness for U.S. forces. Moreover, quantitative and qualitative gains by the Soviets in military forces (and strategic weapons in particular) threatened the military

technological dominance of the United States. This fact forced the US to develop high-profile weapon systems like F-15 fighter aircraft.

To sum up, the interaction of acquisition reforms with budget reductions of 1970s characterizes this period. Although it is hard to predict the net effect of these on defense profits, it is clear that budget cuts and Packard's efforts related to improving competition should affect defense firms in a negative way, especially in an environment where the US is eager for new weapons due to Soviet Union threat.

*From the Reagan Buildup to the End of the Cold War, 1980-1989*

This period starts with the election of Reagan as president. There are two main features of the period. First, this period saw an increase in defense budget and the resulting deficit. Second, it was a period of successful and intense efforts to reform the acquisition process.

In the first years of the period, defense budgets increased rapidly in response to the perception that the US had allowed its armed forces to dwindle, while the Soviet Union had continued to boost its armed forces. In order to deal with the budget deficits that resulted from increasing spending, while cutting tax revenues, Congress passed the Gramm-Rudman-Hollings Deficit Reduction Act in October 1985.

In terms of the efforts related to defense acquisition reform, there are several initiatives in this period. During the 1980s Congressional reformers launched the Military Reform Caucus, an informal coalition of House and Senate members. The Caucus' efforts resulted with the 1984 Competition in Contracting Act (CICA), which promoted "full and open competition" in all federal procurement procedures. Reagan established the President's Blue Ribbon Commission on Defense

Management (the Packard Commission) in 1986. The Commission considered not only the management of the acquisition process, but also the budget process and legislative oversight. Finally, defense acquisition had to address the growing importance and impact of technology and technological change. Advanced technologies were the object of acquisition in the form of such weapon systems as cruise missiles, and stealthy aircraft. Technology also helped to simplify acquisition processes through the automation of acquisition management and logistics.

In the first five years of the period, it can be expected that defense firms earned excess profits. However, the Gramm-Rudman-Hollings Deficit Reduction Act and the several regulatory initiatives have a considerable potential to restrict excess profits during the rest of 1980s.

#### *The Post-Cold War Era, 1989-1999*

The end of cold war starts this period. The first feature of this period is the uncertainty and difficulty of strategic planning after the end of cold war. The second feature is the effort of the Armed Services to transform themselves. The third feature is the deficit reduction after the end of Gulf War. Finally, landmark regulation and legislation characterized the period.

First, the collapse of the Cold War international regime brought much uncertainty about the future direction of U.S. military policy and the source of future threats. The Persian Gulf crisis of 1990-91 revealed the difficulty of strategic planning in an ever-changing world. Security threats were increasingly difficult to measure or even define; terrorism, humanitarian disasters, and even information attack became military problems.

Second, rapid technological change, especially in information technology and other high-tech fields resulted in the Revolution in Military Affairs (RMA). By the end of the 1990s, the Armed Services were all engaged in efforts to transform themselves, technologically and organizationally, in accordance with RMA concepts.

Third, after the Gulf War a deficit reduction occurred. The Armed Forces steadily declined in size, as defense budget was reduced. This limited the funding available for research, development and procurement, and it led to consolidation within the defense industry.

Finally, this period witnessed the passage of landmark legislation and the promulgation of new regulations to professionalize the acquisition workforce and introduce new acquisition practices and organizations. 1993 National Performance Review (NPR), 1994 Federal Acquisition Streamlining Act (FASA) and 1996 Clinger-Cohen Act were among these regulations. These reform efforts were driven not only for the purpose of efficiency, but also by the extreme scarcity of resources.

In summary, the end of cold war, decreasing defense budgets and the landmark reforms in the acquisition process are factors that have the potential to reduce defense industry profits. However, there may be defense firms, which benefited from the potential reduction in competition caused by the consolidation in the industry.

### **5.1.2 Methodology Used in the Relative Performance Analysis**

The analysis compares the performance of a defense stocks portfolio to that of a benchmark portfolio in each of the five sub-periods. Thus, two different portfolios were constructed for the analysis. One is the sample firm's portfolio that contains

defense firms; the other is the benchmark portfolio, which is composed of Center for Research in Security Prices (CRSP) New York Stock Exchange (NYSE) market capitalization deciles.

The choice of benchmark is more important when long-term rather than short-term performance is measured. Evidence in Dimson and Marsh (1986) suggests that an adjustment for firm size is important in studies of long-run performance. They demonstrate that size effect can distort long-term performance measures. They point out that performance measures can be seriously distorted (1) when event stocks differ in size or weighting from the index constituents, (2) when the size effect is large (3) when the measurement interval is long. Fama and French (1992) document that stock returns are related to firm size and book-to-market ratios. Barber and Lyon (1997) argue matching sample firms to control firms based on these two characteristics gives more reliable results since it eliminates new listing, rebalancing and skewness biases. Due to data limitations, it was not possible to control for the book-to-market ratio characteristic in this study.

*Defense stocks portfolio:*

For each period, securities available at the beginning of the period are used to form the defense stocks portfolio, which is equally weighted and rebalanced monthly. If a security drops out from one month to the next, the equally weighted average return is calculated using the remaining securities. Delisting of a security can be because of a merger, exchange or liquidation. Delisting information is demonstrated by the delisting codes in CRSP, which classify the cause of delisting into 57 categories. Table 5 depicts the delisting codes observed for the sample firms in this study.

**TABLE 5****Delisting Codes**

Code	Category	Explanation
100	Active	Issue still trading NYSE/AMEX or NASDAQ
231	Mergers	When merged, shareholders receive common stock or ADRs.
233	Mergers	When merged, shareholders receive cash payments.
241	Mergers	When merged, shareholders primarily receive common stock and cash
242	Mergers	When merged, shareholders receive common stock, preferred stock or warrants.
243	Mergers	When merged, shareholders receive common stock
331	Exchanges	Issue exchanged, for another class of common stock.
500	Dropped	Issue stopped trading on exchange-reason available.
551	Dropped	Delisted by current exchange-insufficient number of shareholders.
552	Dropped	Delisted by current exchange-price fell below acceptable level.
580	Dropped	Delisted by current exchange-delinquent in filling, non-payment of fees.
582	Dropped	Delisted by current exchange-failure to meet exception or equity requirements.
585	Dropped	Delisted by current exchange-protection of investors and the public interest

Source: Data Description Guide for the CRSP US Stock Database and CRSP US Indices Database.

*Benchmark portfolio:*

The design of the benchmark portfolio is similar to Agrawal *et al.* (1992). CRSP NYSE market capitalization decile portfolios are used for this purpose. These portfolios are rebalanced by CRSP each year, using the security market capitalization at the end of the previous year to rank the securities. The largest securities are placed in portfolio 10 and the smallest securities are placed in portfolio 1. Using the capitalization values of sample firms and the minimum and maximum market values for each year for each decile, sample stocks were categorized into ten groups. The weight of a decile in the benchmark portfolio reflects the percentage of sample stocks

falling into that decile. Benchmark portfolio is rebalanced monthly to account for any changes in weights due to delistings of sample stocks.

As a result, for each of the five periods, two portfolios were constructed with monthly time series of returns. Using the monthly returns, four measures were calculated for both portfolios. These measures are;  $\overline{R}_p$  (Average return of the portfolio), BHR (Buy and hold return of the portfolio),  $\beta$  (Beta) and  $\sigma$  (Standard deviation).

1.  $\overline{R}_p$  : Average monthly return of the portfolio over each period, is calculated as:

$$\overline{R}_p = \frac{1}{T} \sum_{t=1}^T R_{pt} , \quad (1)$$

where  $R_{pt}$  is the return of the portfolio in month  $t$  and  $T$  is the number of months in the period.

2. BHR: Buy and hold return of the portfolios, at the end of each period is given by:

$$BHR = \prod_{t=1}^T (1 + R_{pt}) , \quad (2)$$

where  $R_{pt}$  is the return of the portfolio in month  $t$ ,  $T$  is the number of months in the period.

We can always split the variance of the return on a security or portfolio into two parts:

$$\sigma^2(r) = \beta^2 \sigma^2(r_M) + \sigma^2(\varepsilon) . \quad (3)$$

The first term on the right hand side of the equation is called the systematic risk of the investment. It accounts for that part of the security's variance, which cannot be diversified away. This part of the variance measures the contribution of an



asset to the variance of a well-diversified portfolio. The second term is called residual variance or unsystematic risk. It represents the part of a security's total variance that disappears as we diversify.

3.  $\beta$  (Beta) of the portfolio:  $\beta$  represents the systematic risk of the portfolio.

This measure was calculated for each portfolio by regressing portfolio returns on CRSP NYSE value-weighted index.

4.  $\sigma$  (Standard deviation) of the portfolio: This measure represents the total risk of the portfolio. It is calculated as follows:

$$\sigma = \sqrt{\frac{\sum_{t=1}^T (R_{pt} - \bar{R}_p)^2}{T}} \quad , \quad (4)$$

where  $\bar{R}_p$  is the mean of the monthly portfolio returns over the period,  $R_{pt}$  is the return on portfolio in month  $t$  and  $T$  is the total number of months in the period.

In testing the difference between sample and benchmark returns, t-test and Wilcoxon ranksum test were employed. These are parametric and non-parametric tests, respectively. A parametric test assumes that data come from a specific distribution, usually the normal distribution. A non-parametric approach is free of such an assumption. The inclusion of a non-parametric test provides a check of the robustness of conclusions based on a parametric test. Therefore, both tests were employed in the analysis.

t-test tests the equality of means. The test statistics for  $\mu_x = \mu_y$  for unknown  $\sigma$  and  $\sigma_x \neq \sigma_y$ , is given by:

$$t = \frac{(\bar{x} - \bar{y})}{\sqrt{\frac{S_x^2}{n_x} + \frac{S_y^2}{n_y}}} \quad , \quad (5)$$

where  $S_x$  and  $S_y$  denote the sample variances of  $x$  and  $y$ , respectively.

Wilcoxon ranksum test is based on ranks and tests the hypothesis that two independent samples come from distributions with equal medians. The test statistic is:

$$z = \frac{T - E(T)}{\sqrt{Var(T)}} , \quad (6)$$

where  $T$  is the sum of ranks for the observations in the sample.

## **5.2. The Impact of Regulatory Changes**

This section is organized as follows. First, the event study concept is reviewed. Next, the advantages of using the multivariate regression model (MVRM) in event studies are described. Finally the version MVRM used in this study is discussed.

### **5.2.1 Event Studies**

An event study measures the impact of a specific event on the value of a firm. The usefulness of such a study comes from the fact that, given rationality in the market, the effects of an event will be reflected immediately in security prices. (Mackinley (1997)) According to Mackinley, by using the event study methodology a measure of the event's economic impact can be constructed using security prices observed over a relatively short time period. In contrast, direct productivity related measures may require many months or even years of observation. 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, earnings announcements, issues of new debt or eq-

uity, and announcements of macro-economic variables such as the trade. According to Megginson (1997) event studies became an important tool of research because of their clarity of purpose, flexibility, and absence of confusing influences.

There are four types of event studies:

1. *Market efficiency studies*: They assess how quickly and correctly the market reacts to a particular type of new information.

2. *Information usefulness studies*: They assess the degree to which company returns react to the release of a particular bit of news.

3. *Metric explanation*: In a metric explanation study, the event study is only the first step. Early studies explained the metrics (extra returns) by splitting the sample into different sub samples and examining whether the unusual element of returns differed among the sub samples. More recent studies use excess returns as dependent variables in cross-sectional regressions to explain the source of the extra returns.

4. *Methodology studies*: These are related to event study design, research that considers how best to run event studies.

Although there is not a unique method, most of the event studies use the following main steps:

1. *Defining the event date*: The event can be a dividend announcement, a regulation, or any news that the market may react. Event date is the date when the market anticipated the news related to the event.

2. *Measuring abnormal returns*: Abnormal returns are the difference between realized returns and the expected returns. There are several approaches in characterizing expected returns:

1. Mean returns: In this approach, a company is expected to generate the same return that it averaged during the estimation period.

2. Market returns: According to this approach, a company, in the absence of news, is expected to generate the same returns as the rest of the market during the event window.

3. Control portfolio returns: A portfolio of companies is selected that resemble the sample firms except for the absence of news about the firms in the control portfolio.

4. Conditional or risk-adjusted returns: In this approach, a regression model is used to predict expected returns for the firm.

3. *Statistically testing the abnormal returns*: The last step in the event study is statistical testing of aggregated returns. Different researchers have employed different tests.

There are several problems in using the standard event study methodology. These problems are non-normality, autocorrelation in residuals, variance shifts and event clustering. The most important one in the context of regulatory event studies is the last problem. Event clustering refers to events occurring at or near the same time for all sample firms. There can be also industry clustering, which is the case in this study, which refers to events concentrated in the same industry. In standard event study methodology, both event clustering and industry clustering lead to correlation between residuals and consequently give rise to Type 1 error. To deal with this problem, a version of MVRM is used in this study.

## 5.2.2 Multivariate Regression Model in Event Studies

In standard event studies, an estimation period is used to estimate the expected returns. An alternative strategy can be to extend the estimation period to contain the event period. In the case of a single event, a zero-one variable  $D_t$  can be included in the return equation:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \gamma_i D_t + u_{it} , \quad (7)$$

where  $R_i$  is the return on the security of firm  $i$  in period  $t$ ,  $R_{mt}$  is the return on the market portfolio in that period,  $D_t$  is a dummy variable that equals one during the event period and 0 otherwise,  $u_{it}$  is a random component, and  $\alpha_i$ ,  $\beta_i$  and  $\gamma_i$  are the parameters. The coefficient  $\gamma_i$  characterizes the abnormal return for security  $i$  during period  $t$  and directly estimated in the regression.

For  $N$  securities, this method results in a system of  $N$  equations:

$$\begin{aligned} R_{1t} &= \alpha_1 + \beta_1 R_{mt} + \gamma_1 D_t + u_{1t} \\ R_{2t} &= \alpha_2 + \beta_2 R_{mt} + \gamma_2 D_t + u_{2t} \\ &\vdots \\ R_{Nt} &= \alpha_N + \beta_N R_{mt} + \gamma_N D_t + u_{Nt} . \end{aligned} \quad (8)$$

Here, individual excess returns are allowed to differ across firms. This system of equations is an application of the general seemingly unrelated regression model. Its use in event studies is first proposed in Gibbons (1980). The system can be expressed as a single regression in the following form:

$$\begin{bmatrix} R_1 \\ R_2 \\ \cdot \\ \cdot \\ \cdot \\ R_N \end{bmatrix} = \begin{bmatrix} X_1 0 \dots 0 \\ 0 X_2 \dots 0 \\ \dots \\ \dots \\ 0 0 \dots X_N \end{bmatrix} \begin{bmatrix} \delta_1 \\ \delta_2 \\ \cdot \\ \cdot \\ \cdot \\ \delta_N \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \cdot \\ \cdot \\ \cdot \\ \varepsilon_N \end{bmatrix}, \quad (9)$$

where  $R_i$  is a T X 1 vector,

$X_i$  is a T X K matrix of independent variables, which is the same for each equation in the system.

$\delta_i$  is a K x 1 vector of coefficients, for the system in ( 8 ) it contains  $\alpha_i$  ,  $\beta_i$  and  $\gamma_i$ ,

$\varepsilon_i$  is a T X 1 vector of disturbances.

The system can be written simply,

$$R = X\delta + \varepsilon . \quad (10)$$

There are three assumptions made by multivariate regression model. First, disturbances are independent and identically distributed within each equation. Second, disturbance variance is allowed to differ across firms. Third, noncontemporaneous covariances of the disturbances across securities are assumed to be zero. These assumptions fit stock return data well. Therefore, the covariance matrix of disturbances can be expressed as:

$$V = \Sigma \otimes I \quad \text{and} \quad (11)$$

$$V^{-1} = \Sigma^{-1} \otimes I , \quad (12)$$

where  $\Sigma$  is the N X N covariance matrix of contemporaneous disturbances,

$I$  is a T X K identity matrix,

$\otimes$  is the Kronecker product.

The equation (10) is estimated with generalized least squares. GLS estimator is:

$$\delta = [X'V^{-1}X]^{-1}X'V^{-1}R_i . \quad (13)$$

$\Sigma$  is not known, therefore  $V$  is not known, either. In order to make GLS estimation feasible one can use  $\hat{\Sigma}$  instead of the true  $\Sigma$ . The ordinary least squares residuals are used to estimate consistently the elements of  $\Sigma$  with:

$$\hat{\sigma}_{ij} = S_{ij} = \frac{\hat{e}_i e_j}{T} . \quad (14)$$

Although GLS is different from ordinary least squares, if the equations have identical explanatory variables, as in our case, it can be shown that coefficient estimates from OLS and GLS are identical. (Greene 1990). If the equations are actually unrelated and disturbances are uncorrelated, there is no efficiency gain from using MVRM. However, the real advantage of the approach is in hypothesis testing since heteroscedasticity across equations and contemporaneous dependence of the disturbances are explicitly incorporated into the hypothesis tests. This avoids the statistical problems in the standard event study methodology. In MVRM, joint hypothesis about the abnormal returns can be easily tested. (Binder 1985). Table 6 depicts the hypotheses of this study, which are also of primary interest in this literature:

**TABLE 6**

<b>Hypothesis</b>	
Hypotheses	Description
H1: $\frac{1}{N} \sum i \gamma_{ia} = 0$	The average abnormal return during announcement period $a$ equals zero.
H2: $\gamma_{ia} = 0 \forall i$	All abnormal returns for announcement period $a$ equals zero.

Test of H1 is similar to that in the standard event study. Test of H2 is a joint hypothesis that the abnormal returns are zero for all firms. It is a more powerful test than tests of H1 when the abnormal returns differ in sign. Wald test can be applied in testing those two hypotheses. This test is asymptotically distributed as chi-squared due to the use of a consistent estimate of the covariance matrix. The Wald statistic is

$$W = (R\hat{\delta} - q)'(R\hat{V}R')^{-1}(R\hat{\delta} - q), \quad (15)$$

where  $\hat{\delta}$  is the estimated coefficient vector,

$\hat{V}$  is the estimated variance –covariance matrix,

$R\hat{\delta} - q$  denote the set of linear restrictions to be tested jointly.

### 5.2.3 Methodology of the analysis examining the impact of regulatory changes

The preceding discussion of using MVRM in event studies considered the analysis of a single event. The number of dummy variables can be increased if there are multiple events or multiple announcements. Schipper and Thompson (1983) and Binder (1985) use MVRM in their studies to examine the effects of regulation. Both models measure excess returns during the periods of multiple announcements related to regulatory changes.

Schipper and Thompson (1983) use the following model:

$$(R_{it} - R_f) = \alpha_i + \beta_i(R_{mt} - R_f) + \sum_a^A \gamma_i D_{at} + u_{it}, \quad (16)$$

with additional parameters; where

$R_f$  is the risk free rate.

$\gamma_i$  is the coefficient of the impact of the regulatory change for firm  $i$ , that reflects the uniform treatment of all announcements.



$D_{at}$  is a dummy variable that equals one during the  $a$ th announcement period and zero otherwise.

$A$  is the total number of announcements for the regulatory change.

Binder (1985) uses the following model:

$$R_{it} = \alpha_i + \alpha_{it} D_{0t} + \alpha_{it} DJAN_t + \beta_i R_{it} + \beta_{it} R_{mt} D_{0t} + \sum_{a=1}^A \gamma_{ia} D_{at} + u_{it} \quad , \quad (17)$$

with additional parameters; where

$D_{0t}$  is a dummy variable that equals one for every observation between the first announcement period and the last observation in the sample inclusive, and zero for every other observation. This dummy variable allows alpha and beta to change when the market's expectation of regulatory constraint changes,

$DJAN_t$  is a dummy variable that equals one only during January and controls for the January seasonality in the size effect in stock returns,

$\gamma_{ia}$  is the coefficient of the regulatory change for firm  $i$  in announcement month  $a$ ,

$D_{at}$  is a dummy variable that equals one during the  $a$ th announcement period and zero otherwise.

There are four main differences between the methodologies of these two studies. The first one is the usage of risk free rate for calculating excess returns in Schipper and Thompson (1983). The second and third differences are concerned with the process of controlling for the January seasonality and allowing alpha and beta to change in Binder (1985). Final and the main difference is related to consideration of the regulatory event variables. Schipper and Thompson (1983) apply a uniform treatment of announcements. For each regulatory change, they use one dummy variable for all announcement periods, which takes the value of one during the announcement periods and zero otherwise. Binder (1985) applies a differential

treatment of announcements. He uses different dummy variables for each announcement and measures the effect of each announcement separately. In this study, Binder's model is used to measure the effects of regulation. The estimation periods are determined as follows. First, the date, which lies in the middle of the first and the last announcement dates, is identified. 30 months before and after this date forms the 60-month estimation period for the analysis of each regulatory change. Table 7 displays the sample of regulatory reform initiatives that are examined. In the table it is possible to see the first announcement date, the last announcement date, the number of announcements and the number of months from the first announcement month to the last announcement month. There are two types of regulatory initiatives; commissions and acts. For commissions, the first and last announcement dates denote the dates when commissions are established and the reports are delivered, respectively. For acts, these dates refer to dates when the acts are introduced and approved, in the senate or the house, respectively.

Requirements of these regulations are displayed in Table 8. According to Binder (1985), it is not clear a priori that the effects of the regulation are consistently positive or negative: in the same industry some firms may gain while others lose. This is one of the features of the regulatory event studies that make them more difficult than the standard event study. The same holds for the regulations in acquisition process. However, some predictions can be made by examining the motives and requirements of the regulations. There are several common characteristics of these reforms like reducing the inefficiencies and improving the acquisition system. What actually differentiates them is the acquisition atmosphere in which the regulations are put into action. It is better categorizing them in different periods as was suggested in the defense acquisition history project.

Hoover Commission (1949) is one of the first important reform initiatives in defense acquisition history. It emphasized centralization and simplification of the procurement system. The commission was motivated by the complexity and confusion surrounding the procurement. For instance in 1947, there were seven supply systems in the Army, and 18 systems in the Navy. Hoover Commission recommended that the authority of the Secretary of Defense be strengthened so that he could integrate the organization and procedures of the various phases of supply in the military services. Such a regulation is expected to bring negative impacts for defense firms since it may eliminate the opportunistic behavior in a complex environment where acquisition process is difficult to be managed. The effect can be worse especially in a period when the country is eager for new weapons and not very much reform effort exists.

TINA (1962) required contractors to provide full and fair disclosure in the conduct of negotiations. The act was motivated by the perceived contractor waste, fraud and abuse. It falls into the second period. This period is characterized by the new national military strategy for nuclear and conventional weapons and Secretary of Defense Robert S. McNamara's efforts to make the acquisition system more systematic. The act is expected to affect the defense firms negatively due to its restrictive character.

Commission in Government Procurement (1972) recommended a shift toward commercial product acquisition, increase competition and eliminate inconsistencies and confusion in procurement system. The commission was motivated by the desire to increase competition in the system and it falls into the third period. It is noticeable that it is one of the first reform initiatives that emphasize competition and reliance on commercial items. Commercial items refer to commercial products and technologies

developed in purely competitive market by the commercial companies or the commercial divisions of defense companies. Where feasible, it leads to relying on the relatively similar technologies and products in the commercial market, except the military unique high-tech weapon systems. In this period, despite the budget cuts in 1970s, the US is still ambitious for new high-tech weapon systems due to Soviet threat. The impact of the commission is expected to be negative.

The rest of the regulations fall into the last two periods. As can be remembered, the fourth period (1980-1989) is marked with an increase in defense budget in the first five years. However, there is an intense effort to reform the acquisition system especially after 1984. The Competition in Contracting Act of 1984 and Blue Ribbon Commission of 1986 are examples. Reform effort has been accelerated after the end of cold war. Consequently, the fifth period witnessed landmark legislations like Advisory Panel, FASA, NPR and Clinger-Cohen Act. Increasing the competition, improving and streamlining the internal structure of the acquisition process are the common characteristics of these reforms. The last period is characterized by the budget cuts, consolidation and the reduction in workforce in defense industry. The impacts of the regulations in the last two periods are expected to be negative.

**TABLE 7****The sample of Regulatory reform Initiatives**

Regulatory Change	First Announcement	Last Announcement	a	t
Hoover Commission on Organization of the Executive Branch of the Government	July 7, 1947	May 5, 1949	3	22
Truth-In-Negotiations Act (TINA)	April 30, 1962	September 10, 1962	2	4
Commission on Government Procurement	November 26, 1969	December 31, 1972	2	37
The Competition in Contracting Act	July 18, 1984	April 1, 1985	2	8
The President's Blue Ribbon Commission on Defense Management (The "Packard Commission")	July 15, 1985	June 30, 1986	3	11
Advisory Panel on Streamlining and Codifying Acquisition Laws pursuant to Section 800 of the National Defense Authorization Act for Fiscal Year 1991	November 5, 1990	January 12, 1993	2	25
National Performance Review (NPR)	March 3, 1993	September 7, 1993	2	6
Federal Acquisition Streamlining Act (FASA)	October 26, 1993	October 13, 1994	4	10
Clinger-Cohen Act	February 10, 1996	November 18, 1997	3	15

Note: a is the number of announcements about each regulatory change and t is the number of months from the first announcement month to the last announcement month, inclusive.

**TABLE 8****Major Regulatory Initiatives in Federal Acquisition**

Regulatory Initiative	Requirement
1949 Hoover Commission on Organization of the Executive Branch of the Government	Recommended the centralization and simplification of the defense procurement process by giving more authority to the secretary of defense.
1962 Truth-In-Negotiations Act (TINA)	Required contractors to support their prices with cost and pricing data and to provide for full and fair disclosure in the conduct of negotiations.
1972 Commission on Government Procurement	Recommended a shift toward commercial product acquisition, increase competition and eliminate inconsistencies and confusion in procurement system.
1984 The Competition in Contracting Act	Established the competitive acquisition systems and recommended a procurement system through full and open competitive procedures.
1986 The President's Blue Ribbon Commission on Defense Management (the "Packard Commission")	Recommended reducing DOD's reliance on military specifications, streamlining the defense acquisition process.
1993 Advisory Panel on Streamlining and Codifying Acquisition Laws pursuant to Section 800 of the National Defense Authorization Act for Fiscal Year 1991	Report called for improving government access to commercial technologies and streamlining and improving acquisition system by extending the definition of commercial items to also include the services.
1993 National Performance Review (NPR)	Recommended increased reliance on the acquisition of commercial items, cutting red tape, and increasing the efficiency of acquisition system.
1994 Federal Acquisition Streamlining Act (FASA)	Streamlined acquisition procedures for commercial items while initiating a computer-based system and placing a greater emphasis upon the use of past performance when selecting a contractor.
1996 Clinger-Cohen Act	Built upon FASA initiatives, simplified the acquisition of commercial items, and allowed contracting officers to select competitive contractors more efficiently.

### **5.3 Data and the Sample**

The data used in this study are obtained mainly from CRSP. Monthly stock return data with dividend adjustment, value weighted index returns, NYSE capitalization decile portfolio returns and capitalization values are taken from CRSP.

Another issue related to data is the identification of the event dates. Unlike stock splits or similar simple events, regulatory events usually involve no single well-defined announcement; rather there are multiple announcements, such as formation of a committee, announcement of a committee report, and House or Senate approval during the legislative process. A source like Wall Street Journal index or New York Times index is generally used for this purpose. Due to lack of these sources, announcement dates of each regulation were obtained from the Internet and via e-mail from several librarians in the US.

Examining the effects of regulatory changes requires identifying securities likely to be affected by these changes. The following procedure was applied to form the sample used in this study: First, the universe of standard industrial classification codes (SIC) was examined and nine exclusively military ones were determined. These SIC codes gave a sample of 48 firms. Second, datastream aerospace-defense list and Department of Defense Top 100 Contractors lists from 1995 to 2000 were examined. It appeared that the sample obtained by using those nine SIC codes did not contain several major defense firms. To account for this gap, three additional SIC codes were identified by relying on those two lists. These SIC codes are 3721, 3724 and 3731, representing the manufacturers of aircraft, aircraft engine and shipbuilding, respectively. Finally, firms with these SIC codes were screened to

eliminate those which operate in non-defense industries. The process gave 19 additional firms. The overall procedure resulted in a total of 67 firms. Table 9 shows the composition of the sample based on SIC codes. Table 10 gives the list of securities used in this study. The first column represents the time period in which a security remains active. In case of a merger or acquisition, the name of a company may change. The second column gives the latest company name. The third column shows the primary permanent CRSP identifier (Permno). The last two columns present the SIC and delisting codes.

Table 11 displays the distribution of sample firms across deciles. The percentage of sample firms that fall into different deciles can be observed over different periods. Average decile of sample firms is around seven during the first two periods. Thus, for those early periods, the sample contains relatively big firms. In the last three periods the average decile is slightly smaller than six and implies a portfolio typically containing medium size stocks.

Table 12 shows the market values for CRSP decile portfolios over different years. The numbers show the maximum market values in the corresponding decile portfolios. It can be seen that market values have increased over time.



**TABLE 9****Sic Codes**

Sic Code	Explanation	Number of firms
3761	Ballistic missiles, guided missiles, rockets, space and military	4
3769	Guided missile and space vehicles and auxiliary equipment	4
3764	Engines and engine parts, propulsion units, rocket motors, guided missile	5
3484	Small arms	5
3489	Ordnance and accessories (naval, aircraft, tank, coast, field artillery)	2
3795	Tanks and tank components	2
3812	Search, detection, navigation, guidance, aeronautical	20
3483	Ammunition, except for small arms	4
3482	Small arms ammunition	2
3721	Aircraft	7
3724	Aircraft engines	4
3731	Shipbuilding	8

**TABLE 10**  
**Sample Securities List**

No	Period	Company Name	Permno	SIC	DEL
1	19370430-19950331	MARTIN MARIETTA CORP NEW	20562	3761	231
2	19391230-20021231	LOCKHEED MARTIN CORP	21178	3761	100
3	19880930-19971031	ASTROTECH INTERNATIONAL	75368	3761	231
4	19900430-20021231	ORBITAL SCIENCES CORP	76139	3761	100
5	19251231-20021231	GOODRICH CORP	12140	3769	100
6	19721229-19730731	CONSOLIDATED AIRBORNE SY	26519	3769	500
7	19620731-19721130	AEROJET GENERAL CORP	28732	3769	231
8	19721229-19760831	ROSEMOUNT INC	67601	3769	231
9	19790629-19880129	ATLANTIC RESEARCH CORP	15676	3764	233
10	19300131-19850228	AVCO CORP	18606	3764	233
11	19400531-20000531	CORDANT TECHNOLOGIES INC	21290	3764	233
12	19581231-19820930	THIOKOL CORP	26665	3764	231
13	19721229-19850628	ROCKCOR INC	67361	3764	233
14	19721229-19780731	BROWNING	19554	3484	233
15	19620731-19800131	REMINGTON ARMS INC	35844	3484	231
16	19710930-19780131	GENERAL RECREATION INC	53292	3484	552
17	19721229-20021231	STURM RUGER & CO INC	73219	3484	100
18	19920228-20000131	COLEMAN CO	77368	3484	242
19	19721229-19740731	GRIFFITHS ELECTRONICS IN	40126	3489	500
20	19711231-20000531	O E A INC	53639	3489	233
21	19830831-19870630	WEDTECH CORP	67109	3795	585
22	19840928-19890331	I M T INC	88816	3795	580
23	19860131-20010531	SCOTT TECHNOLOGIES INC	10016	3812	231
24	19721229-20021231	AEROSONIC CORP	11157	3812	100
25	19721229-20021231	ANALOGIC CORP	14198	3812	100
26	19290328-20021231	SPARTON CORP	17523	3812	100
27	19520930-20021231	RAYTHEON CO	24942	3812	100
28	19570731-20010531	LITTON INDUSTRIES INC	26294	3812	233
29	19620731-20010430	B A E SYSTEMS CANADA INC	30250	3812	233
30	19770630-20021231	HERLEY INDUSTRIES INC	41663	3812	100
31	19681231-20021231	LA BARGE INC	47255	3812	100
32	19810130-20021231	D R S TECHNOLOGIES INC	65226	3812	100
33	19721229-20011130	SENSORMATIC ELECTRONICS	70018	3812	551
34	19901031-20021231	E S C O TECHNOLOGIES INC	76478	3812	100
35	19930831-19990430	CYCOMM INTERNATIONAL INC	79551	3812	582
36	19931130-20021231	ELECSYS CORP	79797	3812	100
37	19940331-20021231	HI SHEAR TECHNOLOGY CORP	80393	3812	100
38	19961129-20021231	ELBIT SYSTEMS LTD	84207	3812	100
39	19971231-20010531	RAYTHEON CO	85658	3812	331
40	19981030-20021231	B V R SYSTEMS LTD	86383	3812	100
41	20000831-20021231	INNOVATIVE SOLUTIONS & S	88534	3812	100
42	20001229-20021231	GARMIN LTD	88837	3812	100
43	19840430-20021231	ALLIED RESEARCH CORP	11923	3483	100
44	19291031-19991231	HONEYWELL INC	18374	3483	231

45	19721229-20021231	TRANSTECHNOLOGY CORP	61209	3483	100
46	19831230-19881130	SOONER DEFENSE FLA INC	71205	3483	580
47	19760130-19771130	LEISURE GROUP INC	49155	3482	500
48	19980930-20021231	D H B INDUSTRIES INC	86355	3482	100
49	19260130-20021231	GENERAL DYNAMICS CORP	12052	3731	100
50	19340929-20021231	BOEING CO	19561	3721	100
51	19471231-20021231	TEXTRON INC	23579	3721	100
52	19511231-20021231	NORTHROP GRUMMAN CORP	24766	3721	100
53	19590331-19970731	MCDONNELL DOUGLAS CORP	26729	3721	231
54	19290531-20021231	UNITED TECHNOLOGIES CORP	17830	3721	100
55	19520930-19890831	FAIRCHILD INDUSTRIES INC	24897	3721	233
56	19620731-19870130	BUTLER INTERNATIONAL INC	30031	3721	241
57	19721229-20021231	KAMAN CORP	47002	3721	100
58	19251231-20021231	HONEYWELL INTERNATIONAL	10145	3724	100
59	19290830-20021231	CURTISS WRIGHT CORP	18091	3724	100
60	19620731-20021231	HEICO CORP	32678	3724	100
61	19980430-20021231	HEICO CORP NEW	85945	3724	100
62	19620731-19710226	ROLLS ROYCE LTD	36011	3724	584
63	19870130-20021231	SEQUA CORP	72733	3724	100
64	19870130-20021231	SEQUA CORP NEW	72741	3724	100
65	19401130-19680930	NEWPORT NEWS SHIPBUILDING	21418	3731	242
66	19961231-20020131	NEWPORT NEWS SHIPBUILDING NEW	84383	3731	243
67	19620731-20021231	TODD SHIPYARDS CORP	37399	3731	100

**Note:** Period refers to the beginning and ending dates of the period in which the security is traded. Company name is the latest name of the company after a merger or acquisition. Permno is one of the primary permanent identifiers used in CRSP. SIC is the standard industrial classification and DEL is the delisting information for the related stocks

**TABLE 11****Distribution of Sample Firms across Deciles**

	1945-1958	1958-1968	1968-1980	1980-1989	1989-1999
Decile 1	3%	6%	12%	14%	25%
Decile 2	4%	1%	6%	11%	4%
Decile 3	2%	2%	5%	9%	4%
Decile 4	9%	2%	3%	5%	13%
Decile 5	9%	5%	9%	9%	9%
Decile 6	12%	9%	6%	4%	6%
Decile 7	12%	13%	7%	9%	2%
Decile 8	14%	18%	17%	6%	5%
Decile 9	19%	21%	16%	14%	10%
Decile 10	16%	23%	12%	20%	21%
Average Decile	6.97	7.55	5.81	5.89	5.32
Number of firms	13	17	25	34	33

**TABLE 12****Market Values for Decile Portfolios**

	1945	1958	1968	1980	1989	1998
Decile 1	553.4	1,009.7	4,442.1	3,282.6	4,881.2	7,880.4
Decile 2	901.9	1,814.4	6,889.1	5,996.8	8,739.3	14,241.8
Decile 3	1,191.4	2,754.1	9,278.5	9,393.0	13,800.0	22,899.7
Decile 4	1,644.3	3,926.5	12,400.1	14,940.6	20,823.7	36,499.6
Decile 5	2,169.0	5,733.0	16,748.5	21,722.3	34,117.2	53,198.8
Decile 6	2,943.8	8,810.6	23,655.9	33,246.5	54,681.0	82,545.9
Decile 7	4,339.5	13,096.0	35,075.0	50,549.4	94,666.2	138,479.4
Decile 8	6,634.3	24,442.6	56,073.9	85,960.4	179,127.2	262,570.1
Decile 9	15,024.2	51,593.7	98,341.6	159,223.5	373,581.8	690,373.2
Decile 10	385,170.6	1,587,262.5	3,558,492.0	3,962,590.0	6,258,160.0	3,423,717.0

Note: Numbers are in (x1000) dollars.

## **CHAPTER 6**

### **RESULTS**

This chapter discusses the results of the empirical analysis in this study. Discussion of the results consists of two parts. First, the results of the relative performance analysis are presented. Next, the results of the analysis examining the impact of regulations are explained.

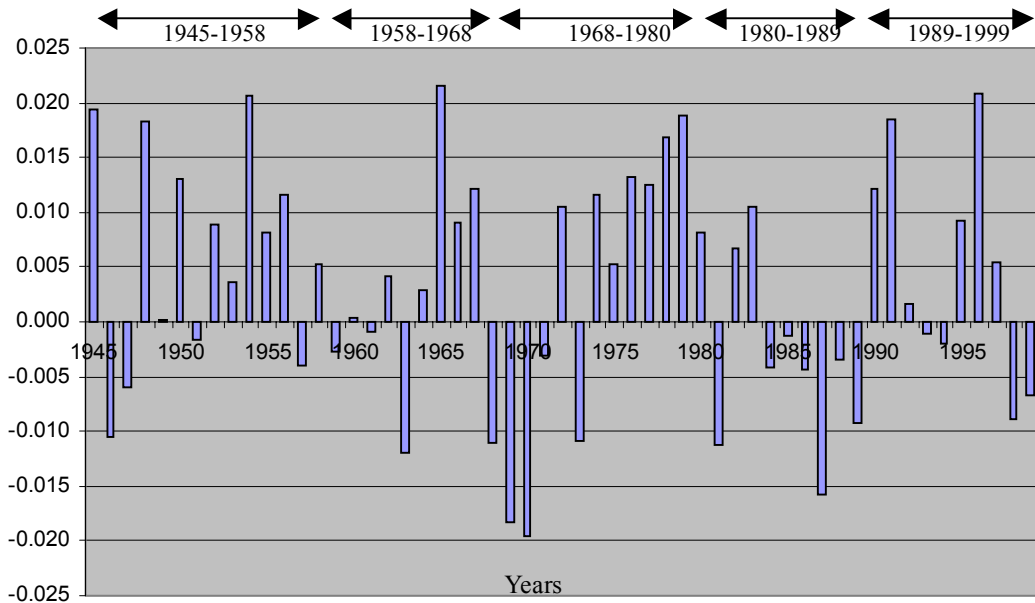
#### **6.1 Results of the Relative Performance Analysis**

The classification of the entire 1945-1999 period for the empirical analysis is based on the Defense Acquisition History Project of US Department of Defense, which divides Defense Acquisition History into five periods. Before a discussion of the results, it is useful to take a look at the average difference of the sample portfolio and the benchmark portfolio over different periods. This process gives a feeling about the data. Figure 1 displays the average monthly excess returns per year.

In Figure 1, it can be observed that average monthly excess returns varied across periods. For the first period average excess returns are generally positive. As was suggested in defense acquisition history project, not very much effort was exerted to reform the acquisition system in this period. Moreover, there was an increasing political tension with Soviet Union and development of complex weapon systems in an atmosphere of intense rivalry. Thus, these features made this period suitable for defense firms to earn excess profits. The result is consistent with the expectations in this respect.

**FIGURE 1**

**Average Monthly Excess Returns per Year**



The second period is marked with the new national military strategy for nuclear and conventional weapons in addition to the Secretary of Defense Mcnamara's reforms. These factors seemed to effect defense firms differently over the years. At the beginning of the period, there are both positive and negative excess returns. Especially after 1964, positive excess returns are observed.

At the beginning of the third period, there are negative excess returns. This may be explained by the budget cuts and the reform efforts of David Packard, the Deputy Secretary of Defense. Consistently positive excess returns are observed in the following years. The reason for these excess profits can be desire for developing high-profile weapon systems like F-15 fighter aircraft and the Vietnam War.

At the beginning of the fourth period, defense budgets increased rapidly in response to the perception that the US had allowed its armed forces to dwindle, while the Soviet Union had continued to boost its armed forces. In general, this factor affected the defense stock returns positively. However, especially after 1984, it can

be seen that there are negative excess returns. This can be explained by the very successful and intense reform efforts and the deficit reduction act in 1985-1989 period. Competition in Contracting Act (CICA) and Blue Ribbon Commission on Defense Management (the Packard Commission) are examples of the reform efforts.

The end of cold war, decreasing defense budgets and the landmark reforms in the acquisition process characterizes the last period. Both positive and negative excess returns are observed. It is likely that the decreasing competition level in the defense industry due to the consolidation is the reason for excess returns. However, these positive excess returns seems to have been balanced partly by the reforms like National Performance Review (NPR), Federal Acquisition Streamlining Act (FASA) and Clinger-Cohen Act.

Table 13 gives the risk and return measures of the two portfolios over these periods. It can be seen that, in four periods out of five, sample stocks portfolio exceeded the benchmark portfolio in terms of mean and buy and hold returns. Benchmark portfolio exceeds the sample portfolio only in 1980-1989 periods. As mentioned in the preceding discussion, this period is characterized by the increasing defense budget in the beginning and important reforms in the acquisition process afterwards. It seems that these reforms affected sample stocks negatively. The biggest difference between the sample portfolio and the benchmark portfolio in terms of buy and hold returns is in the 1945-1958 period. This is consistent with the expectations regarding the period. Increasing political tension with Soviet Union and development of complex weapon systems in addition to the lack of reform efforts made this period convenient for defense firms to extract excess profits. Sample portfolio is slightly riskier than the benchmark portfolio over the periods, except

systematic risk in the last period. Both total risk (standard deviation) and systematic risk (beta) measures confirm this fact.

**TABLE 13**

**Risk and return measures for the portfolios (1945-1999)**

Period	<u>Sample portfolio</u>				<u>Benchmark portfolio</u>			
	BHR	Beta	Stdev	Mean	BHR	Beta	Stdev	Mean
Sep 45- Apr 58	9.4511	1.0911	0.0547	0.0164	4.8023	1.0718	0.0407	0.0112
Apr 58-Nov 68	5.7745	1.1683	0.0545	0.0153	4.6046	1.0491	0.0357	0.0127
Nov 68-Nov 80	3.6280	1.3032	0.0762	0.0118	2.6880	1.1834	0.0606	0.0086
Nov 80-Nov 89	3.0704	1.1404	0.0617	0.0123	3.7861	0.9940	0.0491	0.0136
Nov 89-Nov 99	5.5841	0.8390	0.0459	0.0152	3.6028	0.9085	0.0374	0.0112

Table 14 presents the statistical test results for the comparison of the returns of two portfolios. The hypotheses that the mean and median of two portfolios are the same cannot be rejected for any period.

**TABLE 14**

**Statistical Test Results for the comparison of the Sample Portfolio and the Benchmark Portfolio (1945-1999)**

	<u>t-test</u>		<u>Ranksum Test</u>	
	t-statistic	p value	z-statistic	p value
Sep 1945- Apr 1958	0.9319	0.3522	0.6370	0.5240
Apr 1958-Nov 1968	0.4540	0.6503	0.5010	0.6161
Nov 1968-Nov 1980	0.3858	0.700	0.0170	0.9865
Nov 1980-Nov 1989	-0.1660	0.8683	-0.4790	0.6319
Nov 1989-Nov 1999	0.7418	0.4590	0.6390	0.5231



The results do not change qualitatively when value weighted market index is used instead of the size benchmark portfolio. Table 15 gives t-test and Wilcoxon Ranksum test results for the comparison of the sample portfolio and the market index. Statistical test results are still insignificant.

**TABLE 15**

**Statistical Test Results for the comparison of Sample Portfolio and Market Index (1945-1999)**

	<u>t-test</u>		<u>Ranksum Test</u>	
	t-statistic	p value	z-statistic	p value
Sep 1945- Apr 1958	-0.9738	0.3311	0.7280	0.4665
Apr 1958-Nov 1968	0.8095	0.4192	0.7970	0.4255
Nov 1968-Nov 1980	-0.7531	0.4521	0.0760	0.9391
Nov 1980-Nov 1989	0.1407	0.8883	-0.2790	0.7805
Nov 1989-Nov 1999	-0.4227	0.6729	0.3070	0.7592

These findings are not consistent with the findings in two comparable papers in the literature. These are Stigler and Friedland (1971) and Trevino and Higgs (1992). The former study found excess returns over the period 1948-1961. The latter one concluded that stock returns of defense contractors exceeded those of comparable non-defense companies over the period 1970-1989.

One reason for the difference can be the period examined. The two portfolios were compared over the periods used in those two studies. Table 16 reports the risk and return measures over the periods 1948-1961 and 1970-1989. As in the previous tables, although risk and return measures are larger for the sample stocks portfolio than the benchmark portfolio, the difference in average returns is not significant as

shown in Table 17. Using value-weighted market index in place of the size benchmark portfolio (not rejected) leads to the same conclusion.

**TABLE 16**

**Risk and Return Measures for the Two Portfolios (1948-1961, 1970-1989)**

Period	<u>Sample portfolio</u>			<u>Benchmark portfolio</u>		
	Beta	Stdev	Mean	Beta	Stdev	Mean
1948-1961	1.0992	0.0516	0.0193	1.0195	0.0355	0.0136
1970-1989	1.2527	0.0724	0.0144	1.0979	0.0562	0.0119

**TABLE 17**

**Statistical Test Results for the Comparison of Sample Portfolio and Benchmark Portfolio (1948-1961, 1979-1989)**

	<u>t-test</u>		<u>Ranksum Test</u>	
	t-statistic	p value	z-statistic	p value
1948-1961	1.1810	0.2386	1.1520	0.2493
1970-1989	0.4215	0.6736	0.0450	0.9639

Another reason for the difference in the findings between this study and those two papers can be the benchmark selection. For instance, Stigler and Friedland (1971) used NYSE equally weighted index and Trevino and Higgs (1992) used S&P 500 index as benchmark. On the other hand, a portfolio based on capitalization deciles and NYSE value-weighted index are used in this study to control for size. Due to size effect, the use of an equally weighted index, as in Stigler and Friedland (1971), rather than a size based portfolio is less likely to find positive excess returns.

The benchmark used in Trevino and Higgs (1992) is similar to the one in this study. Therefore, it is unlikely that the difference is because of the benchmark selection.

It may be argued that another reason for the difference is the sample selection. Both Stigler and Friedland (1971) and Trevino and Higgs (1992) use top defense contractors in their analysis. Top defense contractors are generally big firms in size. Employing the same procedure for firms, which have big market values, may lead to similar findings. For this purpose, the firms that consistently fall into the largest three deciles (deciles 8, 9, and 10) during these periods were identified. Two new portfolios of big firms were constructed. 1945-1958 portfolio consists of four firms, whereas 1970-1989 portfolio is composed of 10 firms.

**TABLE 18**

**Statistical Test Results for the Comparison of Big Firms' Portfolio and Benchmark Portfolio (1948-1961, 1970-1989)**

	<u>t-test</u>		<u>Ranksum Test</u>	
	t-statistic	p value	z-statistic	p value
1948-1961	0.6834	0.4949	-0.822	0.4110
1970-1989	1.0317	0.3028	0.600	0.5486

**TABLE 19**

**Statistical Test Results for the Comparison of Big firms' Portfolio and Market index (1948-1961, 1970-1989)**

	<u>t-test</u>		<u>Ranksum Test</u>	
	t-statistic	p value	z-statistic	p value
1948-1961	0.7718	0.4409	-0.887	0.752
1970-1989	1.0576	0.2909	0.541	0.5884

Table 18 and Table 19 report the test statistics for the comparison of big firms' portfolio to the benchmark portfolio and the market index. Both tables indicate that no significant excess return exists over these periods for big firms portfolio, either. The preceding analysis suggests the major reason that the findings in this study do not support those in other two studies may be the difference in methodologies.

These findings do not mean that there are no significant excess returns over the years. An analysis of sub periods 1952-1956 and 1976-1980 gives significant excess returns for the big firms' portfolio. Table 20 gives the risk and return measures over these periods. Table 21 and Table 22 present the test statistics for the comparison of big firms' portfolio to the benchmark portfolio and market index, respectively.

**TABLE 20**

**Risk and Return Measures for the Big Firms' portfolio and the Benchmark Portfolio (1952-1956, 1976-1980)**

Period	<u>Sample portfolio</u>			<u>Benchmark portfolio</u>		
	Beta	Stdev	Mean	Beta	Stdev	Mean
1952-1956	0.9686	0.0467	0.0287	1.0100	0.0335	0.0149
1976-1980	0.8613	0.0651	0.0381	0.9860	0.0422	0.0131

**TABLE 21**

**Statistical Test Results for the Comparison of Big Firms' Portfolio and the Benchmark Portfolio (1952-1956, 1976-1980)**

	<u>t-test</u>		<u>Ranksum Test</u>	
	t-statistic	p value	z-statistic	p value
1952-1956	1.8601	0.0656	1.973	0.0484
1976-1980	2.4533	0.0159	2.137	0.0326

**TABLE 22**

**Statistical Test Results for the Comparison of Big Firms' Portfolio and Market Index (1952-1956, 1976-1980)**

	<u>t-test</u>		<u>Ranksum Test</u>	
	t-statistic	p value	z-statistic	p value
1952-1956	1.9068	0.0592	2.047	0.0407
1976-1980	2.5152	0.0135	2.192	0.0284

t-test results are significant at 5 % level for 1976-1980 period. Wilcoxon Ranksum test statistics are significant at 5 % level in both periods.

To sum up, stock market performance of defense stocks exceeded its comparable benchmark in four periods out of five from 1945 to 1999. Defense firms were found to be both more profitable and riskier than other firms that have the same market value. However, the difference is not statistically significant in any period. Further analysis to explain the difference in findings in this study and two others in the literature leads to the following conclusion. Neither changing the analysis period nor applying the analysis to firms in the largest deciles resulted in significant test statistics. These findings do not mean that defense firms did not earn excess returns in any sub-periods. Statistically significant positive excess returns were observed for the largest defense stocks during the periods 1952-1956 and 1976-1980.

**6.2 Results of the Analysis Examining the Impact of Regulatory Changes**

As was shown in Table 6 empirical tests of the impact of each of the nine regulatory changes are organized around two null hypotheses. Tests of H1 measure

the average impact across sample firms, whereas tests of H2 measure allow for heterogeneity in reactions.

Table 23 summarizes the results of the tests of hypothesis 1. Summary statistics on individual parameter estimates are given in Table 24 to show the average effect and the extent of heterogeneity. Out of nine regulatory changes examined, only two resulted in statistically significant average abnormal returns. These regulations are Hoover Commission of 1949 and the Commission on Government Procurement of 1972, which are significant at 5 % level. The percentage of the negative individual parameter estimates is 92 % in the former and 77 % in the latter. These results show that average reaction of sample firms have been negative and significant to these regulatory changes. The significance of z-statistics for these regulations implies that the findings are not driven by a small number of firms.

In general Hoover commission aimed to improve the effectiveness and efficiency of the acquisition process and emphasized centralization and simplification of the government procurement by giving more authority to the secretary of defense. Centralization process may reduce the problems related to coordination and increase the bargaining power of the government. Hoover commission was the first important effort to reform the acquisition process after World War 2. As it was explained before, the period in which the commission was established can be called a suitable period for defense firms to earn excess profits. Such a reform had a considerable potential to reduce these excess profits. In these respects, the results are consistent with the expectations that the commission would have negative impact on defense stock returns. Unlike the case for the establishment month, no significant abnormal returns are found in the month when the report was

released. It seems that the market anticipated the motives and the requirements of the commission when the commission was established.

Commission on Government Procurement of 1972 aimed to provide a common basis for procurement policies and for the first time in the acquisition history recommended a shift toward commercial product acquisition. Some items procured by DOD had close commercial substitutes. Detailed specifications put by DOD was limiting the number of potential suppliers to DOD due to the economies of scale problem. The commission's decision to encourage the purchase of commercial substitutes was a landmark approach in terms of increasing the level of competition in the defense industry. This is likely to reduce defense firms' profits in an otherwise favorable period characterized by increased need for high tech weapon systems. The abnormal returns are significant for the month the report was released. It seems that the recommendations of the commission was more effective and binding than they had been expected.

The prominent character of the results of the tests of H2 is that sample firms reacted significantly to most of the regulatory changes. All first announcement months related to regulations resulted in significant abnormal returns. In general, in 17 announcement months out of 21 examined, sample firms significantly reacted to the regulations. Not surprisingly, two regulations discussed above gave significant abnormal returns. For the others, rejection of H2 but not H1 indicates the existence of heterogeneity in reaction by sample firms. Excluding Hoover commission and Commission on Government Procurement, the maximum percentages of negative reactions for the regulations are 76%, 74% and 71 %, for TINA, Advisory panel and FASA, respectively. z-statistics are significant in those three regulations. It is likely

that positive reaction of a small number of firms washes out the negative reaction of other firms in the sample. That is why H2 but not H1 is rejected. For the rest of the regulations, the percentage of negative reaction does not exceed 62 % and varies between 32 % and 62 %. Not surprisingly, z-statistics are not significant.

In summary, defense firms reacted significantly to the regulatory changes. The reaction was homogeneous in only two of the regulatory changes: Hoover Commission and the Commission on Government Procurement. For others, reaction varied across firms. Some firms gained in market value while others lost.



**TABLE 23****Tests with monthly returns of the hypothesis that average excess returns equal zero**

Regulation	Year	N	A	t	A1		A2		A3	
					Wald	P	Wald	P	Wald	P
Hoover	1949	13	2	22	6.55*	0.0105	0.58	0.4500		
TINA	1962	17	2	37	2.15	0.1425	0.71	0.4000		
Commission	1972	24	2	4	0.2	0.6577	4.39*	0.0400		
Competition	1984	29	2	10	0.17	0.6802	0.10	0.7500		
Blue ribbon	1986	29	3	11	0.00	0.9806	0.11	0.7446	0.09	0.7680
Advisory	1993	31	2	4	0.05	0.8173	2.11	0.1460		
NPR	1994	31	3	10	0.48	0.4881	0.18	0.6723		
FASA	1993	31	2	25	0.80	0.3701	0.00	0.9944	0.59	0.4435
Clinger	1996	30	3	20	1.59	0.2070	1.3	0.25	2.74	0.098

**Note:** N is the number of firms in the sample, A is the number of dummy variables (announcement months), t is the number of months from the first announcement month to the last announcement month, inclusive, A1, A2, and A3 represent the first, second and third announcement months, respectively.

\* significant at the 5 % level.

**TABLE 24**

**Results for the Individual Parameter Estimates ( $\gamma_{ia}$ )**

Regulation		Average	% Negative	z-statistic
Hoover,	A1	-0.0932	92%	3.0509
	A2	-0.0281	69%	1.3868
TINA,	A1	-0.0465	76%	2.1828
	A2	-0.0261	82%	2.6679
Commission,	A1	0.0154	54%	0.4082
	A2	-0.0804	75%	2.4495
Competition,	A1	0.0103	41%	-0.9285
	A2	-0.0077	62%	1.2999
Blue Ribbon,	A1	-0.0006	55%	0.5571
	A2	0.0082	52%	0.1857
	A3	0.0074	45%	-0.5571
Advisory,	A1	0.0061	52%	0.1796
	A2	-0.0405	74%	2.6941
NPR,	A1	0.0175	32%	-1.9757
	A2	-0.0107	68%	1.9757
FASA,	A1	0.0226	52%	0.1796
	A2	0.0002	48%	-0.1796
	A3	-0.0195	71%	2.3349
Clinger-Cohen,	A1	0.0305	50%	0.0000
	A2	0.0338	33%	-1.8257
	A3	-0.0444	77%	2.9212

Note: A1, A2, and A3 represent the first, second and third announcement months, respectively. The z-statistic is given by  $\frac{G - Mp}{\sqrt{Mp(1-p)}}$ , where G is the number of negative parameter estimates, M is the total number of parameter estimates, and p is the probability of a negative parameter estimate (0.50).

**TABLE 25****Tests with monthly returns of the hypothesis that all excess returns equal zero**

Regulation	Year	N	A	t	A1		A2		A3	
					Wald	P	Wald	P	Wald	P
Hoover	1949	13	2	22	25.45*	0.0201	8.96	0.7800		
TINA	1962	17	2	37	49.10*	0.0001	8.51	0.9500		
Commission	1972	24	2	4	57.32*	0.0002	65.34*	0.0000		
Competition	1984	29	2	10	103.63*	0.0000	159.28*	0.0000		
Blue ribbon	1986	29	3	11	50.21*	0.0086	75.6*	0.0000	70.71*	0.0000
Advisory	1993	31	2	4	100.43*	0.0000	97.16*	0.0000		
NPR	1993	31	3	10	57.46*	0.0027	33.57	0.3436		
FASA	1994	31	2	25	463.63*	0.0000	130.27*	0.0165	41.08*	0.0130
Clinger	1996	30	3	20	82.82*	0.0000	130.46*	0.0000	40.47	0.0960

**Note:** N is the number of firms in the sample, A is the number of dummy variables (announcement months), t is the number of months from the first announcement month to the last announcement month, inclusive, A1, A2, and A3 represent the first, second and third announcement months, respectively.

\* significant at the 5 % level

## CHAPTER 7

### CONCLUSION

The purpose of this study is to analyze the relative performance of US defense firms by using stock price data over different time periods and examine the impact of regulatory changes within the event study framework.

In the defense acquisition history, regulatory changes were motivated by several factors. One factor is the perceived contractor waste, fraud and abuse that led to regulations regarding the contracting mechanism. Another factor is the efforts to centralize the acquisition decision-making process. This factor is motivated by the complexity and confusion surrounding the procurement system. Finally, some regulations were motivated by the desire to increase the competition in the acquisition environment. Regulations and reforms commonly aimed to reduce inefficiencies in defense procurement on which much public attention is focused. Large amount of money spent on defense procurement enhanced the concern with the relative profitability of defense firms.

The findings from the relative performance analysis can be summarized as follows:

1. Defense firms are both more profitable and riskier than other firms that have similar market values.
2. However, it appears that, within the five major sub periods (1945-1958, 1958-1968, 1968-1980, 1980-1989, 1989-1999), the returns of the portfolio of defense stocks are not statistically different from the returns of the benchmark portfolio.

3. There is evidence that for specific and relatively short time periods like 1952-1956 and 1976-1980, big defense firms were able reap excess profits.

Regarding the second issue examined in this study, namely the impact of regulatory changes on defense stock returns, the major findings are as follows:

1. Defense firms reacted significantly to the regulatory changes. The results imply that regulations related to acquisition process have considerable impacts on the gains of defense firms, either positive or negative. The result points to the importance of regulation in the defense industry.
2. Only for two regulatory changes, tests that measure the average impact across firms resulted in significant average excess returns. Sample firms reacted negatively to these regulations. The results support the expectations that regulations emphasizing efficiency in acquisition process have a potential to reduce related firms' future cash flows. Moreover, results imply that besides the nature of regulatory change, the political atmosphere and the general demand for weapons are also important.
3. However, considerably few significant results of the tests that measure the average impact indicate that the reactions of firms varied across the sample, thus there is no homogeneity in the reactions of sample firms in most of the regulations. In the same industry, some firms gained while others lost.

## BIBLIOGRAPHY

- Agapos, A.M. and Gallaway, L.E., 1970, "Defense Profits and the Renegotiation Board in the Aerospace Industry", *The Journal of Political Economy*, 78 (5): 1093-1105
- Agrawal, A. ;Jaffee F. and Mandelker G., 1992, " The Post-merger Performance of Acquiring firms in Acquisitions: A Reexamination of an Anomaly", *Journal of finance*, 47: 1605-1621
- Barber, B.M. and 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
- Bohi, D. R., 1973 "Profit performance in the defense industry" *Journal of Political Economy*, 81 (3), 721-728.
- Burns, A., 1972, "Regulated Industries and the Defense Space Industries, *The Bell Journal of Economics and Management Science*. 3: 3-25
- Demski, J. and Magee, R., 1992, "A perspective on Accounting for Defense contracts", *The Accounting Review*, 67: 732-740
- Dimson, E. and Marsh, P., 1986, "Event Study Methodologies and the Size Effect", *Journal of financial Economics*, 17: 113-142
- Fama, Eugene F., 1970, " Efficient Capital Markets", *The Journal of Finance*, 46 (5): 1575-1617
- \_\_\_\_\_ 1991, "Efficient Capital Markets: II", *The journal of Finance*, 46 (5): 1575-1617
- Fisher, F. M. and McGowan, J. J. 1983, "On the misuse of accounting rates of return to infer monopoly profits", *American Economic Review*, 73 (1): 82-97
- Greene, William H., 1990, *Econometric Analysis*, New York, Macmillan Pub. Co.

Greer, W. R., Jr. and Liao, S. S., 1986, "An analysis of risk and return in the defense market: Its impact on weapon system competition", *Management Science*, 32 (10): 1259-1273.

Henderson G., Jr., 1990, "Problems and Solutions in conducting Event Studies", *Journal of Risk & Insurance*, 57 (2): 282-307

Karpoff, J.; Lee D.; and Ventrzyk V., 1999, "Defense Procurement, Fraud, Penalties, and the Contractor Influence", *The Journal of Political Economy*, 107: 809-842

Kovacic, W.E. and Smallwood, D.E., 1994, "Competition Policy, Rivalries, and Defense Industry consolidation", *The Journal of Economic Perspectives*, 8 (4): 91-110

Lichtenberg, F., 1992, "A Perspective on Accounting for Defense Contracts", *The Accounting Review*, 67: 741-752

MacKinlay, Craig A., 1997, "Event Studies in Economics and Finance", *Journal of Economic Literature*, 35: 13-39

Mcgowan, A. and Ventrzyk, V., 2002, "The Relation Between Cost Shifting and Segment Profitability in the Defense Contracting industry", *The Accounting Review*, 77: 949-969

Pownall, G., 1986, "An empirical Analysis of the Regulation of the Defense contracting Industry: The Cost Accounting Standards Board", *Journal of Accounting Research*, 24 (2): 291-315

Rogerson, W., 1989, "Profit Regulation of Defense Contractors and Prizes for Innovation", *The Journal of Political Economy*, 97:1284-1305

\_\_\_\_\_ 1994, "Economic Incentives and the Defense Procurement Process", *The Journal of Economic Perspectives*, 8: 65-90

\_\_\_\_\_ 1992, "Overhead Allocation and Incentives for Cost minimization in Defense Procurement", *The Accounting Review*, 67: 671-690

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

Stigler, G. and Friedland, C., 1971, "Profits of Defense Contractors", *The American Economic Review*, 61: 692-694

Suarez, J., 1976, "Profits and Performance of Aerospace Defense Contractors", *The journal of Economic Issues*, 10 (2): 386-402

Thomas, J and Tung, S.,1992, “Cost Manipulation Incentives under Cost Reimbursement: Pension Costs for Defense Contracts, *The Accounting Review*, 67: 732-740

Trevino R.,and Higgs, R., 1992, “Profits of Defense Contractors”, *Defence Economics*, Vol 3

Weidenbaum, M., 1968, “Arms and the American Economy: A Domestic Convergence Hypothesis”, *The American Economic Review*, 58: 428-437