

REVISITING THE EXCESS PROFITABILITY OF U.S. DEFENSE  
CONTRACTORS - FACT OR FICTION?

By

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This study revisits the long-standing debate surrounding the profitability of the United States' (U.S.) defense industry. Prior research on this topic has revealed conflicting and inconsistent results. Several studies have asserted that defense industry profitability is excessive relative to comparable commercial or industrial firms. Research on this topic has been limited since the 1980's.

The study's primary objective is to examine whether U.S. defense industry profitability is similar to the profitability of comparable non-defense commercial or industrial firms over the period 1986 to 2019. Profitability is measured using market-based return, which is comprised of the annual change in a firm's stock price plus the dividends received. This is the first study of defense industry profitability that utilizes a Fama-French model to evaluate abnormal profitability. The study uses a judgmentally selected defense firm sample and a benchmark firm sample is established for comparison purposes.

The study's main test results show that the market-based profitability returns of the defense firms and comparable non-defense commercial or industrial firms are both abnormally high and similar over the total study period. The defense firm results reveal a positive annual profitability alpha of 4.24% and the findings are statistically significant. The test results of the benchmark firm sample of comparable commercial or industrial firms had a similar positive alpha return of 4.08% and the findings were also statistically significant. A t-test reveals that the difference between the returns is not statistically different. Additional supplementary testing reveals that defense firm profitability improved starting in the mid-1990's, and that larger-sized defense firms and firms that derive higher percentages of their total sales from defense sales are more profitable.

This research finds that the market-based profitability of the U.S. defense industry has been strong over the past three decades. However, the study results do not find this profitability to be excessive when compared to a benchmark group of similar commercial or industrial firms. The defense industry market-based profitability results also indicate that the investment community has viewed the industry as an attractive market sector. This is a positive sign for sustaining a critical strategic and economic asset of the U.S.



## CHAPTER 1. INTRODUCTION

For several decades, it has been a common assertion that U. S. defense contractors obtain excessive profits on their business with the U.S. government. Those assertions have typically been made by the media, politicians, Congressional committees, and periodically by academics. At the same time, defense contractors, industry experts, industry trade associations, and the U.S. Department of Defense (DoD) have asserted that defense contractors do not earn excessive or adequate profits. The motivations of these assertions vary widely and the bases of the assertions are often questionable. The assertions have often evolved into significant research studies.

The primary purpose of this study is to revisit the topic of whether U.S. defense contractors receive excess profits on their business with the U.S Government. Prior studies on this subject have revealed conflicting results. Some studies find that defense contractor profitability is exceedingly high, and other studies find that comparable commercial firms enjoy higher earnings. The various studies suffer from a lack of consistency. They have differed in the profitability measurements used, breadth of the samples selected, commercial benchmarking firms or indexes used, time periods and lengths used, statistical methodologies used, and in several cases the overall quality of the study. The studies have typically attempted to measure excess profitability by comparing the profitability of a sample of U.S. defense contractors with the profitability of a sample of “reasonably equivalent” commercial or industrial firms.

Profitability studies of the U.S. Defense Industry have been performed for a variety of reasons. Several studies have been performed to ensure that U.S. taxpayer interests are being protected through the effective oversight of government spending and government contractors. Studies have also been performed to measure whether the DoD is allowing its contractors to earn equitable returns on their investments in the defense market. It is important that this topic be

accurately and fairly evaluated. The U.S. Defense Budget is the largest discretionary component of the overall U.S. Budget. The effective and efficient spending of those funds needs to be assured. Additionally, properly incentivizing and maintaining a strong defense industry is critical to the security of our nation.

A number of profitability studies of U.S. defense contractors have been made over the past fifty years with the majority of studies occurring in the 1970's through the early 1990's. The most comprehensive studies have often been directed and managed by the DoD or by various committees of the U.S. Congress. In addition to analyzing profitability, those studies also were performed to identify potential improvements in the defense acquisition system. Studies have also been performed by independent consultants, industry associations, public accounting firms, and by academics. Academic research on this topic has been particularly sparse in the past two decades. Wang and San Miguel (2012) states, "First, for whatever reason, there is a long history of avoidance of military-related research among academics. As a result, studies in this field are quite limited. Second, the already limited studies on this topic stopped in 1990, leaving a blank of almost two decades."

A prime example of conflicting study results occurred in the mid-1980's between a study commissioned by the DoD, the Defense Financial and Investment Review (DFAIR 1986), and a review of that study commissioned by committees of the U.S. Congress and performed by the U.S. General Accounting Office (GAO). The DoD study concluded that the profitability of defense contractors and comparable commercial businesses were approximately equivalent. The GAO review strongly disputed those results and concluded that the profitability of defense contractors significantly exceeded commercial firm profitability during the same time periods.

The utilization of different profitability measurement approaches was the primary reason for the widely divergent results.

The prior studies also lacked consistency regarding the definition of what “excess profitability” is and in selecting a representative sample of companies that represent the U.S. defense industry. This lack of consistency and definition leads to varying results and increases the potential for measurement bias. In this study, defense contractors are defined as large or medium-sized firms that are publicly traded, and who supply products and related services that are primarily designed and manufactured for defense purposes. These products include fighter and transport aircraft, helicopters, aircraft carriers, battleships, aircraft and helicopter engines, missiles, tanks, surveillance, and space rockets and vehicles. The defense firms that support the manufacture of these products and services are typically the firms that have received the brunt of negative publicity claiming excess profitability, and also the claims of fraud, waste, and abuse.

The definition of defense contractors for this study excludes firms who provide commercial or commodity type items or services that are primarily sold in the commercial marketplace but are also used by the DoD. Examples of these items include fuel, food, medical services, insurance, and housing. The pricing of those goods and services are primarily determined on a competitive basis utilizing market-based pricing. Several past profitability studies have broadly included this group of contractors in their defense firm samples and this can distort the specificity and relevance of the results of the research.

The selection of the appropriate profitability measurement to use has been debated extensively in the literature. The majority of prior studies utilized accounting-based rate of return measures such as return on assets (ROA), return on equity (ROE), or return on sales (ROS) as the primary profitability measures. Accounting based rate of return measures introduce several

problematic measurement issues when evaluating the profitability of a group of companies over an extended time period. This study utilizes market-based rate of return (monthly change in stock price and dividends paid) as the primary measure of firm and industry profitability. Market-based returns measure profitability and return on investment from the perspective of the stockholder.

The U.S. has been the leading military power in the world since the end of World War II. This position has been aided by several factors. A key factor of this advantage has been the innovative talents and skills of the U.S. Defense Industrial Base (DIB). The DIB is a combination of people, technology, firms, and facilities that design, manufacture, and maintain the products and services needed to meet U.S. national security objectives. The DIB has enabled the U.S. military to enjoy a strong technological lead over our enemies. Technology leadership in this area is a critical national asset and it has been a vital part of keeping the peace, especially during the Cold War. However, the world is rapidly changing and the speed of technological change is constantly increasing. It is clear that this critically important advantage over our rivals and allies is decreasing. It is also clear that the U.S. is highly dependent on a strong DIB to sustain the peace and protect our economy.

Scholarly and government research on this topic has been particularly scarce in the last twenty years and prior literature has had conflicting results. This study builds on prior defense industry profitability research, fills the gap created by limited recent research, and extends the literature in several directions. First, it utilizes a more focused definition of defense industry firms. It excludes contractors who primarily provide commercial or commodity type items to the government. It utilizes a defense contractor selection baseline that includes fifty-three leading defense contractors that were previously included in two major DoD directed profitability studies, Profit '76 Study (1977) and DFAIR (1986). In addition to the baseline selection, twenty-

four large and medium-sized defense firms that became significant during the study period are included in the defense firm sample. The study follows the profitability of those firms over an extended time period (1986- 2019). It also compares the profitability of those defense firms with the profitability of a comparable sample of commercial or industrial firms. Secondly, this is the first study of defense industry profitability that uses a Fama-French model for determining which portion of the return is ‘excessive’. Finally, the study adds to the literature by identifying and assessing factors that affected the profitability of the defense industry over the study period. During the time period of the study, a multitude of factors and events occurred that influenced the profitability of the defense industry. This study identifies and measures several key factors that affected this profitability. Prior studies have not broadly analyzed those factors, especially over a time period of this length.

The remainder of this paper is organized as follows. The U.S. Defense Industry operates in a highly unique and regulated environment. In order to provide context and understanding, Chapter Two includes an overview of the DoD and defense industry structure, key procurement laws and regulations, and a concise history of the defense industry. A literature review is included in Chapter Three and the development of the study’s Hypothesis is included in Chapter Four. Chapter Five provides the empirical methodologies used in the study, and Chapter Six includes the empirical results, supplemental analyses, and a discussion of the results. Chapter Seven notes the limitations of the study and opportunities for additional research. The conclusion of the study is presented in Chapter Eight.

## **CHAPTER 2. INDUSTRY BACKGROUND & HISTORY**

The U.S. defense industry operates in a complex and unique environment. This chapter provides an overview of the size, structure, spending, and recent history of the DoD and the U.S.

defense industry. It also provides a summary of the key DoD procurement regulations and practices that affect the pricing and profitability of defense contracts. The chapter also provides context for identifying the key events and factors that have shaped the profitability of firms in the defense industry since the end of World War II through the present time.

## **2.1 Defense Market Overview**

The U.S defense market does not operate like a free market. The DoD is a monopsony buyer and through its power directs a highly regulated industry. As essentially the only buyer, it dominates and controls the market for the goods and services that it procures from the defense industry. The DoD establishes the rules and regulations for setting the contractual terms, pricing, and payments for its contracts. It also establishes the characteristics and quality acceptance requirements of the goods and services that it purchases. Even when U.S. defense firms wish to sell their products to allies or other foreign government's they must receive approval from the DoD, and usually the U.S. State Department, in order to market and support their products.

After years of industry consolidation and downsizing, the DoD now purchases many of its major systems from a limited number of large prime contractors. Industry consolidation became particularly prevalent in the 1990's as the industry reacted to large defense budget cuts after the end of the Cold War. As a result, today there are significant barriers to entry and exit from the industry. Only a small number of significant new U.S. firms have entered the defense industry in the past several decades. The limited new competition in the market has often come from foreign suppliers. Due to these circumstances, the defense industry can now be characterized as a monopsony buyer primarily purchasing from an oligopolistic supply base.

Watts (2008) notes that the U.S. defense industry operates in an industry that is heavily reliant on continuous technology improvements. The industry is highly cyclical with dramatic

surges in spending as a result of conflicts in the world or changes in the strategic directions of the U.S. government for dealing with new threats. The industry is also significantly affected during economic downturns that take place in the national and international environment. Defense spending has also been impacted by the shifting of U.S. government spending to other priorities such as reducing budget deficits, increased spending on popular social programs such as Medicare, social security and unemployment, and the payment of higher interest costs necessary to service the national debt. Other factors significantly affecting the industry include: changes in the technology of military products; increased purchases of U.S. military products by foreign governments; the globalization of the defense industry supply chain; and changes in procurement regulations.

The national security policy that the U.S. has utilized is based on a strategy of deterrence. This policy was initially adopted in the early 1950's to primarily deal with the Soviet Union. The policy of deterrence requires that we maintain a substantial technological advantage in our military systems over our potential enemies. The strategy assumes that our potential adversaries will be deterred by their fear of the overwhelming technological strengths of our weapon systems (Watts 2008). Our policy also is to use our technological advantages to develop systems that minimize the casualties of our troops.

## **2.2 Department of Defense**

The U.S. DoD is one of the largest and most complex organizations in the world. To describe the DoD as complex and bureaucratic is likely a big understatement. The major segments of the DoD include the Office of the Secretary of Defense, the departments of the Army, Navy, and Air Force, and the Joint Chiefs of Staff. Key agencies and other departments that are significantly involved in procurement and contractor oversight activities include the

Office of the Inspector General (IG), Defense Contract Audit Agency (DCAA), Defense Contract Management Agency (DCMA), and the Defense Finance and Accounting Service (DFAS).

In 2019, the DoD had approximately 2.2 million active duty and ready reserve soldiers. Additionally, the DoD employed approximately 775,000 civilian personnel (Under Secretary of Defense-Comptroller 2020). These employment levels have remained relatively constant since the late 1990's. During the 1990's the total employment levels of the DoD were reduced by approximately one million primarily as a result of the end of the Cold War (Fox 2010). The DoD operates thousands of installations across the world in order to achieve its national security objectives and its security agreements with our allies. To support these requirements the DoD purchases a wide variety of goods and services. It executes the acquisition of these items with detailed rules and regulations that attempt to provide fairness and consistency.

To achieve its objectives, the DoD spends billions of dollars each year acquiring and supporting the worlds most advanced weaponry. The DoD's annual budget in 2019 was approximately \$686 billion (Chantrill 2019). This amount excludes the nearly \$200 billion spent annually on healthcare and retirement benefits for U.S. veterans. The overall U.S. spending on defense represented approximately 20% of the total U.S. government budget in 2019 (\$4.45 trillion). This percentage has dropped steadily over the past several decades. As a percentage of GDP, defense spending peaked at 41% of GDP during World War II, ranged between 6% and 10% of the GDP during the Cold War, and has steadily declined to approximately 4% today. This reduction is primarily the result of moderate increases in defense spending combined with the large growth in GDP and the large increases in the government's spending on social programs such as retirement, disability, health care, welfare, education, and debt service to pay



for the increases in the national debt (Chantrill 2019). Despite these reductions the DoD is the largest customer of defense equipment in the world. It is estimated that in 2017 the U.S. spending on national defense exceeded the combined spending of the next seven highest countries. Those seven countries were China, Russia, Saudi Arabia, India, France, United Kingdom, and Japan (Peter G. Peterson Foundation 2018).

### **2.3 Defense Industrial Base**

The DIB is an extensive and complex combination of firms, technology, facilities, and talented people which together design and develop, manufacture, and support the wide array of weapon systems the DoD utilizes. The DIB includes both public and private sector firms with the vast majority of work performed by firms in the private sector. There are approximately fifteen very large contractors who currently dominate the industry. Several of the most recognizable contractors are Lockheed Martin, Northrup Grumman, General Dynamics, Raytheon, and Boeing. However, there are hundreds of mid-sized firms and thousands of small contractors who also provide products and services to the DoD. Including both direct and indirect employees, it is estimated that approximately 2.8 million private sector employees support the DIB (Deloitte, 2016). The number of employees supporting the DIB leveled off during the prior decade after dropping significantly for many years. However, as a result of budget cuts in the beginning of this decade, the Deloitte study estimated that employment levels in the private sector dropped by approximately 18% between 2010 and 2014.

The DIB firms are divided into three major tiers: prime contractors, large subcontractors, and suppliers of parts and raw materials. The DOD primarily contracts through the prime contractors who are responsible for integrating and delivering the end products. The prime contractors typically contract with and manage the supporting group of subcontractors, parts

suppliers, and raw material suppliers. The DoD has identified nine major industrial sectors which primarily comprise the DIB- Aircraft, Electronics, Ground Vehicles, Materials, Munitions & Missiles, Radar & Electronic Warfare, Space, Shipbuilding, and Command & Control.

DOD's spending is categorized into four main elements. Those categories are 1) military personnel, 2) operations & maintenance, 3) procurement, and 4) research, development, test & evaluation (RDT&E). The DIB business volumes are primarily dependent on procurement and RDT&E spending levels.

The procurement category includes spending on major combat systems and other supplies and services. Procurement spending is subject to large swings in volume usually as a result of conflicts or changes in strategies such as the Reagan defense build-up during the 1980's.

RDT&E includes spending on new technologies and the development and testing of new military weapon systems. The spending on RDT&E has been relatively constant since the 1960's, in constant dollars. The DIB's revenues are highly dependent on the manufacturing of major combat systems. Large swings in the purchase of those items greatly influences industry profitability and the attractiveness of the industry to investors.

## **2.4 Historical Overview & Industry Formation**

The defense industry that exists today had its roots established supporting World War I and World War II. However, its current structure became more solidified during the 1950's and 1960's. To prepare itself for those conflicts the U.S. primarily utilized a combination of an existing arsenal system and the rapid mobilization of private sector firms. The U.S. arsenal was a system of government-owned and operated facilities that supplied the majority of Army ammunition needs and a portion of its aircraft and ships. The private sector firms that were utilized primarily produced commercial items and in many instances were reluctant to convert

their production to military needs. At the time, the private sector defense industry was minimal with only a small number of firms producing primarily military products.

In both World War I & II the U.S. initially adopted a neutrality position and delayed participating in those conflicts. Subsequently, the U.S. began supplying our allies with critically needed arms and goods and eventually was drawn into the conflicts. In both instances the ability to quickly ramp up to meet the requirements of our allies and our military services was impeded by poor prewar planning and preparedness. It was also impeded by the existing strategy of depending on a limited arsenal system and the rapid mobilization and conversion of private sector firms.

The ability to supply the needed armaments and supplies was often delayed. In both wars it required nearly two years before the defense industry supply chain became fully operational. A large portion of the required armaments were produced by private sector firms that needed to convert their existing production lines from commercial goods to military goods. Despite those challenges the U.S. was able to effectively meet the enormous military requirements of its war fighters and its allies. This primarily ad hoc mobilization approach had some amazing results and earned the U.S. the title of the “Arsenal of Democracy.” Many believe that this mobilization was an instrumental part of how the Allies were successful in both wars. Fortunately, the delay of the U.S. entering World War I & II provided the U.S. with time to ramp up its weapon producing capabilities. Additionally, the manufacturing capabilities of the U.S. were protected by its significant geographic separation from the main areas of conflict.

After both World War I & II, the U.S. immediately demobilized and defense spending plummeted. This resulted in private sector firms stopping their production of military equipment and returning to the commercial markets that they previously served. These reconversions

resulted in numerous plant closings and significant employment reductions. A standing defense industry was not maintained in the aftermath. This seemingly ad hoc approach was not conducive to the establishment of a stable or efficient defense industry. When the Korean conflict broke out in 1950 the U.S. was again unprepared to quickly supply its troops with the needed weapons. Additionally, the immediacy of that conflict did not allow the U.S. the extended time period to ramp up its manufacturing capabilities.

Watts (2008) divides the development of the DIB into three distinct time periods: “1) formation and early growth after World War II (1945-1960); 2) stabilization as a distinct industry during the Cold War (1960-1990); and 3) post-Cold War fundamental restructuring (1990-2007).” The formation period arose as a combined result of the Korean conflict and the strategy to contain the Soviet Union. Watts notes that the strategy of containment required the “establishment of America’s first large-scale peace-time military force. Investments in research and development (R&D) and procurement to outfit that force ... These developments led to a large set of private-sector companies supporting the US military.” During this time period the DoD and industry achieved significant technological advances in a wide variety of weapon systems. This technological advantage in weapon systems is still maintained in many areas today. The DoD purchased these new weapon systems in such large quantities that by 1960 the defense industry emerged as one of the leading sectors of the U.S. economy (Watts 2008).

## **2.5 Defense Industry Maturity Stage**

Between 1960 and 1990, the DIB matured into a large and relatively strong industry. However, growth rates slowed dramatically from the prior decade and the industry experienced two dramatic surges and subsequent contractions due to the Vietnam War (1968-1973) and the Reagan defense build-up of the early 1980’s. During that time period, the DIB enhanced its

technological and manufacturing advantages and developed and produced the most advanced weapon systems in the world. The U.S. military forces remained focused on the Soviet Union as the primary threat. Both countries spent hundreds of billions of dollars on weapons as they competed in a dangerous arms race.

This period was also notable for the expansion of the power of the DoD civilian leadership over the procurement of weapon systems and RDT&E spending. Civilian leadership in the DoD became a powerful force in the justification process for new weapon systems. New program budgeting and planning systems were developed to evaluate program performance. Very comprehensive review and monitoring systems were also imposed on industry and these requirements became significant cost burdens for the DoD and industry. This increase in power was accompanied by the shift in power from the services (Army, Navy, Air Force) to the Secretary of Defense within the DoD. The position of the Secretary of Defense was established in 1947 and was initially more of an advisory position to the services.

Due to the volatile sales volumes experienced by the defense industry the attractiveness of the industry to investors declined. At the same time, the attractiveness of the various commercial industries in the private sector steadily improved with significant growth opportunities due to increased international opportunities and technological advances. Additionally, significant increases in U.S. government spending on social programs began to compete with defense spending in the annual budget. The combination of these factors led to a reduction of the significance of the defense sector in the U.S. economy.

## **2.6 Defense Industry Consolidation & Restructuring**

The end of the Cold War in the 1980's marked the beginning of an extended downturn in defense spending by the U.S. government. This downturn had dramatic effects on the

procurement of weapon systems and had negative effects on a majority of major defense contractors. This resulted in significant industry consolidation and the exiting of several major contractors from the industry. Defense industry consolidation was particularly dramatic after an assessment of the industry's over-capacity by the Clinton administration and his Secretary of Defense, Les Aspin. In the fall of 1993, at a famous meeting called "The Last Supper," Aspin and his Deputy Secretary, William Perry, met with the chief executives of the top fifteen U.S. defense contractors. They stated that the industry faced a continued downturn in defense spending over the foreseeable future and that the firms needed to reduce their overhead costs dramatically. They stated that they expected that half of the companies at the meeting would not exist in five years (The Economist 1997).

This blunt message helped spur a flurry of downsizing and consolidation activity in the industry. It was acknowledged by all participants that the defense industry suffered from significant over-capacity. Mergers and acquisition activity rapidly created mega-firms and many firms divested their defense businesses to these mega firms and exited the industry. Exhibit A. provides a dramatic overview of the extensive consolidation activity during 1993-2007. These actions created the five major defense firms that continue to lead the industry today, Boeing, Raytheon, Northrup Grumman, Lockheed Martin, and General Dynamics.

Initially the DoD and the Justice Department (DoJ) adopted a hands-off approach regarding anti-trust regulation and did not interfere with the industry's prolific merger & acquisition activity. However, starting in 1997 the DoJ and the Federal Trade Commission (FTC) began to challenge the larger proposed mergers based on concerns of lessening competition in the industry. This reached a peak in 1998 when the DoJ challenged the proposed merger of Northrup Grumman and Lockheed Martin. The proposed merger was called off prior to reaching

a scheduled trial. Subsequently, merger activities of major contractors tapered off significantly. However, by then the merger and acquisition activity had changed the landscape of the DIB.

An additional development that manifested itself during the 1970's through the 1990's was the globalization of the industry's supply chain. During the 1970's many U.S. defense firms began selling their weapon systems to certain foreign allies. These sales were approved and supported by the U.S. government and partially offset the effect of reduced DoD procurements. As part of these sales the foreign countries often required that certain elements of the weapon systems were co-produced in their countries. This practice expanded throughout the 1980's and 1990's and eventually most major U.S. defense firms created strategic alliances or joint ventures with the most capable foreign suppliers in those countries. The effect on the DIB was significant with large portions of the subcontractor requirements being off-shored. This resulted in the loss of manufacturing capabilities in the DIB and further reduced the business volumes of many U.S. firms. It also resulted in the loss of certain proprietary advantages and in some cases helped create very capable competitors.

As expected, investor sentiment of the future of the U.S. defense industry was not strong during this time period. Watts noted that, "from the mid-1980's through 2007, a number of major American companies have chosen to leave the defense industry but no major non-defense firms have chosen to enter it." (Watts 2008).

## **2.7 Defense Industry Today**

As a result of the extensive consolidation of the industry over the prior two decades there is significantly less competition today. Often only one or two contractors exist that can provide the critical products and services that the DoD requires. For example, during the 1990's the number of aircraft manufacturers dropped from eight to three, Navy shipbuilders dropped from

six to three, armored vehicle producers were reduced from three to two, and missile manufacturers dropped from thirteen to three (Dombrowski et al., 2002). An additional study noted that in 1992 the top four and top ten aerospace contractors accounted for approximately 26% and 50%, respectively, of the contracts going to the top 100 defense contractors. By 2002, those percentages had increased to 50% and 63%, respectively (Weidenbaum 2003). The remaining large prime contractors now clearly dominate the design, development, and manufacturing of major military systems.

The security threat today has now moved past a primary focus on the Soviet Union. Today, the U.S. is required to a focus on a wide variety of new threats that necessitate a change in military strategies and the weapons and systems needed to deal with those threats. The new threats today involve dealing with non-state terrorism, cyberterrorism, a rapidly strengthening China, a resurgent Russia, and nuclear threats from Iran and North Korea. The attacks on September 11, 2001, and the accompanying conflicts in the Middle East, created a large surge in U.S. defense spending beginning in 2002. This surge in spending continued throughout the decade and peaked during the 2010 time period. Subsequently, spending dropped precipitously through 2016 as war efforts in the Middle East were reduced. During the past decade the DoD has significantly revised its procurement plans and several large military systems were cancelled, reduced, or stretched out. This surge and contraction again created stress for the DIB.

The Trump administration has ended the recent defense budget cuts. Defense spending increased significantly starting in 2017 as the military services replenished their system shortfalls.



## **2.8 DoD Profit Policy**

It is commonly viewed that it is the responsibility of the U.S. government to make acquisition laws, regulations, and strategic decisions that sustain the DIB. One of the key factors in that process is the profit policy that the DoD has established. This profit policy is implemented through extensive rules and regulations that have evolved over time. The DoD believes that profit is a basic motivating force of its private industry contractors. Therefore, the primary objectives of the DoD profit policy are to provide its contractors with reasonable profits in order to stimulate efficient contract performance, attract the best capabilities of qualified large and small business concerns to government contracts, and maintain a viable industrial base. The DoD's profit policy is set forth in the federal acquisition regulations. It is designed to: 1) reward contractors that take on more difficult tasks that require higher risk; 2) encourage contractors to accept greater responsibility for cost risk through differing contract types; and 3) encourage contractors to make cost-effective capital investments for reducing future costs (Federal Acquisition Regulation 15.404 2019).

Another key objective of DoD's profit policy is the strong desire to have competition in the industry. The DoD believes that competition between its contractors fosters innovation and lowers costs. This objective is complemented by socio-economic programs that the DOD has implemented with the goal of increasing the use of minority owned firms and small businesses.

However, the reality of the situation has been a consolidation of the industry and an exodus of numerous contractors from the DIB over the past twenty to thirty years. Many firms were squeezed out of the industry by extensive merger and acquisition activity. Other firms lost interest due to the excessive regulatory burdens and the low profitability that they believed the industry offers (Watt's 2008). This has resulted in limited competition and often results in sole

source procurements that primarily utilize cost-based pricing. Industry experts believe that cost-based pricing results in lower productivity and higher product costs. The reduction in competition also created a must win attitude when the remaining firms competed for new major military systems. Firms bid very aggressively knowing that the winner was likely to receive a sole source position on the new program for many years. The loser was often forced to close down that product line or become a supplier or a supporting partner of the winning prime contractor.

## **2.9 Key Procurement Regulations & Practices**

The defense industry operates in a highly regulated environment and the DoD procures a wide variety of goods and services. The procedures that the DoD must follow for contracting with its suppliers are much more complex than the practices found in the commercial marketplace. Many of these practices can be attributed to the statutory requirements that the government must consider when they enter into transactions with commercial enterprises. Due to its sovereignty role, the government must follow practices that are fair to all potential contractors and represent sound business decisions. These practices must assure that the prices paid by the DoD to its contractors are fair and reasonable, the quality of goods and services received are appropriate, and the government only purchases what it needs (Federal Acquisition Regulation-15.404, 2019).

In 1795, the U.S. Government enacted the first law governing the purchase of military goods and services for the Army and Navy. New laws were passed periodically thereafter and with limited exceptions these statutes required competitive bidding. The practice of competitive bidding was implemented to ensure that favoritism, political corruption, and profiteering were reduced in federal contracting. These bidding practices continued until World War II.

Unfortunately, these practices were slow and cumbersome and resulted in shortages and delays of the products and services needed during wartime. In 1942, the War Production Act passed Directive 2. That directive provided significant relief from competitive bidding requirements and required that all contracts be negotiated based on established criteria for selecting contractors during the war (McDonnell 1999).

Subsequent to World War II several new procurement statutes were enacted for negotiating contracts with DoD suppliers. In 1947, the Armed Services Procurement Act (ASPR) was implemented. Amongst many requirements, ASPR required that sealed bidding be the preferred procurement method. However, exceptions were allowed under certain circumstances or through specific justifications. ASPR was subsequently revised by the Defense Acquisition Regulation (DAR) in 1978 and then replaced in 1984 by the Federal Acquisition Regulation (FAR) along with its agency supplement the Defense Federal Acquisition Regulation (DFAR).

Since the early years of our country allegations of excessive profits by producers of wartime goods have been made. These allegations were made during the Revolutionary War and the U.S. Civil War. During World War I, these allegations again arose and subsequently the Vinson-Trammell Act of 1934 (Vinson-Trammell Act) was enacted. The Vinson-Trammell Act placed limits on the profits that contractors could earn on their contracts with the U.S. government (12% on military aircraft, and 10% on naval contracts).

The issue of profiteering by defense contractors became an issue again during World War II. As a result, Congress passed The Renegotiation Act of 1942 (Renegotiation Act). This act authorized the government to re-determine what a fair and reasonable profit was on a contract-by-contract basis after the delivery of the products. The government was then was able to recover any excess profits from the contractor. The Renegotiation Act was amended several times and

lasted until 1976. It was an exceptionally intrusive and expensive requirement for defense contractors. It was also a one-way street. Contracts that experienced low returns were not considered in the profit recovery determinations. The legislation had a lasting negative impact on the public's perception of the defense industry.

Defense contracts are subject to unique accounting, regulatory, reporting, and oversight requirements that significantly increase the costs of doing business with the DoD and often stretch out the timelines for contract negotiations and performance. The following procurement regulations and practices are examples of unique requirements for contracting with the DoD that have no equivalencies in the commercial marketplace:

- 1) Specific cost accounting rules that are utilized for contract pricing, reporting, and billing.
- 2) The use of varying contract types based on the degree of risk inherent in contract performance. The contract types range from fixed-price type contracts to cost reimbursable type contracts.
- 3) The use of the weighted guidelines methodology for establishing profit/fee objectives for contract negotiations.
- 4) The submission of cost or pricing data by contractors to support estimated costs used in their contract proposals.
- 5) Technical and administrative surveillance and auditing by government representatives during the performance of a contract for ensuring the quality of the goods and services procured by the DoD and the reasonableness of the prices and payments paid to the contractor.
- 6) The ability of the government to terminate contract performance whenever it is in the public interest- either for convenience of the government or for the fault of the contractor.

- 7) The ability of the government to unilaterally change the contract after it was signed.
- 8) A variety of contract financing terms such as progress payments and cost reimbursements during contract performance. These payments are a significant differentiator when comparing profitability performance between a DoD contractor and a commercial firm. They can have a dramatic effect on asset measurements and therefore ROA calculations.
- 9) The disallowance of recovery of certain contractor costs in the pricing of government contracts. Examples of these unallowable costs include interest, advertising, public relations, entertainment, lobbying, certain fines & penalties, certain executive compensation costs, contributions, goodwill, and certain restructuring costs. The disallowance of interest costs has a significant impact when evaluating the comparability of defense and commercial firm profitability.

Since the 1960's, almost continuous defense acquisition reforms have been proposed and implemented. These actions are often driven by political motivations because the large defense budget is an attractive target for politicians of both major parties (Fox 2011). As a result, acquisition reform efforts have typically accompanied each new President's administration. Additionally, each newly appointed Secretary of Defense often brings his own brand of acquisition reform to the DoD. Noted defense historian J. Ronald Fox observed that, "From 1960 through 2009, more than twenty-seven major studies of defense acquisition were commissioned by presidents, Congress, secretaries of defense, government agencies, studies and analyses organizations, and universities". Fox stated that the reform studies over those years typically came up with the same findings and similar recommendations.

The motivation of these reform efforts is usually the result of allegations of inefficiencies within the DoD or in the defense industry. Large cost overruns, delays in development programs,

or technical failures tend to be the biggest motivations. Other reform efforts also examine wasteful spending by either defense contractors or the DoD. A large number of these reform initiatives placed significant pressure on the DIB and often led to negative effects on industry profitability and cash flow. The constant wave of reform efforts has often been cited as a key factor that makes the defense industry less attractive to both firms contemplating entering the industry and to the investment community.

Due to the extensive regulations and required processes, large defense contractors are subject to extensive and constant oversight. This oversight includes auditors or inspectors from the following organizations or functions DCAA, DCMA, Inspector General, GAO, IRS, company internal auditors, and certified public accountants. Often the work of these auditors or inspectors takes place simultaneously and greatly burdens the contractors. This costly and often duplicative oversight greatly exceeds the oversight encountered by firms in the commercial sector.

A procurement regulation of particular importance to this study is the government's Cost Accounting Standards (CAS). Nineteen standards were established to achieve uniformity and consistency in the cost accounting of defense contractors. These cost accounting practices are used in the pricing, billing, and the cost accounting of government contractors. Certain contracts are exempt from these standards and dollar threshold levels exist on contracts covered by CAS. A contractor must submit a Disclosure Statement that identifies his cost accounting practices. Any changes to these practices must be disclosed to the government. The original Disclosure Statement, and any revisions to this statement must be audited and approved by the government. This process is used to inhibit contractors from implementing changes in cost accounting practices adverse to the government's interests. For the purposes of this study, and based on the significant size of the defense firms selected, it can be assumed that all firms selected must

follow these standards. Certain research on the topic of excess profitability focuses on cost shifting as a possible cause. While no system is perfect, the use of CAS, and the accompanying auditing requirements, makes cost shifting a more difficult practice for large defense contractors.

### **CHAPTER 3. LITERATURE REVIEW**

The question of whether U.S. defense contractors have obtained excess profits on their business with the U.S. government has been the subject of a number of studies over the past fifty years. Research of this topic was more frequent during the mid-1960's through the early 1990's. However, the frequency of research on this topic has greatly tapered off since that period. Only five academic studies of significance were performed in the past twenty years. With the exception of annual surveys performed by industry associations and industry consultants, such as the Aerospace Industries Association, Deloitte, and PricewaterhouseCoopers, non-academic research has also become relatively scarce during the past twenty-five years.

The research on this topic is divided between academic research and non-academic research. Non-academic research primarily consists of large-scale studies commissioned by either the DoD, or by congressional committees of the U.S. Congress. Non-academic research also has been performed by industry experts, industry consultants, and by trade organizations. The ability to obtain adequate data directly from defense contractors to perform these studies has proven to be very difficult. For a variety of proprietary reasons, defense contractors will not provide this data unless significant leverage is placed on them. In several large-scale non-academic research studies, the DoD or the U.S. Congress used its leverage to obtain comprehensive data from industry participants. Unfortunately, due to these constraints academic research on defense industry profitability principally resorted to the use of data available from public domain sources.

Tables 3-1 and 3-2 outline the results of the most significant research performed on defense industry profitability since 1969. The tables summarize the profitability measurements used, time periods analyzed, sample sizes, comparability groups, and major findings. Table 3-1 summarizes the academic research performed and Table 3-2 summarizes the non-academic research performed.

Two objectives have been the primary motivations of prior research on defense contractor profitability. The first objective is whether U.S. defense contractors achieve excess profitability at the expense of U.S. taxpayers. A presumption of several studies is that defense contractor profitability is excessive if it exceeds comparable non-defense commercial or industrial firm profitability. The second objective is whether defense contractors receive adequate profitability from their business with the DOD. Additional motivations noted include: 1) the effectiveness of the implementation of DoD's profit policy; 2) the identification of improvements of the DoD acquisition process; 3) identifying issues, such as cost shifting, that may create opportunities that enable a firm's defense segment to achieve higher profitability levels than a firm's commercial segment; and 4) identifying factors that may lead to differing profitability levels amongst defense contractors.

The research on defense industry profitability has frequently exhibited contradictory results that are often caused by the use of differing measurements and methodologies. The various studies have used different profitability measurements, sample selection criteria, sample sizes, sampling methods, variation in time periods analyzed, and variation in the definition of the variables used. The methodology approach for analyzing defense industry profitability also has varied. Several studies analyzed profitability differences by comparing a selection of defense firms with a selection of comparable non-defense commercial or industrial firms. Other studies



analyzed profitability by comparing the segment profitability of firms that have both defense and non-defense related business segments. Additionally, several studies that utilized the segment approach, analyzed the use of cost shifting as a method that firms may use for enhancing the overall profitability of a mixed segment company.

This literature review is presented in three sections. The first section includes research performed during the industry formation and maturity periods. This period primarily runs from the 1960's through the 1970's. Section Two covers the period of significant industry consolidation and restructuring that occurred starting in the 1980's through the current period. Section Three reviews research that primarily focused on cost shifting as a cause of higher profitability levels.

### **3.1 Research Studies - Industry Formation and Maturity Period (1960's - 1970's)**

Research in this period was dominated by research sponsored by the DoD or by committees of the U.S. Congress. The primary motivations of those studies were: 1) to determine the effectiveness of implemented or proposed changes in defense procurement rules and regulations; or 2) to determine if the profitability of defense firms is adequate or excessive and consistent with the regulations.

In December 1969, the Logistics Management Institute (LMI) completed a study named Defense Industry Profit Review (LMI, 1969). The study was performed under the direction of the DoD. LMI is a highly respected non-profit consulting firm that primarily provides services to the federal government. LMI has extensive consulting experience in the defense industry. The studies' primary objective was to determine the effects of procurement and contracting policy changes implemented in the early 1960's on the defense industry. Of particular significance, was

the new DoD profit policy implemented in 1963, which adopted the weighted guidelines methodology for determining profits in negotiated procurements.

The LMI study analyzed the profitability of the defense industry over a period of ten years (1958 to 1967). A sample of 40 large and medium sized defense contractors was selected and the selected firms also had significant commercial sales. The sample represented a significant portion of U.S. defense industry sales. The information requested for the survey was extensive and the contractors participated on a voluntary basis. Firm profitability data was allocated between its defense and commercial segments. Despite the large volume of data requested, response rates were strong with an 86% response rate by the large contractors and a 61% rate by the medium sized contractors. Additionally, profitability data and ratios were compiled for a selection of durable goods industrial firms using Federal Trade Commission (FTC) and Securities and Exchange Commission (SEC) financial reports (FTC-SEC Durable Goods).

The primary profitability measurement used was ROA and the secondary metric analyzed was ROS. ROA was determined by dividing pre-tax profit by total capital investment (TCI). TCI was equity capital investment plus long-term debt. The study results revealed that defense industry profitability (ROA) declined by approximately 25% during the ten-year period. Defense segment profitability exceeded both commercial segment profitability and FTC-SEC Durable Goods profitability during 1958 to 1961. However, between 1962 and 1967, defense profitability was found to be lower than those two groupings. Defense segment ROS (pre-tax profit/sales) was significantly lower than commercial segment and FTC-SEC Durable Goods ROS over all the years surveyed.

The LMI study concluded that the reduction in defense profitability in 1962 to 1967 was largely attributable to the increased competition in the defense market. During that period, the mix of government contracts shifted to a higher percentage of fixed-price contracts versus cost-reimbursement type contracts. The study notes that the increased competition created a must-win or buy-in mentality for many defense contractors on contract competitions. Fixed-price contracting was typically used during those competitions. Additionally, high rates of inflation during the period were viewed as another cause of lower profitability for contractors holding fixed-price contracts.

Shortly after the completion of the LMI study, the GAO was directed to re-examine the profitability of defense contractors. The LMI study was heavily criticized during Senate committee hearings. Concerns about the study's validity were raised since it was financed and directed by the DoD and defense company participation was voluntary. In March 1971, the Defense Industry Profit Study (Comptroller General, 1971) was issued. The study period covered the four-year period 1966 through 1969. The study included a judgmental sample of 74 large and medium-sized DoD contractors. Similar to the LMI study the GAO study obtained data directly from the selected firms. Using this information, the study calculated separate profitability and asset data for the firm's defense and commercial businesses. For several items this required significant judgmental allocations in order to determine the estimated amounts.

The GAO study utilized three profitability measurements based on pre-tax profit; 1) return on TCI (ROA), 2) ROS, and 3) return on ECI (ROE). The study noted that; "the percentage of profit earned on TCI is the most meaningful for evaluating defense profits." The results of the study were consistent with LMI, 1969 with regards to ROS. For the four-year period the ROS on defense sales (4.3%) was considerably lower than ROS on commercial sales

(9.9%). However, the differences between ROE and ROA were considerably lower than the LMI study results revealed. The difference in returns on ECI (ROE) was approximately equal with ROE of 21.1 % on defense sales and 22.9% on commercial sales. Similarly, the difference in ROA was lower at 11.2% for defense sales and 14% for commercial sales.

The GAO observed that the primary reason that ECI and TCI rates of return were similar was due to the large amounts of capital provided by the government to contractors during the performance of their contracts. The capital that the government provides includes progress payments for fixed-price contracts, cost-reimbursement payments for cost-type contracts, and certain equipment and facilities. This capital significantly reduces the asset requirements of a government contractor and reduces the interest costs that a contractor would incur to finance its capital needs.

The Comptroller General, 1971 study recommended that the government revise its profit policy. It recommended the inclusion of an additional factor in the weighted guidelines methodology that recognizes contractor capital requirements in the profit objective of negotiated contracts. The purpose of this change was to motivate contractor investment in new capital in order to improve production efficiencies and reduce the cost of defense products.

In the early 1970's, two academic studies also added to the dialogue on defense industry profitability. Stigler and Friedland (1971) analyzed profitability of the defense industry using stock market performance as the primary profitability measurement. The study tracked the stock market performance of the leading defense contractors versus all New York Stock Exchange (NYSE) stocks over two different time periods. Stock market performance included the change in stock price plus the reinvestment of dividends. Stigler justified this profitability measurement and states that; "Stock market experience avoids (or at least ignores!) the complications of

accounting practices, including the difficulties of segregating assets and income within the enterprise.”

The first period (1948-1961) measured the performance of 54 leading defense contractors versus the NYSE measure. The study revealed that a \$1,000 investment in 1948 in the NYSE stocks grew to \$6,740 by 1961. Defense stock performance was nearly two times better and the results showed that investing \$1,000 in the leading defense contractor shares grew to \$12,573. The second period (1958-1968) included a revised grouping of the top 50 defense contractors. The study revealed that a \$1,000 investment in 1958 in the NYSE stocks grew to \$4,702 versus \$3,860 for the top defense contractors. The results for the second period were consistent with the results of the LMI (1969) study but not the GAO (1971) study.

Bohi (1973) believed that the contrasting results of the LMI (1969) and GAO (1971) studies were caused by the difficulty in separating and allocating profits and assets between a firm’s defense and non-defense business. Bohi selected a judgmental sample of 36 large defense firms that were consistently on the “Top 100 Defense Contractors” list for the period 1960 to 1969. The DoD issues the “Top 100 Defense Contractors” report annually. The profitability results for the selected 36 firms were based on firm level profitability and were not allocated between their defense and non-defense businesses.

The profitability measurement used by Bohi was pre-tax income divided by net worth. This measurement is consistent with return on equity (ROE). The profitability results of the defense firm sample were compared with the profit rates of the 500 largest manufacturers as reported by Fortune (Fortune 500) for the period 1960 to 1969. Bohi finds that the profitability between the defense firms and the Fortune 500 was approximately equal over the ten-year period. Those results are consistent with GAO (1969) but not LMI (1969). Additionally, the lack

of declining profitability of the defense firms over Bohi study period contradicts the LMI (1969) study conclusion that the defense industry was becoming more competitive.

In 1977, the DoD completed a study (Profit '76 Study) to examine the effectiveness of its current profit policy. In particular, a goal of the study was to develop policy revisions that would encourage defense contractors to invest in capital that could reduce product costs. Two major shortfalls identified in the existing policy were an overemphasis on cost as a profit determinant, and the lack of consideration of contractor investment as a profit determinant. An important secondary objective of the study was to examine the strength of the defense industrial base. LMI was responsible for providing an assessment of the defense industrial base. The study was considerably more comprehensive than prior studies.

A major part of the Profit '76 Study was the review of defense contractor profitability and investment levels. The review was for the five-year period 1970 through 1974 and data was obtained from 64 large defense contractors with 168 profit centers. Comparisons of profitability and asset amounts were made between the firm's defense and commercial profit centers. A comparison was also made to a grouping of durable goods manufacturers. The FTC published a quarterly financial report that tracked the financial performance of approximately 5,000 durable goods manufacturers (FTC Durable Goods). This grouping was the main comparability group of the study.

To ensure the integrity and accuracy of the study, the public accounting firm of Coopers & Lybrand was designated as the lead firm to aggregate and review the survey data. The selected defense contractors represented approximately 73% of the durable goods volume purchased by the DoD during the period.

The primary profitability measures of the study were ROS and ROA. The ROA calculation included the reduction of progress payments and advances from the asset amounts. Consistent with prior studies, defense contractor profit center ROS was lower than FTC Durable Goods and the commercial profit centers. The five-year averages were 17.1% for the commercial profit centers, 6.7% for FTC Durable Goods, and 4.7% for defense profit centers. The five-year averages for ROA were 17.6% for the commercial profit centers, 10.7% for the FTC Durable Goods, and 13.5% for the defense profit centers. Similar to the GAO, 1971 study, the ROA results were significantly impacted by government financing of defense contractors through the use of progress payments on fixed-price contracts and cost-reimbursement payments on cost-type contracts.

As result of this study, the government enacted revisions to its profit policy by issuing Defense Procurement Circular (DPC) 76-3 in 1976. The primary changes involved; 1) including recognition in profit rate negotiations of a contractor's investment in facilities capital, and 2) recognizing as an allowable cost in contract negotiations the imputed cost of capital of a contractor's investment in facilities and equipment.

Two additional early academic research papers also examined defense industry profitability. Weidenbaum (1968) compared the profitability of six major aerospace defense contractors with six commercial firms of similar size. The study covered two time periods, 1952 to 1955, and 1962 to 1965. Weidenbaum concluded that the defense firms were more profitable than the commercial firms. However, the small sample sizes and the omission of 1960 and 1961 results were criticized as weaknesses of the study. During 1960 and 1961, the commercial aerospace industry experienced significant losses.

Agapos and Galloway (1970) studied the profitability of the aerospace industry during wartimes. While restricted to the aerospace industry, their study's conclusion was "there is almost no evidence that aerospace firms in contemporary America are able to reap unusually large or excessive profits from the presence of positive shifts in the demand for military hardware."

### **3-2. Research Studies – Industry Consolidation & Restructuring Period (1980's – Today)**

In 1985, the DoD completed a seventeen-month study regarding its contract pricing, financing, and profit policies. The Defense Financial and Investment Review (DFAIR) objectives were to ascertain that current DoD policies "insure the effective and efficient spending of public funds and at the same time were sufficient to maintain the viability of the defense industrial base." The DFAIR study is arguably the most comprehensive study of defense contractor profitability that has been performed. The last major profitability study performed by the government prior to DFAIR was the Profit '76 study that was performed nearly ten years earlier.

The DFAIR study analyzed financial data for the years 1975 through 1983. These results were compared and combined with Profit '76 results for the period 1970-1974. A judgmental sample of 76 major defense contractors with 194 business segments was utilized in the study (see Exhibit G.). The selected contractors voluntarily participated in the study. To ensure data accuracy and confidentiality, the CPA firm Touche Ross coordinated the data compilation and analysis process. The data was reviewed for reasonableness but not subject to audit. The DFAIR study utilized a more refined determination of a durable goods manufacturers (DGM) industry grouping. The profitability of the DGM grouping was compared with the defense firm sample.



The most controversial aspect of the DFAIR study was the adjustments made to the profitability measurements in order to improve comparability between defense and commercial firms. Excluding those adjustments, DFAIR used a profitability measurement methodology that was consistent with Profit '76's methodology. The primary profitability measures used were ROA and ROS.

The major adjustments made to the profitability measures in the DFAIR study primarily revolved around the treatment of progress payments and cost-reimbursement amounts in the financial ratio calculations. Defense contractors typically receive significant progress payments or cost-reimbursement payments from the government to defray the costs of carrying inventory. Those payments are interest free and save the contractor from raising capital to pay for them. The procurement regulations do not reimburse contractors for interest costs.

In order to improve comparability between defense and commercial firms, the DFAIR study essentially removed this financing from the asset base calculations. Previous studies included this government financing as a contra-asset and netted the payments against the inventory balances. DFAIR also created an economic profit amount by making adjustments to profits and revenues. The economic profit amount included an imputed value amount to account for the disallowance of interest costs. The most significant differences in the profitability calculation methodology between DFAIR and the prior studies are depicted below.

#### DFAIR

ROS: *Profit Before Interest & Taxes + Imputed Value of Government Financing/ Sales+  
Imputed Value of Government Financing*

ROA: *Profit Before Interest & Taxes + Imputed Value of Government Financing/ Total  
Assets – Cash (progress payments are not netted against inventory)*

## Prior Studies

ROS: *Profit Before Taxes/ Sales*

ROA: *Profit Before Taxes/ Total Assets – Cash – Progress Payments*

Using these modified profitability measures the following results were noted in the DFAIR study. The ROS for defense firms was 1% lower than DGM ROS for the 1970-1983 period (7.4% versus 6.4%). Defense firm ROS only exceeded DGM ROS during the 1980 to 1983 period when the commercial sector encountered a recessionary period. The ROA for defense firms was approximately 3% higher than the ROA of the DGM's for the period 1970-1983. The ROA's were fairly consistent from 1970 to 1979. The ROA of the DGM's deteriorated greatly during the 1980 to 1983 recessionary period.

The DFAIR study concluded that defense contractors had made significant capital investments since the adoption of DPC 76-3 in 1976. The DFAIR study also concluded that the current DoD policies were protecting taxpayer interests and were enabling the U.S. defense industry to achieve equitable returns. DFAIR also recommended that the profitability of the defense industry should be monitored on a periodic basis versus the ad-hoc method that was being used.

In mid-1985, the U.S. Senate Committee on Governmental Affairs and the U.S. House Committee on Government Operations, requested that the GAO perform a review of the DFAIR report. Members of Congress were skeptical of the results of the DFAIR study for a variety of reasons. The most basic reason for the skepticism was that the report was performed under the direction of the DoD. At the time of the report Congress was divided. Republicans controlled the Senate and Democrats controlled the House of Representatives. President Ronald Reagan was

supporting the rapid build-up and modernization of the U.S. military to put pressure on the Soviet Union. The high levels of defense spending were adding to the U.S. budget deficits.

The GAO performed a comprehensive review of the DFAIR study (GAO 1986). They also performed parallel testing on several matters that were done in the DFAIR study. The GAO disagreed or challenged nearly every major finding of the DFAIR report. In particular, the GAO disputed the profitability results of the DFAIR study. The GAO disagreed with the modifications that were done to the profitability measurements. They asserted that progress payments should be treated as contra-assets and that generally accepted accounting methods (GAAP) and conventional financial analysis methods supported their position. The GAO recalculated the DFAIR results using the conventional methodology for treating progress payments as contra-assets.

The DFAIR study indicated that the profitability of defense contractors was roughly comparable to the profitability of commercial businesses during 1970 to 1979 and was higher between 1980 and 1983. The GAO review concluded that the profitability of defense contractors was substantially greater than the profitability of commercial businesses during all years. The GAO results indicated that defense contractor profitability exceeded commercial profitability by 35% during 1970-1979, and by 120 percent during 1980-1983.

The GAO also performed a separate analysis of defense business profitability using a sample of 84 large defense contractors and 228 commercial firms. The study used publicly available data from Compustat and analyzed profitability at the firm level. Six profitability measures were used (ROS, ROA, ROE, Cash Flow ROA, Cash flow return on stockholders' equity, and Market return). The GAO study revealed that defense firm profitability exceeded

commercial business profitability during the 1975 to 1983 time period in all categories except market return.

The separate GAO profitability study results revealed defense firm ROS and ROA of 5.7% and 5.8%, respectively. Commercial firm ROS and ROA were 4.0% and 5.1%, respectively. It should be noted that the period 1975 to 1983 was a strong growth period for defense spending. As noted earlier, commercial firms encountered a significant recession during the 1980 to 1983 time period. Considering those facts, it is fairly remarkable that defense and commercial firm profitability was so close.

The GAO also disagreed with several other findings of the DFAIR study. The GAO study recommended greater fee reductions in the weighted guideline method than the DFAIR study had recommended. The GAO study also did not agree with DFAIR's recommendation to institute interim or milestone payments for certain contracts. Additionally, the GAO disputed DFAIR's finding that defense contractors had been increasing their capital investments over the past ten years. The GAO used a capital intensity measure and observed that while the defense industry had increased its capital spending it was still lagging the spending by commercial firms.

The GAO also recommended that the government institute a mandatory Profitability Reporting Program for defense contractors. They believed this program would create more accurate and consistent information for monitoring the industry than the existing ad-hoc approach. Despite those recommendations, the government never implemented a periodic profit-monitoring program of the defense industry. In fact, the government has not performed a comprehensive profitability study like Profit '76, DFAIR, or the GAO review of DFAIR in the past thirty plus years.

In 1992, Robert Higgs issued a research paper (Higgs 1992) that analyzed defense industry profitability using stock market returns as the primary profitability measurement. This was the first comprehensive review of profitability using that measurement approach since Stigler and Friedland (1971). The stock market performance is based on the change in the market price of the stock and the dividends received for a year (MRET). The study covered the period 1970 to 1989, and complemented the Stigler study that examined defense industry stock market performance of the prior two decades. Similar to the approach in the Stigler study, Higgs broke down the performance into separate decade groupings (1970's and 1980's).

Despite criticizing the usefulness and accuracy of accounting-based rates of returns, Higgs also supplemented his study with two accounting-based measures of profitability, ROA and ROI. The study analyzed the performance of the top ten and top fifty defense contractors from the DoD's annual list of top 100 prime contractors. The financial data was compiled from Compustat and only publicly traded U.S. firms were selected. The performance of this sample of defense contractors was compared to the Standard & Poor's 500 stock index (S&P).

The study results revealed that defense contractor profitability equals or exceeds the performance of the S&P grouping in nearly every category over the study's twenty-year period. In the 1970's, the defense contractor group significantly exceeded the performance of the S&P grouping on the MRET and ROA measures. The ROI measures were approximately equal. For the 1980's, MRET performance was approximately equal but defense firm ROI and ROA performance significantly exceeded the S&P index performance. Consistent with the GAO's study results (GAO, 1989), defense firm MRET performance was particularly strong in the 1970's.

The Higgs' study also assessed the relative riskiness of investment in defense contractors over the twenty-year period. The study computed betas of the MRET for 1970 to 1989 and the betas ranged between 1.22 and 1.27. However, the analysis of the higher risk was not deemed statistically significant.

A more recent study (Zhong and Gribbin 2009) examined defense industry profitability through a different perspective. Instead of just comparing the profitability of defense firms and commercial firms, this study investigates which factors led to varying levels of profitability amongst defense contractors. The study covers the period 1984 to 1998. A sample of 11,051 firm-year observations was selected using Compustat segment data. All firms selected were U.S. firms and had government sales. The profitability measure used was R&D-adjusted ROA (AdROA). This measure is calculated as income before extraordinary items and discontinued operations plus R&D expenses, divided by average assets. The researchers believed that this adjustment reduces revenue and expense mismatches that occur during periods of high R&D spending.

Regression analysis was used to test the hypotheses. The study uses the percentage of defense sales to a firm's total sales as the main-effect variable for defense contractor profitability. Three hypothesized factors were selected as moderating variables. Those variables were: 1) risk of defense business; 2) innovation involved in defense business task; and 3) influence of defense contractor.

Zhong and Gribbin's regression tests find that a higher percentage of total sales from defense sales are related to a lower AdROA. This suggests that defense sales are less profitable than commercial sales. Also, the results suggest that defense contractor profitability is higher

when they are more innovative, assume higher risks, or are more influential. Rewarding higher risk and innovation is consistent with the DoD's profit policy objectives.

Wang and San Miguel (2012) emphatically asserted the excessive profitability of defense contractors. Wang and San Miguel challenged the previous methodologies used in defense profitability studies. They particularly disagree with the use of the comparison of profitability against broadly defined indexes. The authors note that the defense industry is comprised of a wide range of industries and profitability is very industry specific. The study claims the use of an innovative method to measure the excessive profitability of the defense industry. Their innovative approach utilizes an industry-year-size matched measure to evaluate the excessive profitability of the defense industry. The study identifies two factors effecting excessive profitability: 1) defense contractor excessive profitability became more pronounced after the significant industry consolidation activity of 1992; and 2) excessive profitability increases with poorer corporate governance.

The study identifies the top 500 defense contractors in 2008. From this group the study identifies 112 publicly traded firms for analysis. The sample selection covers a wide range of industries as measured through SIC codes. Using this contractor selection, the results of 4,099 firm-years for the period of 1950 to 2010 were obtained. A review of the firms selected finds that a significant number of the firms provide products or services that clearly are of a commercial and/or commodity nature and were not specifically designed for the DoD. Examples include, food, fuel, insurance, facilities, and medical items or services.

Wang and San Miguel (2012) use ROA, return on common equity (ROCE), net income divided by sales (PMR), and EBIT divided by sales (OMR) as the profitability measures. Their findings assert that defense contractors achieve consistently excessive levels of profitability as

measured by ROA, ROCE, and PMR. However, the term excessive appears to be an overly strong term considering the differences identified. For example, the study noted mean differences of ROA and PMR at levels of 1% and .45%, respectively.

Wang (2014) built on the profitability research of Wang and San Miguel (2012). The primary purpose of this study was, “investigating the impact of political connections on the excessive profitability of DoD contractors.” Wang defines politically connected based on whether any of a firm’s board members had prior employment with the federal government, or in the military services.

Wang (2014) uses the empirical results of Wang and San Miguel (2012) that indicated that defense contractors achieve excess profitability. Wang (2014) uses a slightly slimmed down version of the sample from Wang and San Miguel (2012). It trims the sample from 112 to 90 firms due to the lack of available information regarding the political connections of a selected firm’s board of director’s members. The study re-tested the ROA results of the revised 2008 sample selection and the re-testing revealed that defense contractors achieved an excessive ROA of 3% in 2008. The sample used for this study also includes a large number of firms that primarily provide commercial or commodity type products.

The primary results of the study revealed that excessive profits are lower for defense contractors with more politically connected board of directors. Additionally, the study finds that DoD contractors are more likely to have politically connected board members and to have higher discretionary expenditures during periods of cost-plus contracts.

### **3.3 Cost Shifting Hypothesis Studies**

Several studies examined excess profitability by analyzing whether cost-shifting between a firm’s defense and non-defense segments could be used to increase a firm’s overall



profitability: Lichtenberg (1992), Thomas and Tung (1992), Rogerson (1992), and McGowan and Vondra (2002). A mixed segment firm is a firm that has substantial sales to the DoD and to commercial customers. A mixed segment firm also may have completely separate defense and non-defense business segments. If cost shifting takes place, the ability to analyze segment profitability becomes more complicated.

Frequently, firms that sell to defense contractors also sell similar or dissimilar products to commercial customers. A primary assertion of the cost-shifting hypothesis is that a firm can shift certain of its overhead costs from its non-defense contracts to its defense contracts. Cost shifting can be accomplished through the use of generally accepted cost accounting methods for allocating costs between business segments or between contracts. Cost shifting can also occur between different time periods.

The cost-shifting hypothesis is based on the assumption that defense contract pricing is more cost sensitive than non-defense contracts. The pricing of a majority of defense contracts is based on the actual or estimated costs that are allocable to those contracts. Therefore, higher cost allocations result in higher prices on those defense contracts. Alternatively, the pricing of commercial contracts is usually competitively determined and not directly based on cost. If additional overhead costs can be shifted to defense contracts then the profitability of a firm's commercial business is enhanced while the increased costs allocated to a firm's defense business is recovered through higher prices. This is particularly true when price competition in the defense sector is lower. Additionally, cost allocation practices can also be changed over time when the business mix of a firm changes.

Rogerson (1992) postulates that defense procurement regulations create incentives for multiple-product firms to shift costs and to utilize inefficient production methods. He notes that

the pricing of a firm's products with the DoD is primarily derived through the estimated or actual costs of the products. Therefore, the pricing of those products are highly cost sensitive. This is particularly the case when firms have cost reimbursable or sole-source contracts with the DoD. When the firm also sells commercial type products, the pricing of those products are much less responsive to cost allocations.

The differences in cost sensitivity on price provide incentives for a firm to allocate higher amounts of overhead cost to defense products and away from commercial type products.

Rogerson (1992) also notes that defense firms are more likely to allocate certain overhead costs based on direct labor and direct material. Due to those allocation methods, multiple-product firms will undercapitalize the production of products with cost-sensitive revenues (defense products) and overcapitalize the production of products with less cost-sensitive revenue (commercial products). Similarly, those firms are also more likely to utilize in-house labor to produce their more cost-sensitive revenue products (defense products) and use subcontractors for their less cost-sensitive revenue products. These allocation methods result in higher cost allocations for a firm's defense products than for a firm's commercial products and also creates the selection of less efficient sourcing decisions for the production of a firm's defense products.

In summary, Rogerson (1992) believes that DoD procurement regulations provide firms the ability to shift additional overhead costs to their defense business. Subsequently, those increased costs are substantially recovered in the pricing of the defense contracts. At the same time, the costs on commercial sales are reduced and the overall profitability of the firm is increased. Additionally, these incentives increase the opportunity for inefficiencies in the production of defense products. Firms are motivated to produce their defense products with higher levels of direct labor, use less automation, and subcontract their commercial work to

potentially more efficient suppliers. Rogerson includes several models in his research to demonstrate his theories. However, no empirical testing was performed in the study.

Thomas and Tung (1992) also examine the ability of defense contractors to shift costs to their cost-sensitive revenue defense business. The researchers state that the primary objective of the study is, “this article examines the incentives for defense contractors that operate under cost reimbursement to manipulate pension costs.” The study covers a relatively short period (1980-1983) and used a sample of eighty large defense contractors. The study notes pension costs can be shifted on an inter-contract basis and inter-time basis.

Based on the differences in pension plan funding levels identified in the study, a primary observation of the study is that pension plans are overfunded when a higher proportion of a firm’s employees are working on cost reimbursable defense business. Subsequently, excess pension plan assets are withdrawn from the pension plan when a higher proportion of employees are working on non-defense business. As a result of these manipulations, a firm’s overall profitability is enhanced through the initial recovery of the overfunding of the pension plan in the pricing of its cost-sensitive defense contracts and the subsequent withdrawal of this excess funding when the business mix shifts to higher proportions of non-defense business. It is also assumed that the firm would be able to limit the government’s recovery of this excess pension funding. Despite the varying funding level observations and manipulation opportunities noted, Thomas and Tung (1992) conclude that, “this study does not address the issue of whether these hypothesized strategies result in contractors earning abnormal profits by overcharging the government.”

Similarly, Lichtenburg (1992) suggests that cost shifting could be responsible for the excess profits of government contractors that his study observed. Lichtenburg (1992) performs

an econometric analysis of 9,300 firm industry segments for the period 1983-1989. From this group the study identified approximately 800 firms with reported sales to the U.S. government. Using ROA, the primary findings indicate that the profit rates of defense contractors are between 68 and 82 percent higher than the profitability of non-defense contractors. Further, by grouping the defense contractors into quartiles based on a firm's concentration of government sales, the study reveals that the profitability of the firms increases significantly as their concentration increases. The quartile profitability rate of the most concentrated defense firms is approximately three times higher than the rate of the remaining quartile groupings. Using U.S. defense industry employment data from 1940 to 1993, the study also finds that defense firms with the highest concentration levels are significantly less capital intensive. This would tend to indicate that defense contractors potentially over-utilize labor in their operations.

The three studies noted above, Rogerson (1992), Thomas and Tung (1992), and Lichtenberg (1992), all imply that cost shifting is a potential reason for excess defense firm profitability. Lichtenberg's study is the only one that measures excess profitability of defense contractors. However, that study only covers a relatively short period of time and that period includes a large increase in U.S. defense spending.

McGowan and Vendrzyk (2002) revisit this topic a decade later with an arguably more robust and nuanced research methodology. Compustat segment data for 1984-1989 and 1994-1998 is utilized to generate a sample of 701 segments for the earlier time period and 422 segments for the later time period. The reduction in segments in the later time period is attributed to the significant industry consolidation activity that occurred between the two periods. The 1984 to 1989 time period represents a period of high defense spending and a period of low competition in the defense industry. During 1994-1998, defense spending was significantly lower and the

industry experienced higher competition. To test the relationship between cost shifting and excess profitability, the study compares relative profitability of three segment groupings during those periods. The segment groupings for the defense firms selected were: segments with only commercial revenues, segments with predominately defense revenues, and mixed segments. If cost shifting was responsible, it would be expected that the profitability of the commercial and mixed segments would reveal higher profitability than the defense segments.

The primary results of McGowan and Vendryzk (2002) did not confirm the results of prior studies that proposed that excess defense firm profitability is attributable to cost shifting. ROA is used as the study's profitability measurement. The results for 1984-1989, revealed that defense contractor business segments that receive the predominate percentage of their revenues from government contracts were more profitable (19.4% ROA) than segments that derived their revenues either from purely commercial sources (12.4% ROA) or were mixed segments (14.1% ROA). During the more competitive time period (1994-1998), the results for the three segment groupings were approximately equal (12.3%, 12.0%, and 12.3%, respectively).

The biggest reduction in profitability between periods was reported in the predominately government segment. McGowan and Vendryzk (2002) attribute this change to the reduction in competition between periods. They propose that, "the unusually high profitability reported on government contracts when competition is low is more likely explained by non-accounting factors... or that the market for defense goods in the 1980's was a seller's market."

A recent study by Chen and Gunny (2014), also examined whether cost shifting was responsible for higher profitability by certain government contractors. The primary objective of their study was to determine whether government contractors that obtain cost-plus contracts achieve higher profitability levels and whether those higher levels are due to cost shifting. ROA

was used as the primary profitability measurement. A secondary objective of the study was to determine if profitability levels were lower for government contractors with cost-plus contracts when government cost accounting standards (CAS) were in effect.

Their study was the first research paper that analyzed excess profitability and cost-shifting using contract data. Detailed information identifying which government contractors were awarded cost-plus contracts was not available in the public domain until 2004. The period covered by study was 2005-2010 and for the main test a sample of 258 firms and 1,505 firm-years was used. Only government contractors that were awarded a cost-plus contract in a year of the sample period and only a fixed-price contract in a different year of the sample period were included. The contractors selected were also required to be publicly traded U.S. firms.

Chen and Gunny (2014) concluded that higher profitability levels (ROA) were associated with cost-plus contract activity than with fixed-price contract activity. They report evidence that indicates that cost shifting is a factor in the higher profitability levels. They also provide evidence that this excess profitability is reduced when CAS rules apply and when increased monitoring of the contractor by the government is performed. It should be noted that even if the conclusions are accurate, essentially all large and medium-sized defense contractors are subject to CAS rules. They are also subject to extensive oversight by various government auditors.

#### **CHAPTER 4. HYPOTHESIS DEVELOPMENT**

Defense industry profitability literature reveals varying results over the past sixty years. The existing literature is clearly conflicted in the results observed. The literature also reveals inconsistencies in profitability measurements used, representative samples selected, and methodological approaches taken. It is evident that there is no “holy grail” approach for evaluating the profitability of the defense industry, or for asserting that its profits are excessive.

A summary analysis of the selected research studies finds defense firm profitability higher for ten time periods reviewed, non-defense commercial/industrial firm profitability higher for four time periods, and profitability approximately equal for five time periods reviewed. An approximation of the study results by decade finds defense firm profitability higher in the 1950's, 1970's, and 1980's, and non-defense commercial/industrial firm profitability higher in the 1960's and the 1990's. The reduced number of studies after the 1990's does not allow for such an assessment. Based on these varying results, it appears difficult to assert that defense contractor profitability is excessive, especially all the time. These varying results are consistent with the peaks and valleys that many other cyclical industries go through.

The two basic measurement approaches used for analyzing profitability are accounting-based rate of returns and stock market-based rate of returns. Selecting the best accounting-based rate of return method to use is a challenging task especially when comparing profitability between different industries or different industry segments. The comparability of those measures also becomes more difficult when they are used over extended periods of time or when significant judgmental allocations of costs, assets, and liabilities are required. Several examples of the difficulties encountered when utilizing accounting based rate of return measures are: 1) differing accounting practices exist between firms and industries; 2) changing accounting rules and disclosure requirements over time; 3) results are based on historical cost and not on market prices; 4) relying on segment data which varies in methodology and transparency over time; and 5) using judgmental allocations to separate a firm's defense and non-defense business activity and asset bases.

The most comprehensive studies that utilized accounting-based rates of returns were Profit '76 Study (1977), DFAIR (1986), and GAO (1986). Those studies examined relatively

short periods of time, required numerous judgmental allocations, and exhibited conflicting results. The DFAIR study attempted to improve comparability by making adjustments to certain profitability and balance sheet measures in order to account for the unique effects of government financing and pricing. However, the DFAIR methodology was strongly criticized by the GAO for not using GAAP or conventional financial analysis methodologies. The DFAIR study wasn't disputing GAAP, it was using a different methodology in an attempt to improve the comparability of the study's results.

Only two studies utilized stock market-based rate of return measures as their primary measurement method, Stigler and Friedland (1971), and Higgs (1992). Stock market-based rate of return measures have several weaknesses especially if used for short periods of time. However, their utilization over longer periods of time tends to normalize the effects of short-term periods of volatility or transient events.

The studies also varied in the sampling methodologies used for selecting representative defense firm samples and selecting samples of comparable commercial or industrial firms. The breadth of the samples varied with some studies using relatively small samples (Weidenbaum 1968, Bohi 1973), and some studies using very large samples (Lichtenburg 1992, Zhong and Gribbin 2009, and Wang and San Miguel 2012). The large defense firm samples were particularly broad based and often included a significant number of firms that were producers of products primarily sold in the commercial marketplace, not products designed for use by the defense industry.

There has been limited research on defense contractor profitability since the 1990's. This study extends the literature by examining the profitability of a focused selection of leading defense contractors over an extensive time period. This extensive period includes periods of



significant industry consolidation and downsizing, defense budget reductions and surges, combat and terrorism, DoD procurement reforms, and economic recessions and expansions.

To extend and add to the literature on defense firm profitability, this study's hypothesis will revisit and update the assessment of defense contractor profitability since the mid-1980's through the use of market-based profitability measures. Consistent with prior literature, this study compares the results of a defense sample with a benchmark sample comprised of a peer group of commercial or industrial firms. The findings of prior literature have varied on whether defense contractors have achieved higher or lower profitability than their non-defense commercial or industrial peers. Based on those conflicting results the following null hypothesis is proposed.

Hypothesis: During the past thirty-four years (1986-2019), U.S. defense contractor profitability does not differ from the profitability of comparable non-defense commercial or industrial firms.

Additionally, prior literature has included limited analysis of the key factors that have impacted defense industry profitability. Several studies have included anecdotal commentary regarding the factors that they believed favorably or unfavorably affected defense or commercial firm profitability during the periods studied. Only three studies (Zhong and Gribbin, 2009, Wang and San Miguel 2012, and Wang, 2014) performed empirical testing of certain factors to evaluate their effect on defense industry profitability. Zhong and Gribbin evaluated firm risk taking, innovation, and influence as possible indicators of increased defense firm profitability. Wang and San Miguel researched whether increased industry consolidation activity commencing in 1993, or corporate governance practices, affected defense firm profitability. Wang, 2014 examined political connections as a possible factor.

Supplementing the study's hypothesis results, this study analyzes the effect of a defense firm's size on its profitability and the significance of a firm's defense sales as a percentage of its total sales on its profitability. Additionally, an analysis of the variability of defense firm profitability over five interim time periods within the study period is performed. This supplemental analysis is performed using market-based measurements and accounting based measurements.

## **CHAPTER 5. METHODS**

The methodologies used in prior research on the topic of defense industry profitability have varied greatly. The most significant issues affecting prior research methodology were: 1) data accessibility; 2) profitability measurement approach used (accounting-based returns versus market-based returns); 3) study period used (length and timing); and 4) development of suitable defense firm and comparable commercial or industrial firm samples.

The inability to obtain detailed financial information directly from defense contractors without significant leverage has resulted in academic researchers primarily using public domain data for their studies. Those studies utilized data compiled at either the firm level or at the operating segment level. Data for this study was also obtained from public sources. Only firms that are publicly traded on major U.S. stock market exchanges are included in this study.

Accounting data for the firms selected was obtained from Standard & Poor's Compustat database and stock market data was obtained from the Center for Research in Security Prices (CSRP) database. Information regarding merger and acquisition activity was obtained from applicable firm 10-K's and several secondary sources.

This study avoids the problematic issues concerning accounting-based measures and utilizes stock market-based measures as the primary measure to evaluate long-term profitability.

Also, the study uses a more focused sample of defense contractors. The defense contractors selected represent the firms that produce or support the principal weapon system needs of the DoD.

This section is divided into the following five sections. The first section describes the selection process for compiling the defense firm judgmental sample. Section two describes the process for developing the benchmark sample of non-defense commercial or industrial firms. Section three describes the measurements and model used to test the study's hypothesis. Section four describes the supplementary analysis approach used for segmenting the Fama-French results. Section five provides the supplementary analysis approach used for obtaining accounting-based profitability measures of the defense and benchmark firm samples.

### **5.1 Defense Firm Sample Selection**

A multi-stage approach was used to compile a representative and focused defense firm judgmental sample. As noted in the literature, the approaches used in prior studies for developing their defense samples varied greatly. The initial step of this approach was to develop a baseline selection of defense firms using firms included in prior defense profitability studies in the 1970's and 1980's.

The baseline selection of defense firms for this study was drawn from two comprehensive research studies performed in 1977 and 1985. The Profit '76 Study (1977), and DFAIR (1986) studies were both commissioned by the DoD. Both of those studies focused on large and medium-sized defense contractors that primarily produced durable goods. Participation in both studies was voluntary and strong participation rates were achieved based on the leverage placed on the contractors by the DoD.

Sixty-four defense firms participated in the Profit '76 study and seventy-six firms participated in the DFAIR study. Fifty contractors participated in both studies. These studies represent an excellent starting point for this research since the key objectives of both studies were to evaluate defense industry profitability and the stability and strength of the DIB at that time. During the 1970's and 1980's, significant concerns were raised regarding defense industry profitability levels and the strength and health of the DIB. Conflicting views by interested parties led to the performance of several studies, including the Profit '76 Study (1977) and DFAIR (1986).

Participating firms from those two studies were combined and adjusted for mergers, acquisitions, and divestitures that took place between 1976 and 1985. Additionally, forty-nine defense firms who elected to not participate in the DFAIR study were identified and added to the baseline sample selection. This resulted in one hundred and twenty-five firms and provided a very representative baseline selection of the most significant defense contractors in the mid-1980's.

In order to create a more focused defense firm sample, the following adjustments were subsequently made to the baseline sample: 1) firms that spun-off, sold, or discontinued their defense units during the mid to late 1980's were excluded due to the short period of time that they existed during the study period; 2) firms that were acquired during the mid to late 1980's were excluded due to the short period of time that they existed during the study period; 3) firms that primarily sell commercial or commodity type items (e.g. petroleum, food products, insurances, furniture & fixtures, and health-care) were excluded; 4) privately held or closely held firms were excluded; and 5) foreign owned or controlled firms were excluded. These adjustments resulted in a more representative baseline sample of the defense firms that provided the U.S.

government its major defense and security products, systems, and support services in the mid-1980's. A reconciliation of this process is summarized on Table 5-1. These steps resulted in an adjusted baseline sample of 53 defense firms being selected from the DFAIR and Profit '76 studies.

The next step involved the identification of new large and medium sized defense firms that emerged over the study period or were not included in the two studies used as the baseline. These firms were primarily identified based on a review of the Top 100 Contractors Report compiled annually by the U.S. General Services Administration. This step was further supplemented by identifying the creation of new firms through a review of applicable 10-K information of the baseline sample firms. New firms that were identified were primarily created through the merger of smaller defense firms or through spin-offs from larger firms who were exiting the defense industry. New firms that were identified were added to the baseline firm sample at the time they achieved significant size (over \$100 million in annual sales). Twenty-four new firms were identified by this process and were added to the baseline sample. This resulted in a total defense firm sample of seventy-seven firms. A summary of the firms included in the defense sample, and their source, is included on Table 5-2.

Merger, acquisition, and divestiture activity of the selected defense firms over the study period was significant. This activity was greatly accelerated by the message that Secretary of Defense Les Aspin delivered at the "Last Supper" meeting in 1993 to senior executives of the nation's top defense contractors. Profitability results for defense firms that became defunct as a result of mergers, acquisitions, divestitures, or spin-offs are included in the study results up to the point of their delisting or their exit from the defense sector.

For purposes of this study, defense contractors are more broadly defined as firms who contract with the DoD, NASA, Department of Homeland Security, or the intelligence organizations of the U.S government. Together, these organizations provide the U.S. government with its national security needs and their contractors primarily follow the same procurement regulations when negotiating government contracts.

## **5.2 Benchmark Firm Sample Selection**

A selection of a comparable benchmark sample of non-defense commercial and/or industrial firms was made. The benchmark firms produce non-defense products and services of comparable technology and function with the defense firm sample. To develop a matching benchmark sample a common research approach utilizing Standard Industrial Classification (SIC) codes for matching firms was adopted. The seventy-seven firms in the defense sample represent fifteen unique industry sectors based on their two-digit codes, and forty-four sub-sectors based on their four-digit codes. This distribution is illustrated on Table 5-3.

A multi-step approach was used to identify matching firms for the benchmark sample. First, all firms in Compustat with non-missing values for assets, sales, end of year stock price, number of shares outstanding, and positive equity in any of the two-digit SIC codes of the defense firm sample were selected as a pool of potential matches. Secondly, for each two-digit SIC code-year, assets were standardized using a zero mean and a standard deviation of one. Then for each defense firm-year, the closest non-defense firm-year was matched in terms of similarity of standardized assets (up to a 0.5 standard deviation difference), where a benchmark firm-year was only allowed to be matched once to one defense firm-year (that is, unique matches). This was first done at the four-digit SIC level, and repeated at the 3-digit and 2-digit levels for defense firm-years that had no matched non-defense firm-year.

### 5.3 Measurements & Model

For the main test, profitability is measured using a stock market-based rate of return approach (annual stock price change plus dividends received). Using a longitudinal design, the measurement period was 1986 through 2019. The main test for the hypothesis is comprised of three steps. The first step is to determine if the defense firm sample generates a positive or negative profitability alpha for the measurement period and to determine if it is statistically significant. The second step determines the profitability alpha of the benchmark firm sample for the same time period. Step three compares the results of the two sample portfolios using a t-test.

In an investment context, alpha is a performance measure used to evaluate the excess or abnormal rates of return of an investment or portfolio. A positive alpha indicates that the investment return over the time period analyzed exceeded the expected return based on a portfolio's risk. A negative alpha signifies that the investment's return was less than the expected return based on the portfolio's risk. Alpha is a key parameter of the capital asset pricing model (CAPM). CAPM has been extensively used for evaluating the pricing of equity investments.

However, CAPM has also been widely criticized due to its simplicity and due to the use of volatility (beta) as the single factor in the model. As a result, several alternative models have arisen that propose the use of additional factors for improving the evaluation of investment pricing and performance. Over the past two decades, the Fama-French + momentum factor model (Fama-French Model) has become a preferred methodology for determining alpha because it extends the CAPM with additional factors for analyzing investment risk and performance.

To determine alpha for the main test the following steps were performed using the CRSP data base: 1) the average monthly returns of the selected defense firms were obtained; 2) the risk-

free rate was subtracted from those returns; 3) the results were regressed against the market return and the Fama-French Model factors. Portfolio returns were calculated using a simple average method. Additionally, the Fama-French results were also calculated on a winsorized basis to limit the influence of outliers on the data. The percentiles used in the winsorization process were set at 1% and 99%. The following regression equation was used to determine the profitability alpha of the defense firm and benchmark firm samples:

$$RET = a + b1 * HML + b2 * SMB + b3 * MKTRF + b4 * UMD + e \quad (5-1)$$

The additional factors used in the Fama-French Model are: 1) High Minus Low (HML) is a value premium factor. It reveals the historic excess returns of value stocks (high book-to-price ratio) over growth stocks (low book-to-price ratio); 2) Small Minus Big (SMB) is a size effect factor based on the market capitalization of a firm. It reveals the historic excess returns of small-cap firms over large-cap firms; 3) Excess Return on Market (MKTRF) factor is computed as the market return minus the risk free rate and controls for the difference in return due to varying market risk; and 4) Momentum Factor (UMD) is the tendency of the stock price to continue rising if it is going up or to continue declining if it is going down. These additional factors more accurately account for an investment's or portfolio's specific risk factors when determining excess or abnormal returns.

Fama-French's initial research paper was issued in 1993 (Fama and French 1993). The vast majority of studies on defense industry profitability were performed prior to that date. Accordingly, this study appears to be the first study that utilizes the Fama-French methodology to identify defense industry excess or abnormal profitability.



#### **5.4 Supplemental Analysis- Fama-French Model**

To provide additional insight into the main test results, supplemental analysis was performed by partitioning the sample results. The sample results were partitioned by time period, by firm size, and by percentage of total sales derived from defense sales.

A majority of the prior studies included time series analyses ranging from five to ten years in length. Bohi (1973), Profit '76 Study (1977), DFAIR (1986), GAO (1987), and LMI (1969) are examples of studies that used that approach. Three studies utilized multiple-decade periods for comparing profitability over different time periods, Stigler and Friedland (1971), Higgs (1992), and Wang and San Miguel (2012). Wang and San Miguel's study also segmented results using the effect of a key event. They evaluated the change in defense industry profitability after the "Last Supper" meeting in 1993 through 2010. They determined that industry profitability improved after that watershed event and attributed it to the decreased industry competition that resulted from industry consolidation.

The defense firm sample results were partitioned into five time periods for analyzing profitability trends and the effect of key events. The five time periods that were selected for analysis is based on significant events that occurred during the study's measurement period. Defense industry consolidation was significant throughout the study period. The most significant period of industry consolidation occurred during period 2 (mid-1993 through August 31, 2001). This period started with the "Last Supper" meeting in 1993 and saw the creation of mega-sized defense firms as some of the largest firms in the industry merged. The periods and key events effecting the defense industry and the stock market are noted below:

- 1) 1/1/1986 to 6/30/1993- Post DFAIR study period up to the "Last Supper" dinner meeting period. Major events include: Reagan defense build-up in early to mid-

- 1980's; end of Cold-War and beginning of Peace Dividend with large defense budget cuts; and defense industry consolidation and downsizing.
- 2) 7/1/1993 to 8/31/2001- Post "Last Supper" period up to the 9/11/2001 terrorist event. Major events include: Significant industry consolidation- especially at major prime contractor levels; Peace Dividend with large defense budget cuts; and significant defense procurement acquisition reform.
  - 3) 9/1/2001 to 10/31/2008- Major events include: 9/11/2001 event; Iraq and Afghanistan conflicts; significant defense budget growth; SARS virus event in 2002-2003; and 2008 financial crisis which resulted in a severe recession and stock market collapse.
  - 4) 11/1/2008 to 10/31/2016- Major events include: 2008 financial crisis recovery and stock market recovery; Obama presidency; military conflicts reduced; defense budget growth ends and budget cuts begin.
  - 5) 11/1/2016 to 12/31/2019- Major events include: Trump presidency; defense budget grows significantly to replenish defense system needs; and large rise in U.S. stock market indexes.

Using market capitalization, the defense firm sample results were also partitioned by size. The defense firm sample was divided into terciles to determine if differential profit performance was based on the relative size of the defense contractor (large, medium, and small). Similar analysis was also done in Higgs (1992), LMI (1969), and Comptroller General (1971).

Additionally, to identify potential differential profitability results, the defense firm sample results were also segmented into terciles based on the percentage of a firm's total sales that are derived from defense sales (high, medium, low). A firm's defense sales percentage was based on an average compiled over the time it was included in the study (using every fifth year).

The sales percentage in the last year a firm was listed on the stock exchanges, or when a firm exited the defense industry, was excluded from the average.

The segmenting by tercile was performed annually based on the relative percentages of the firms in the sample. Firms moved from tercile to tercile based on changes in the mix of their business or the overall composition of the sample's firms. This movement was very limited during the study period. The high percentage tercile included firms where defense sales represented approximately 80% or more of a firm's total sales. The medium percentage tercile included firms where defense sales represented approximately 26% to 79% of a firm's total sales. The low percentage tercile included firms where defense sales were approximately 25% or lower of a firm's total sales.

In light of the significant industry consolidation, the above analysis examines the impact on profitability of firms who derive a higher share of their business from the sale of defense products and services. Stigler and Friedland (1971), Bohi (1973), Higgs (1992), and GAO (1986) also evaluated profitability based on the percentage of a firm's sales that were derived from defense sales. Those studies found that defense-oriented firms with a higher percentage of defense sales tended to outperform firms with lower percentages.

No prior studies evaluated all three attributes or factors (time periods, firm size, and percent of a firm's total sales derived from defense sales) in their studies.

## **5.5 Supplemental Analysis- Accounting-Based Profitability Returns**

Further supplementing the main test results, accounting-based returns for the defense firm sample and the benchmark firm sample were compiled. The primary profitability and asset performance measures utilized include return on sales (ROS), return on assets (ROA), return on equity (ROE), asset turnover (AT), and goodwill as a percentage of total assets (GOODWILL

%). Initial analysis of the sample results noted that the defense firms accumulated significant goodwill on their balance sheets over the study period due to the significant industry merger & acquisition activity. Earnings before interest and taxes (EBIT) was used as the profit numerator in the profitability calculations. For purposes of this study EBIT is deemed more representative of comparable operating profitability than net income (NI). NI tends to vary considerably due to significant fluctuations in reductions for interest, income taxes, goodwill impairment, and other non-operating items.

The following equations were used for calculating the profitability and asset performance measurements:

$$ROS = EBIT / Sales \quad (5-2)$$

$$ROA = EBIT / Total Assets \quad (5-3)$$

$$ROE = EBIT / Total Equity \quad (5-4)$$

$$AT = Sales / Total Assets \quad (5-5)$$

$$GOODWILL \% = Goodwill / Total Assets \quad (5-6)$$

Trend analysis of the defense firm sample's accounting-based financial performance was performed. This analysis was performed by partitioning the results by time period to determine if industry profitability improved or deteriorated over the study period. This analysis was also performed for the benchmark firm sample and a comparison of those results was made. Additionally, the defense firm sample's accounting-based results were also partitioned by firm size, and by the percentage of a firm's total sales that are derived from defense sales. The methodologies used for partitioning the accounting-based and market-based results were consistent.

## **CHAPTER 6. RESULTS & DISCUSSION**

The study's results are presented in four sections. The first section includes the study's main test results. These results include the market-based profitability results for the defense and benchmark samples and a comparison of those results. Section two includes supplemental test results for the defense sample. Included in this section are market-based profitability results for the defense firm sample partitioned by firm size, by the percentage of a firm's total sales that are derived from defense sales, and by time period.

To provide further depth to the study's findings, additional supplementary analysis is also included. Section three includes accounting-based profitability results for the defense and benchmark firm samples. For the defense firm sample this also includes partitioning the accounting-based results by firm size, by percentage of a firm's total sales that are derived from defense sales, and by time period. Analysis by time period for the benchmark firm sample is also presented. The fourth section analyzes stock market performance of the defense firm sample, benchmark firm sample, and the S&P 500 index over the study period.

### **6.1 Market-Based Profitability Results – Defense & Benchmark Samples**

The main test for answering the study's hypothesis utilized the Fama-French Model. The monthly returns of the defense and benchmark samples were regressed against the market return and the Fama-French Model factors. The study period was 1986 through 2019 and included 408 months. The number of defense firms during that period ranged between a high of 61 in 1990 and a low of 29 firms in 2019. This resulted in 18,089 monthly return observations. The decrease in the number of firms observed was due to the significant industry consolidation during the study period. The number of benchmark firms during the study period ranged between a high of

54 firms in 1990 and a low of 19 firms in 2019. This resulted in 13,939 monthly return observations.

The results for the defense sample are shown on Table 6-1 (Panel A). The defense firm sample results for the total study period reveal a positive monthly profitability alpha of 0.00353 and the findings are statistically significant at  $p < .05$  (t-statistic-2.48). Annualizing this positive abnormal return over a twelve-month period equates to a positive annual profitability level of 4.24%. Additionally, on a winsorized basis, the positive monthly profitability alpha is 0.00325 and remains statistically significant at  $p < .05$  (t-statistic-2.47).

The results of the benchmark sample are included on Table 6-1 (Panel B). The full period results reveal a positive monthly profitability alpha of 0.00340 and is statistically significant at  $p < .05$  (t-statistic- 2.25). Annualizing this positive abnormal return equates to 4.08%. After those results are winsorized, the profitability alpha was reduced to 0.0178 and was no longer statistically significant (t-statistic-1.47).

The similarity of the market-based profitability results between the defense sample and the benchmark sample indicates that the defense industry profitability is not excessive to its non-defense peer group. To test this assumption, a t-test was performed for testing the differences of the alphas of these independent samples. The results of that testing found a t-value of 0.0613 on an unwinsorized basis and 0.8276 on a winsorized basis. Both of these results were not statistically significant.

The above results reveal that the market-based profitability returns for the defense firm sample and the benchmark firm sample are both abnormally high. The results also support the study's null hypothesis that defense industry profits, as measured by market-based profitability, are similar to the profitability of comparable non-defense commercial or industrial firms.

## 6.2 Supplemental Market-Based Profitability Results – Defense Firm Sample

Table 6-2 (Panel A.) shows the results of partitioning the defense firm sample based on relative firm size (large, medium, or small). The results reveal that large and medium-sized firms achieved higher positive alpha returns than small-sized firms. Large-sized firms have a positive monthly profitability alpha of 0.00405 (t-statistic-2.68), and medium-sized firms have a positive monthly profitability alpha of 0.00462 (t-statistic- 2.60). Both were statistically significant at  $p < .01$ . Small-sized firms have a positive monthly profitability alpha of 0.00189 (t-statistic- 0.94), but the results were not statistically significant. These results are consistent with the realities of an industry which had significant consolidation and downsizing activity over the study period. Many of the leading firms in the industry survived and thrived by growing larger through strategic and successful mergers and acquisitions.

The partitioning of the defense firm sample based on a firm's percentage of total sales that are derived from defense sales (high, medium, or low percentage) is presented on Table 6-2 (Panel B.). Both high and medium percentage firms achieved positive profitability alphas that were statistically significant. High percentage firms had a positive monthly profitability alpha of 0.00566 and was statistically significant at  $p < .01$  (t-statistic- 2.60). Medium percentage firms had a positive monthly profitability alpha of 0.00349 and the results were statistically significant at  $p < .05$  (t-statistic- 2.04). Low percentage firms had a positive monthly profitability alpha of 0.00141 (t-statistic- 0.89), but the results were not found to be statistically significant.

The results of partitioning the defense firm sample by time period is included on Table 6-3. Four of the five time periods revealed positive profitability alphas. However, none of the individual results for those four periods were found to be statistically significant. Period 1 had a

negative monthly profitability alpha of -0.00248 but was also not found to be statistically significant.

A contributing factor to the lack of statistical significance in the results by interim time period is caused by partitioning the sample into five time periods. This partitioning greatly reduced the number of sample results per time period. The full study period, firm size, and percent of total sales derived from defense sales analyses each had 408 monthly observations. The number of monthly observations per interim time period ranged from 38 to 98 months. This reduced the statistical power of those smaller sample tests. Although the results of the individual five periods were not statistically significant, the direction of those results are consistent with actions and major events effecting the defense industry during those time periods.

Period 2 was the post “Last Supper” period which included significant merger & acquisition activity and the creation of several highly successful mega-firms such as Lockheed Martin, Northrup Grumman, Honeywell, and Boeing’s growth in the defense market with its acquisition of McDonnell Douglas. Period 2’s results revealed a positive monthly profitability alpha of 0.00450 with a t-statistic of 1.90. Similarly, Period 3 exhibited a positive monthly profitability alpha of 0.00569 with a t-statistic of 1.70. Period 3’s results are also consistent with period events which included the significant military conflicts in the Middle East. Those military conflicts resulted in large sales growth throughout the defense industry. Period 1’s returns are consistent with an industry in turmoil as defense budgets dropped rapidly with the end of the Cold War and the beginning of the Peace Dividend.

### **6.3 Accounting-Based Profitability Results – Supplementary Data**

To supplement the market-based profitability results, accounting-based profitability results were compiled using Compustat data for the defense and the benchmark samples. The



total period results for the defense sample, and the five interim periods are included on Table 6-4 (Panel A). The corresponding results for the benchmark sample are also included on Table 6-4 (Panel B).

Defense firm sample sales over the full study period totaled \$15.3 trillion and averaged \$448.9 billion per year. Approximately 40% of those sales were defense industry related. The number of defense firms in the sample averaged 42 firms per year and total firm year observations were 1,430. The benchmark sales over the full study period totaled \$2.5 trillion and averaged \$74.6 billion per year. The number of benchmark firms in the sample averaged 34.25 firms per year and total firm year observations were 1,165. The primary reason for the significant difference in sales between the defense and benchmark firm samples is due to the fact that the benchmark peer group does not include as many very large firms as the defense industry has.

Table 6-4 (Panel A) shows the following defense firm sample mean value results: ROS of 11.7%; ROA of 6.7%; ROE of 32.9%; AT of .578; and GOODWILL % of 15.0%. Table 6-4 (Panel B) shows the following benchmark firm sample mean value results: ROS of 9.8%; ROA of 7.6%; ROE of 20.0%; AT of .780; and GOODWILL % of 15.2%.

Several key observations are evident in the above analysis. First, the defense firm sample ROS is higher by 1.9% than the benchmark ROS. Secondly, the benchmark firm sample AT rate is significantly better than the defense firm AT rate (.202). This favorable asset turnover performance results in the benchmark firm sample ROA slightly exceeding the defense firm sample ROA despite the lower ROS and EBIT performance of the benchmark firm sample. Additionally, the defense firm sample ROE is significantly higher than the benchmark firm sample ROE (32.9% vs 20.0%). This results from a combination of higher defense firm sample ROS and EBIT and the lower equity investment by defense sample firms than the benchmark

sample firms. The defense firm sample equity to total asset ratio is .21 while the corresponding benchmark firm sample ratio is .38.

Table 6-4 (Panel A) also provides accounting-based results for the defense firm sample by time period. ROS results by period are consistent with the market-based results as shown by the highest ROS returns being attained in Period 2 (12.4%) and Period 3 (13.8%). Similarly, Period 1 reveals the lowest returns at 8.5%. These improved results indicate that the industry consolidation activities that accelerated in Period 2 resulted in improved and sustained profit performance for the defense industry.

Other significant trends revealed by Table 6-4 (Panel A) for the defense firm sample is the large deterioration in asset efficiency performance and the significant growth in goodwill. Defense firm sample AT dropped from 0.814 turns in Period 1 to 0.545 turns in Period 4. This resulted in ROA remaining relatively flat over the study period despite improved ROS and EBIT performance. Contributing to this asset performance deterioration was a significant growth in goodwill by the defense sample firms. Goodwill as a percentage of total assets for the defense sample firms increased from 3.2% in Period 1 to 25.6% in Period 5. The average goodwill balance by year grew from \$12.2 billion in Period 1 to over \$200 billion starting in Period 4. This growth can be attributed to the continuous acquisition activity that occurred in the defense industry.

The benchmark firm sample accounting-based profitability results by time period are included on Table 6-4 (Panel B). The results indicate improving ROS from Period 1 (8.7%) through Period 4 (12.2%). Although the defense firm sample had higher ROS results over the total study period, the benchmark firm sample ROS exceeded the defense sample ROS in periods 1 and 4. Benchmark firm sample asset performance is higher than defense firm sample asset

performance throughout the study period. Benchmark firm sample ROA exceeds defense sample ROA by approximately 1% and AT was also significantly higher (0.780 turns versus 0.578 turns). This difference is consistent with prior research studies which find that defense contractor's asset efficiency is lower than their non-defense industry peers (GAO 1987).

The defense firm sample accounting-based profitability results were also partitioned by firm size and by percentage of a firm's total sales derived from defense sales. These results revealed additional consistencies between the accounting-based and market-based results. Table 6-5 (Panel A) shows the results by firm size (large, medium, or small sized firms). Large-sized firm ROS of 12.6% significantly exceeds the ROS of medium-sized firms (6.8%) and small-sized firms (6.0%). The data clearly shows the dominance of the defense industry by large-sized firms. The large-sized firms in the sample represented 83.7% of the total sample sales. The large-sized firms also achieved higher ROE performance over the study period. Their ROE was 33.9% in comparison to medium-sized firms earning 25.4% and small-sized firms earning 27.1%. While large-sized firms achieve greater profit rates, the AT performance of the large-sized firms of 0.524 turns clearly trails the performance of the medium-sized (1.259 turns) and small-sized firms (1.117 turns). The more favorable ROS and ROE performance results of the large-sized firms is consistent with the market-based performance results noted earlier for the large-sized firms.

Table 6-5 (Panel B) shows the partitioning of the defense firm sample's accounting-based data by percentage of a firm's total sales derived from defense sales (high, medium, or low percentage). This data reveals that the ROS for low-percentage firms (14.3%) very significantly exceeds the ROS of medium-percentage firms (8.3%) and high-percentage firms (9.4%). At the same time the results reveal that low-percentage firms greatly lagged the ROA and AT

performance of medium and high percentage firms. Low-percentage firms had a 5.9% ROA and an AT of .415, medium-percentage firms had a 7.9% ROA and an AT of .948, and high-percentage firms achieved a 9.9% ROA with an AT of 1.051. ROE results were approximately equal between low-percentage firms (32.2%) and high-percentage firms (32.0%). Medium-sized firms had slightly higher ROE at 36.9%.

Interestingly, for the full study period the market-based and accounting-based profitability returns of the low-percentage defense firms are not consistent relative to the returns of the high-percentage defense firms. High-percentage firms had higher market-based results with a positive alpha of 0.00566 in comparison to low-percentage firms who had a positive alpha of only 0.00141. However, on an accounting-based return basis high-percentage firms had a lower ROS of 9.4% versus the low-percentage firm's ROS of 14.3%. ROE's were approximately equal.

Further analysis of this inconsistency resulted in performing an alternative calculation of ROS and ROE. This alternative calculation uses net income instead of EBIT as the numerator for determining ROS and ROE. It can be argued that using net income for calculating ROS and ROE is more closely aligned with a firm's stock market performance. Based on using net income as the numerator in the calculation of ROS and ROE, the gap between the low and high-percentage firms changes considerably. ROS for high percentage firms is revised to 5.2% and the ROS for low-percentage firms was revised to 6.0%. ROE changes were even more dramatic, with high-percentage firm ROE of 17.8% now exceeding low-percentage firm ROE of 13.6%. This revised analysis is more consistent with the market-based analysis that found high-percentage defense firms are more profitable than low-percentage defense firms.

This change was primarily generated by significant profit and tax adjustments that are not included in EBIT. For example, General Electric (GE) is a very large conglomerate with a significant annual volume of defense sales. However, defense sales only represent approximately 3-5% of GE's total annual sales volume. Accordingly, GE is classified as a large-sized firm and a low-percentage defense contractor in this study. During 2015 through 2019, GE restructured its business and recorded a significant amount of charges that were not included in EBIT. GE's reported EBIT for that five-year period was \$55.0 billion while its reported net income was \$ - 30.4 billion. Goodwill impairment charges in 2018 alone were \$22.1 billion. Additional analysis noted that GE's profit results did not have a similar distortive effect on the study's other accounting-based and market-based defense firm results.

#### **6.4 Stock Market Performance- Supplementary Data**

As a final supplementary analysis, the annual stock market performance of the defense firm sample, benchmark firm sample, and the Standard & Poor's 500 (S&P 500) was compiled and compared. S&P data was obtained from Investopedia (Investopedia, 2020). Table 6-6 shows the performance results of the samples and the S&P 500 for the total study period and for the five interim periods within the study period.

Consistent with the main test results, the defense sample stock market performance has been strong over the study period. Over the total study period the defense sample realized a compound annual rate of return of 15.3%. This exceeds the 13.5% compound annual rate of return for the benchmark sample, and the 10.9% compound annual rate of return for the S&P 500. These returns include the annual change in stock price and the dividends paid.

The interim period stock market performance results are also consistent with the market-based and the accounting-based supplementary profitability results. During periods 2 and 3, the

defense firm sample results significantly exceeded the benchmark firm sample results and the S&P 500 results. During the significant defense industry consolidation of Period 2, the defense firm sample compound annual rate of return was 21.4% as compared to the benchmark firm sample return of 14.5%, and the S&P 500 return of 14.1%. During Period 3 (military conflict period in Iraq and Afghanistan and the 2008 recession), the defense sample compound annual rate of return was 11.1% versus the benchmark sample compound annual rate of return of 4.6% and the S&P 500 negative rate of return of -1.7%.

Investing \$100 in those samples or the S&P 500 for the total study period would have grown to \$12,638 for defense firm sample, \$7,456 for the benchmark firm sample, and \$3,342 for the S&P 500. These results point to a strong presumption that defense firm stock market returns were extraordinarily strong and potentially abnormal or excessive.

However, further analysis of the interim period returns reveal that the returns of the benchmark firm sample exceeded the defense firm sample return during periods 1, 4, and 5. On a cumulative basis, the benchmark firm sample return on a \$100 investment during that nineteen year period is \$1,848 versus the defense firm sample return of \$1,266 (S&P 500 return was \$1,306). Additionally, since 2008 the benchmark firm sample compound annual rate of return of 20.5% was slightly favorable to the defense firm sample return of 18.5%.

This supplementary analysis is consistent with the other supplementary testing results and the main test findings. It reveals the variability by period of whether defense industry profitability is higher or lower than its non-defense commercial or industrial firm peers. It also points out that timing is often everything when evaluating performance and that a study's findings must be considered in that context. Several prior defense profitability studies have made strong conclusions about excess defense industry profitability based on quite short time periods.

## CHAPTER 7. LIMITATIONS & ADDITIONAL RESEARCH

It is recognized that several limitations exist that may impact this study's findings. The most significant limitations are: 1) the judgmental selection process of the defense sample; 2) the lack of direct access to individual firm's financial results and circumstances; 3) the exclusion of defense contractors who are closely-held corporations, privately owned firms, or foreign-owned contractors; and 4) the sample size of small defense firms may not be adequate.

The study's main objective was to determine defense industry profitability. To obtain maximum sample coverage, a judgmental selection was made of large and medium-sized publicly held defense contractors. The coverage rate of the study's judgmental sample was significant. During 2016 to 2018, the study's defense firm sample represented approximately seventy percent of DoD's and NASA's contract awards as reported in Forecast International's annual Top 100 Contractors list (Forecast International, 2019).

Additionally, the study's objective was to have a more focused sample than what was used in prior research studies, and to have the ability to obtain detailed financial data of the firms selected. As a result, the study excluded firms that provide the DoD with products, services, or commodity items that are primarily sold in the commercial marketplace. These firms were categorized as commercial suppliers and not suppliers of defense-oriented products or services. The study also excluded privately-owned firms, closely-held corporations, and foreign-owned firms from the sample. Those firms were primarily excluded due to the inability to obtain adequate information concerning their financial results. As a result of the sampling design, the study results may not be generalizable to these excluded industry supplier groups.

For a variety of reasons, the ability to obtain adequate financial survey data directly from defense contractors is not achievable for academic researchers. As a result, academic studies and

this study utilize public-domain information for compiling financial results. The inability to obtain study data directly from defense firms reduces the accuracy and breadth of the study's accounting-based financial results. In addition, without such direct access it is not possible to obtain adequate financial information of privately-owned firms, closely-held corporations, and foreign-owned contractors.

The study's sampling design was primarily focused on large and medium-sized firms. While the study results were partitioned into large, medium, and small-sized firms, this segmenting was based on the relative size of the firms in the sample. The number of small-sized defense firms (under \$100 million in annual sales) in the study's sample was not significant. Therefore, the study results may not be generalizable to that supplier segment.

Due to the above limitations, several areas are noted where additional research would add to the study's findings. This study excluded foreign-owned or controlled contractors. The use by the DoD of foreign-owned contractors to support its major defense system requirements has increased over the past several decades. This use has increased in importance at both the prime contractor level and at all subcontractor and supplier levels. A separate study analyzing the profitability of this important industry segment would complement this study's results.

The DoD has implemented several strategies and programs over the years to incentivize small firms to become defense industry suppliers. However, the rules and regulations required in contracting with the DoD are costly and burdensome. This has made the industry unattractive to many smaller firms. The results of this study indicate that smaller firms have lower profitability levels than large or medium-sized firms. A more focused study on the profitability of this separate industry segment should be performed to further validate these findings.



It has been over thirty years since the DoD or the U.S. Congress has directed a comprehensive study of the profitability of the defense industry. The leverage that they have over the contractors is needed to motivate appropriate participation. In prior studies (DFAIR 86, GAO 87), it was recommended that periodic profitability studies of the industry should be performed using consistent methodologies. Those recommendations were not implemented.

It is recommended that a new study of defense industry profitability be commissioned by the DoD in the near future. Such a study would provide more accurate results and insight into the key factors affecting defense industry profitability and better ensure that the DIB is properly being rewarded and motivated.

## **CHAPTER 8. CONCLUSION**

This study's primary purpose was to revisit the topic of defense industry profitability. A majority of the prior literature finds that defense industry profitability is higher than the profitability of comparable non-defense commercial or industrial firms. In several cases the findings deemed defense industry profitability as excessive.

This study contributes to the literature on defense industry profitability in several ways. First, academic and non-academic research on this topic has been very scarce over the past twenty-five years. This study helps close the gap in the literature by analyzing defense industry profitability between 1986 and 2019. Secondly, this study is the first research study to use a Fama French model to evaluate the market-based profitability of the defense industry. Fama-French models did not become popular until after the majority of research on this topic was completed. The Fama-French models use several factors for accurately measuring abnormal returns for stock portfolios or investments. This study used the Fama-French + momentum

model to evaluate defense industry and a benchmark sample's market-based profitability over an extended time period.

The study also adds to the literature by utilizing a more focused approach for selecting a representative defense industry sample. It derives its baseline selection of defense firms from two comprehensive defense profitability studies performed in the 1970's and 1980's. Those studies were primarily performed to evaluate defense industry profitability and the health of the defense industrial base. Added to this baseline were significant defense firms that were established after 1985. Prior studies often included defense firm samples that were overly broad or narrow in selection criteria. This study excludes contractors whose products, services, or commodities were primarily sold for non-defense purposes.

Using the benefits of the length of the study's longitudinal design the study adds breadth to the literature by evaluating defense industry profitability using several factors. Through supplemental market-based and accounting-based profitability analysis, the study evaluated profitability by interim time periods, by firm size, and by percentage of a firm's sales derived from defense sales. Earlier studies often evaluated profitability over relatively short time periods which inhibited the adequacy of factor trend analysis.

The study's main test results support the null hypothesis that defense firm market-based profitability over the past thirty-four years is similar to the profitability of its non-defense commercial or industrial peers. The testing also reveals that the profitability of the defense firms and their non-defense peers has been abnormally positive during the study period. This conclusion is based on test results using the Fama-French Model. The total study period results for the defense firm sample reveal a positive monthly profitability alpha of 0.00353 and the findings were statistically significant at  $p < .05$ . Those results equate to a positive annual

profitability alpha of 4.24%. The test results for the benchmark sample reveal a positive monthly alpha result of 0.0340 (4.08% annual rate) and was also statistically significant at  $p < .05$ .

To evaluate if the differences between the profitability alphas of the defense and benchmark samples were statistically significant a t-test was performed. The t-test results indicate that the differences are not statistically significant on both a winsorized and non-winsorized basis. This testing provides support that while defense firm profitability was abnormally high during the study period, it is similar in comparison to a benchmark sample of non-defense commercial or industrial firms.

Additional supplementary market-based and accounting-based profitability testing was performed. Those testing results were consistent with each other and were supportive of the main test results. Those results also indicated similar profitability levels between the defense and benchmark firm samples. Defense firm accounting-based profitability results, as measured by ROS and ROE, were higher than the returns of the benchmark firms over the total study period. However, benchmark firm profitability was higher during several interim time periods, and achieved significantly higher asset return performance (ROA and AT) over the full study period.

The market-based supplementary results also revealed several key factors influencing defense firm profitability during the study period. The results show that large and medium-sized defense firms achieved positive abnormal alpha levels that were statistically significant. Small-sized defense firms did not. The results also revealed that high and medium % defense firms also achieved positive abnormal alpha levels while low % defense firms did not. These results point to higher profitability performance for defense firms who attain greater size and whose defense sales are a higher percentage of a firm's total sales.

The market-based and accounting-based supplementary results also revealed that defense firm profitability strongly improved beginning in the mid-1990's when the industry was essentially forced into extensive consolidation and downsizing actions due to large defense budget reductions. In retrospect, the motivation of those actions by senior DoD leadership in 1993 was instrumental in helping the industry survive and become more financially sound. The interim period financial results also indicate that the defense industry was able to successfully and consistently adapt to the multitude of changes and challenges it faced over the past three decades.

The financial health of the firms that comprise the U.S. DIB is crucial to the economic and national security of the country. The DIB firms must achieve and maintain adequate profitability levels in order to remain an attractive investment in the very competitive capital markets. If defense profitability levels deteriorate the investment community will reallocate its capital investments to other market sectors. This will unfavorably affect the industry's ability to remain cost competitive, productive, and innovative.

At the same time, the government must ensure that taxpayer dollars are spent wisely and frugally. The government must establish procurement policies, rules, and regulations that control and monitor this spending and motivate the performance of its contractors. The use of profit has been a key motivator for ensuring that this happens and the profitability levels of the DIB should not be excessive or inadequate. Accurate periodic assessments of defense contractor profitability are necessary to ensure that the government maintains policies and regulations that properly rewards and sustains the DIB.

This study's findings reveal that the profitability of the defense industry has been similar to the profitability of its non-defense commercial or industrial peer firms over the past thirty-four

years (1986-2019). The study results also reveal that defense industry market-based profitability results were abnormally positive over the study period. This confirms that the investment community has viewed the defense sector as an attractive business sector based on its financial performance and prospects. Those results are favorable signs for sustaining a critical asset of this nation.

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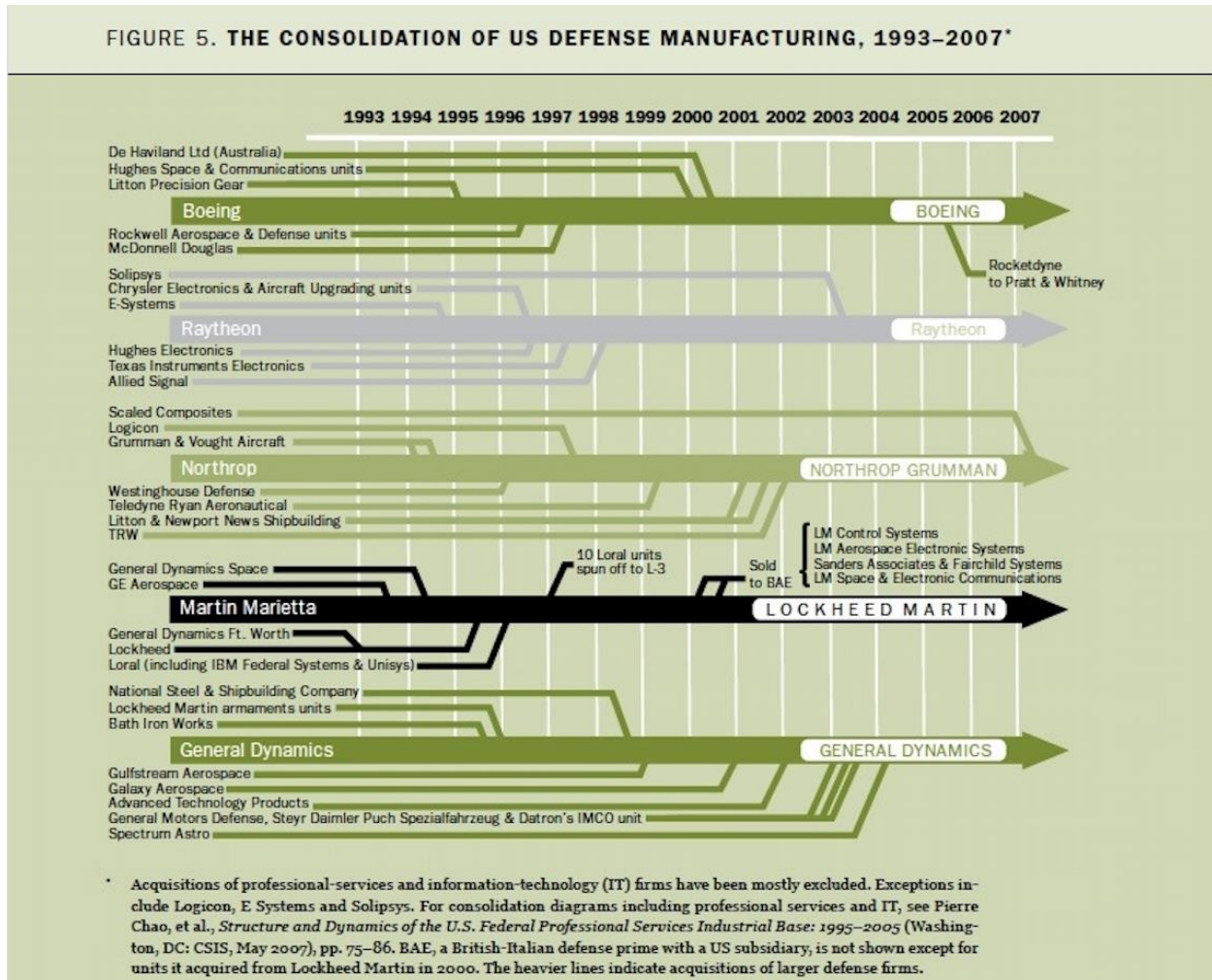
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### Exhibit 3-1.



Source: Watts B. 2008. The US Defense Industrial Base: Past, Present and Future The US Defense Industrial Base: Past, Present and Future. *Center for Strategic and Budgetary Assessments*. Washington, DC: p.33. Available at: <https://csbaonline.org/uploads/documents/2008.10.15-Defense-Industrial-Base.pdf> (Downloaded May 17, 2020).

**Table 4-1. Summary - Academic Studies**

Study Name	Years Measured	Primary Profitability Measure	Sample Size- Defense Firms	Comparable Group	Findings
Stigler-1971	1948-1961, 1962-1967	Market-based rate of return	Top 50 & 54 defense firms	NYSE- all stocks	Defense profits higher (1948-1961); lower (1958-1968)
Bohi-1973	1960-1969	ROE	36 large defense firms	Fortune 500- largest mfgs.	Equal profitability
Higgs-1992	1970-1979, 1980-1989	Market-based rate of return	Top 10 & Top 50 defense firms	S&P 500 stock index	Defense profits higher (1970-79); equal (1980-89)
Lichtenburg-1992	1984-1989	ROA	833 defense segments	Between defense firms and other segments	Defense firms more profitable: cost shifting likely
Thomas & Tung-1992	1980- 1983	NA Pension funding levels	80 defense firms	Inter- and intra-firm variation in pension funding	Cost shifting likely
McGowan & Vendryzk- 2002	1984-1989, 1994-1998	ROA	Multi-segment defense firms-35 & 27	Between segments	Defense profits higher (1984-1989; profits equal (1994-1998). Cost shifting not found.
Zhong & Gribbin-2009	1984-1998	R&D adjusted ROA (AdROA)	11,051 firm year observations	Within multi-segment firm (defense & non-defense) comparison	Defense firm profits lower
Wang & San Miguel- 2012	1950-2010 (2008 used for sample selection baseline)	ROA, ROCE, PMR, OMR	112 defense firms	Between defense firms and comparably sized commercial firms	Defense firm profits higher (1950-2010)
Wang- 2014	Revalidated 2008 for lower sample size (based on Wang & San Miguel-2012)	ROA	90 defense firms	Between defense firms and comparably sized commercial firms	Defense firm profits higher (2008)
Chen & Gunny-2014	2005-2010	ROA	258 defense firms, 1,505 firm years	Cost-type vs fixed-price contracts	Profits increase with increase in cost-type contracts. Cost shifting indicated.

**Table 4-2. Summary - Non-Academic Studies**

Study Name	Years Measured	Primary Profitability Measure	Sample Size- Defense Firms	Comparable Group	Findings
LMI- 1969	1958-1961, 1962-1967	ROA	40 large & medium sized defense firms	FTC and SEC durable goods mfgs.	Defense firm profits higher (1958-1961); Comml. firm profits higher (1962-1967)
Comptroller General- 1971	1966-1969	ROA	74 large defense firms	Between the firms' defense & comml. segments	Profitability approximately equal
Profit '76- 1977	1970-1974	ROA, ROS	64 large defense firms: 168 profit centers	Between defense and comml. profit centers; and FTC durable goods grouping	Defense firm ROS lower; Comml. profit center ROA higher, FTC ROA lower than defense profit centers
DFAIR- 1986	1970-1979, 1980-1983	Adjusted ROA	76 large defense firms	Refined selection of durable goods grouping	Profitability approx. equal (1970-79); Defense firm profits higher 1980-83
GAO- 1987	Re-calculated DFAIR results; and 1979-1984	ROA, ROE, ROS, Cash flow, Mkt. based returns	84 large defense firms	DFAIR comparison: between defense and comml. segments	DFAIR results contradicted- defense firm profits higher in both periods; GAO study also finds defense firms more profitable

**Table 5-1. Defense Firm Baseline Sample- Sources and Adjustments**

	DFAIR & Profit '76	DFAIR non- response	Totals
Total Firms	76	49	125
Less Adjustments:			
1) Mid to late 1980's merged/acquired	-12	-13	-25
2) Private/closely held	-6	-8	-14
3) Foreign owned	-3	0	-3
4) Commercial/commodity products or services	-13	-13	-26
5) Other	-1	-3	-4
Adjusted Sample	41	12	53

This table summarizes the sources of the defense firm baseline sample and the adjustments made to that baseline sample. The primary sources of the baseline sample were the seventy-six firms who participated in either the DFAIR (1986) or Profit '76 (1977) studies, and the forty-nine firms who elected to not participate in the DFAIR study (DFAIR non-response). Several adjustments were made to the baseline sample to create a more focused defense sample. The following eliminations were made: 1) firms that ceased to exist in the mid to late 1980's due acquisition, merger, spin-off, or exiting the defense industry; 2) private or closely-held firms; 3) foreign-owned firms; 4) firms that primarily provide commercial or commodity goods or services; and 5) firms with unavailable data.

**Table 5-2. Defense Firm Sample - 77 Public U.S. Firms**

Name	Study Source	Years in Study	Stock Ticker	SIC	Sales- Year (\$-billions)
Lockheed Martin	DFAIR/Profit 76	1986-2019	LMT	3761	\$59.8- 2019
Martin Marietta	DFAIR/Profit 76	1986-1995	ML	3761	\$9.4- 1993
Boeing	DFAIR/Profit 76	1986-2019	BA	3721	\$101.1- 2019
McDonnell Douglas	DFAIR/Profit 76	1986-1997	MD	3721	\$13.8- 1996
Northrup Grumman	DFAIR/Profit 76	1986-2019	NOC	3812	\$33.8- 2019
Grumman Aircraft	DFAIR/Profit 76	1986-1994	GQ	6711	\$3.2- 1993
Harris	DFAIR/Profit 76	1986-2019	HRS	3812	\$6.8- 2019
General Dynamics	DFAIR/Profit 76	1986-2019	GD	3731	\$39.4- 2019
Raytheon	DFAIR/Profit 76	1986-2019	RTN	3812	\$29.2- 2019
United Technologies	DFAIR/Profit 76	1986-2019	UTX	3724	\$66.5- 2018
Honeywell (Allied Signal)	DFAIR/Profit 76	1986-2019	HON	3714	\$36.7- 2019
ITT	DFAIR/Profit 76	1986-2011	ITT	3561	\$11.0- 2010
Kaman Aerospace	DFAIR/Profit 76	1986-2019	KAMN	5084	\$7- 2019
CACI International	DFAIR/Profit 76	1986-2019	CACI	7373	\$5.0- 2019
Rockwell International	DFAIR/Profit 76	1986-1996	ROK	3714	\$10.4- 1996
Aerojet Rocketdyne	DFAIR/Profit 76	1986-2019	AJRD	3812	\$2.0- 2019
General Electric	DFAIR/Profit 76	1986-2019	GE	3511	\$95.2- 2019
Litton	DFAIR/Profit 76	1986-2001	LIT	3812	\$5.6- 2000
E-Systems	DFAIR/Profit 76	1986-1995	ESY	3662	\$2.0- 1994
EDO	DFAIR/Profit 76	1986-2007	EDO	3662	\$7- 2008
Harsco	DFAIR/Profit 76	1986-1997	HSC	3446	\$1.7- 1998
TRW	DFAIR/Profit 76	1986-2002	TRW	3714	\$16.4- 2001
Todd Shipyards	DFAIR/Profit 76	1986-2011	TOD	3731	\$2- 2009
United Industrial	DFAIR/Profit 76	1986-2007	UIC	8731	\$6- 2006
AEL Industries	DFAIR/Profit 76	1986-1996	AELNA	3662	\$1- 1994
FMC	DFAIR/Profit 76	1986-1997	FMC	3523	\$4.4- 1998
Logicon	DFAIR/Profit 76	1986-1997	LGN	8911	\$6- 1996
Talley Industries	DFAIR/Profit 76	1986-1998	TAL	3873	\$5- 1996
Texas Instruments	DFAIR/Profit 76	1986-1997	TXN	3674	\$8.5- 1998
Westinghouse Electric	DFAIR/Profit 76	1986-1996	WX	3613	\$6.3- 1995
Watkins-Johnson	DFAIR/Profit 76	1986-1999	WJ	3662	\$1- 1998
Arvin Industries	DFAIR/Profit 76	1986-2000	ARV	3714	\$3.1- 1999
EG&G	DFAIR/Profit 76	1986-1999	EGG	8911	\$1.4- 1998
Thiokol	DFAIR/Profit 76	1989-2000	TKC	2891	\$2.5- 1999
Hercules	DFAIR/Profit 76	1986-1995	HPC	2816	\$2.8- 1994
UNISYS	DFAIR/Profit 76	1986-1995	UIS	3573	\$7.4- 1994
SEQUA (Sun Chemical)	DFAIR/Profit 76	1987-2003	SQA	2893	\$2.0- 2005
LTV	DFAIR/Profit 76	1986-1992	LTV	3316	\$3.8- 1992
Tenneco	DFAIR/Profit 76	1986-1996	TEN	4922	\$6.6- 1996
Computer Sciences	DFAIR/Profit 76	1986-2015	CSC	7373	\$13.0- 2013
Morrison Knudson	DFAIR/Profit 76	1986-1996	MRN	1622	\$1.7- 1995
Textron	DFAIR-NR	1986-2019	TXT	3999	\$13.6- 2019
Leidos (Original SAIC)	DFAIR-NR	2006-2019	LDOS	7373	\$11.1- 2019

**Table 5-2. (Continued)**

Name	Study Source	Years in Study	Stock Ticker	SIC	Sales- Year (\$-billions)
Loral	DFAIR-NR	1986-1996	LOR	3679	\$5.5- 1994
Whittaker	DFAIR-NR	1986-1999	WKR	5051	\$1- 1998
Goodrich	DFAIR-NR	1986-2012	GR	3761	\$8.1- 2011
Cubic	DFAIR-NR	1986-2019	CUB	3723	\$1.5- 2019
Curtiss-Wright	DFAIR-NR	1986-2019	CW	3724	\$2.5- 2019
Sparton	DFAIR-NR	1986-2019	SPA	3672	\$.4- 2018
Rohr	DFAIR-NR	1986-1997	RHR	3728	\$.9- 1997
Sundstrand	DFAIR-NR	1986-1999	SNS	3541	\$2.0- 1998
California Microwave	DFAIR-NR	1986-1999	CMIC	3662	\$.3- 1998
Teledyne	DFAIR-NR	1986-1999	TDY	3662	\$2.3- 1999
Orbital Science	NEW	1990-2015	ORB	3663	\$1.4- 2013
Oshkosh	NEW	1986-2019	OSK	3711	\$8.4- 2019
Alliant Techsystems	NEW	1990-2018	ATK	3764	\$4.7- 2017
Rockwell Collins	NEW	2001-2018	COL	3728	\$8.7- 2018
L-3 Technologies	NEW	1998-2019	LLL	3812	\$10.2- 2018
Huntington-Ingalls	NEW	2011-2019	HII	5088	\$8.9- 2019
SAIC (new)	NEW	2013-2019	SAIC	8731	\$6.4- 2019
Exelis	NEW	2011-2015	XLS	3812	\$3.3- 2014
DRS Technologies	NEW	1986-2008	DRS	3662	\$3.3- 2007
Teledyne Technologies	NEW	1999-2019	TDY	8711	\$3.2- 2019
Vectrus	NEW	2014-2019	VEC	8744	\$1.4- 2019
AECOM	NEW	2007-2019	ACM	8711	\$20.2- 2019
URS	NEW	1986-2014	URS	8911	\$11.0- 2013
KBR	NEW	2006-2019	KBR	1629	\$5.6- 2019
MOOG	NEW	1986-2019	MOG	3494	\$2.9- 2019
Newport News Shipbldg	NEW	1996-2002	NNS	3731	\$2.1- 2000
Mantech International	NEW	2002-2019	MANT	7373	\$2.2- 2019
Titan	NEW	1986-2005	TTN	3679	\$2.0- 2004
Transdigm	NEW	2006-2019	TDG	3728	\$5.2- 2019
Fluor Corp.	NEW	1986-2019	FLR	1623	\$19.2- 2018
CSRA	NEW	2015-2018	CSRA	7374	\$5.0- 2016
Woodward	NEW	1997-2019	WWD	3728	\$2.9- 2019
RBC Bearings	NEW	2005-2019	ROLL	3562	\$.7- 2019
Jacobs Engineering	NEW	1986-2019	JEC	8711	\$12.7- 2019

This table presents the seventy-seven firms included in the study's defense sample. The firms were obtained from the following sources: DFAIR (1986) and Profit '76 (1977) studies; DFAIR (NR)-non-respondents to the DFAIR study; and NEW- medium or large firms that were not included in the DFAIR study in 1986 or new firms that were formed after the DFAIR study. New firms were included in the study when their sales levels exceeded \$100 million. Firms ceased to be included when they were de-listed from the applicable stock exchange or exited the defense industry. The table includes the years the firms were included in the study, stock ticker, standard industrial classification (SIC) code, and sales in the most recent year that financial data was available.

**Table 5-3. Defense Firm Sample-Distribution and Frequency of SIC Codes**

Industry Sector Name	2-Digit SIC Code	Firm Frequency	Number of 4-Digit SIC Sub-Codes
1) Transportation Equipment	37	21	9
2) Electronic & Other Electric Equipment	36	13	6
3) Instruments & Related Products	38	8	2
4) Industrial Machinery & Equipment	35	6	6
5) Engineering & Management Services	87	6	3
6) Business Services	73	5	2
7) Chemical & Allied Products	28	3	3
8) Wholesale Trade Durable Goods	50	3	3
9) Heavy Construction Except Building	16	3	3
10) Services, Not Elsewhere Classified	89	3	1
11) Fabricated Metal Products	34	2	2
12) Primary Metal Industries	33	1	1
13) Miscellaneous Manufacturing	39	1	1
14) Holding & Other Investment Offices	67	1	1
15) Electric, Gas, & Sanitary Services	49	1	1
Totals	15 sectors	77 firms	44 sub-code groups

This table summarizes the standard industrial classification (SIC) codes of the defense firm sample. Industry name, 2-Digit SIC codes, and frequency of sample firms in the various 2-Digit SIC codes are presented. The defense firm sample is comprised of fifteen separate 2-Digit SIC code sectors. Over half of the firms in the defense sample are included in the top three 2-Digit SIC code sectors. Also presented is the number of 4-Digit sub-code groupings of the defense firm sample. The defense sample is comprised of forty-four separate 4-Digit sub-code groupings. Over half of the defense firms were included in the top four 4-Digit SIC sub-code groupings.

**Table 6-1. Market-Based Returns- Full Study Period (1986 to 2019)**

	Panel A		Panel B	
	Defense Sample		Benchmark Sample	
	Returns	Returns Winsorized	Returns	Returns Winsorized
Abnormal Returns-Alpha	0.00353*	0.00325*	0.00340*	0.00178
	(2.48)	(2.47)	(2.25)	(1.47)
MKTRF	0.968**	0.920**	1.078**	1.036**
	(21.38)	(25.26)	(28.29)	(33.87)
SMB	0.309**	0.285**	0.658**	0.583**
	(3.61)	(3.72)	(11.52)	(10.81)
HML	0.421**	0.398**	0.0831	0.105
	(5.48)	(5.38)	(1.17)	(1.90)
UMD	-0.054	-0.0289	-0.232**	-0.181**
	(-1.21)	(-0.70)	(-3.79)	(-5.51)
R-Squared	0.744	0.737	0.824	0.846
Observations -months	408	408	408	408

Statistical significance \*=p<0.05; \*\*= p<0.01. T statistics in parentheses

This table shows market-based returns and factor loadings of the defense firm and benchmark firm samples for the full study period. The study period is 1986 through 2019. The returns are calculated using the Fama-French + momentum model (FF Model). The profitability return alpha is the intercept in a time-series regression of monthly excess returns of the sample. The explanatory variables used in the FF Model are market return minus risk free rate (MKTRF), excess return of value stocks (HML), size effect based on market capitalization (SMB), and momentum of stock price (UMD). The returns are in monthly percentage and t-statistics are shown below the coefficient estimates. Statistical significance, if any, is indicated at 5% and 1% levels. Returns were also calculated on a winsorized basis to limit the influence of outliers. The percentiles used in the winsorization process were set at 1% and 99%. Panel A reports the study's main test results for the defense firm sample for the full study period. Panel B reports the results for the benchmark sample for the full study period.



**Table 6-2. Defense Firm Sample – Market-Based Returns by Firm Size and % Defense**

Panel A - Firm Size	Large	Medium	Small
Abnormal Returns- Alpha	0.00405** (2.68)	0.00462** (2.60)	0.00189 (0.94)
MKTRF	0.983** (22.30)	1.057** (18.31)	0.858** (14.63)
SMB	-0.115 (-1.75)	0.312* (2.43)	0.742** (6.78)
HML	0.347** (4.36)	0.485** (5.08)	0.432** (4.56)
UMD	-0.0329 (-0.75)	-0.0398 (-0.79)	-0.0912 (-1.18)
R-Squared	0.693	0.667	0.621
Observations- months	408	408	408
Panel B - % Defense	High	Medium	Low
Abnormal Returns-Alpha	0.00566** (2.60)	0.00349* (2.04)	0.00141 (0.89)
MKTRF	0.833** (13.32)	0.910** (16.98)	1.161** (25.73)
SMB	0.385** (3.89)	0.304** (3.12)	0.228** (2.65)
HML	0.372** (3.53)	0.401** (4.58)	0.477** (6.37)
UMD	-0.002 (-0.03)	-0.0416 (-0.79)	-0.117* (-2.30)
R-Squared	0.505	0.644	0.758
Observations-months	408	408	408

Statistical significance \*p<0.05; \*\*= p<0.01. T statistics in parentheses.

This table shows market-based returns and factor loadings of the defense firm sample based on relative firm size and based on percent of a firm's sales derived from defense sales. The period is 1986 through 2019. The returns are calculated using the Fama-French + momentum model (FF Model). The profitability return alpha is the intercept in a time series regression of monthly excess returns of the sample. The explanatory variables used in the FF Model are market return minus risk free rate (MKTRF), excess return of value stocks (HML), size effect based on market capitalization (SMB), and momentum of stock price (UMD). The returns are in monthly percentage and t-statistics are shown below the coefficient estimates. Statistical significance, if any, is indicated at 5% and 1% levels. Panel A includes results partitioned by firm size. The defense sample was annually divided into terciles (Large, Medium, Small) based on market capitalization of the sample's firms. Panel B includes results partitioned by percentage of total sales derived from defense sales. The sample was annually divided into terciles (High, Medium, Low) based on defense firm sales percentages.

**Table 6-3. Defense Firm Sample- Market-Based Returns by Interim Period**

	Period 1	Period 2	Period 3	Period 4	Period 5
Abnormal Returns- Alpha	-0.00248 (-1.03)	0.0045 (1.90)	0.00569 (1.70)	0.00231 (1.09)	0.00498 (1.09)
MKTRF	1.078** (21.00)	1.018** (15.67)	1.028** (9.72)	1.053** (15.41)	1.119** (8.95)
SMB	0.603** (7.50)	0.339** (3.61)	0.417** (2.88)	0.390** (4.29)	0.373 (2.03)
HML	0.193* (2.27)	0.777** (5.75)	0.387 (1.96)	-0.0196 (-0.22)	0.36 (1.60)
UMD	-0.149 (-1.61)	-0.224** (-3.85)	0.240** (2.95)	-0.0846 (-1.95)	0.137 (0.78)
R-Squared	0.899	0.695	0.725	0.872	0.786
Observations- months	90	98	86	96	38

Statistical significance \*= p<0.05; \*\* =p<0.01. T statistics in parentheses.

This table shows market-based returns and factor loadings of the defense firm sample for interim time periods within the full study period. The full study period is 1986 through 2019. The returns are calculated using the Fama-French + momentum model (FF Model). The profitability return alpha is the intercept in a time-series regression of monthly excess returns of the sample. The explanatory variables used in the FF Model are market return minus risk free rate (MKTRF), excess return of value stocks (HML), size effect based on market capitalization (SMB), and momentum of stock price (UMD). The returns are in monthly percentage and t-statistics are shown below the coefficient estimates. Statistical significance, if any, is indicated at 5% and 1% levels. The interim time periods used are based on significant events that impacted the defense industry and stock market. Period 1 was 1986 through June, 1993. Period 2 was July, 1993 through August, 2001. Period 3 was September, 2001 through October, 2008. Period 4 was November, 2008 through October, 2016. Period 5 was November, 2016 through 2019.

**Table 6-4. Accounting-Based Returns- Interim Periods and Full Period**

Panel A Defense Firm Sample (\$-billions)						
	Period 1 (1986-1993)	Period 2 (1994-2001)	Period 3 (2002-2008)	Period 4 (2009-2016)	Period 5 (2017-2019)	Full Period (1986-2019)
Sales	\$2,446	\$2,718	\$3,488	\$4,823	\$1,788	\$15,263
ROS	8.5%	12.4%	13.8%	11.5%	11.3%	11.7%
ROA	6.9%	7.4%	6.6%	6.3%	7.3%	6.7%
ROE	30.9%	38.8%	33.3%	28.9%	39.3%	32.9%
Asset Turnover	0.814	0.601	0.48	0.545	0.652	0.578
Goodwill	\$97	\$438	\$1,102	\$1,612	\$703	\$3,953
Goodwill %	3.2%	9.7%	15.2%	18.2%	25.6%	15.0%

Panel B Benchmark Firm Sample (\$-billions)						
	Period 1 (1986-1993)	Period 2 (1994-2001)	Period 3 (2002-2008)	Period 4 (2009-2016)	Period 5 (2017-2019)	Full Period (1986-2019)
Sales	\$610	\$539	\$517	\$568	\$303	\$2,538
ROS	8.7%	8.3%	9.7%	12.2%	10.2%	9.8%
ROA	7.1%	8.1%	8.6%	7.6%	6.8%	7.6%
ROE	22.7%	22.8%	19.4%	17.9%	18.9%	20.0%
Asset Turnover	0.812	0.977	0.883	0.625	0.667	0.78
Goodwill	\$20	\$61	\$109	\$218	\$85	\$494
Goodwill %	2.6%	11.1%	18.6%	24.0%	18.8%	15.2%

This table presents the defense sample's accounting-based profitability and asset performance results for the total study period (1986 through 2019). Additionally, the total period results are partitioned into five interim time periods for analyzing performance trends during the study period. The interim time periods used are based on significant events that impacted the defense industry and the stock market. Period 1 was 1986 through 1993. Period 2 was 1994 through 2001. Period 3 was 2002 through 2008. Period 4 was 2009 through 2016. Period 5 was 2017 through 2019. The financial data was obtained from Compustat and is not adjusted for inflation. Balance sheet amounts were based on a firm's end of fiscal year or calendar year results. The measurements used are calculated as follows: 1) Return on Sales (ROS) equals Earnings Before Interest and Taxes (EBIT)/Sales; 2) Return on Assets (ROA) equals EBIT/Total Assets; 3) Return on Equity equals EBIT/Total Equity; 4) Asset Turnover (AT) equals Total Assets/Sales; and 5) Goodwill % equals Goodwill/Total Assets.

**Table 6-5. Defense Firm Sample- Accounting-Based Returns- Firm Size and %Defense**

Panel A Defense Firm Sample- Firm Size (\$-billions)			
	Large	Medium	Small
Sales	\$12,780	\$2,052	\$431
ROS	12.6%	6.8%	6.0%
ROA	6.6%	8.6%	6.7%
ROE	33.9%	25.4%	27.1%
Asset Turnover	0.524	1.259	1.117
Goodwill	\$3,499	\$370	\$85
Goodwill %	14.4%	22.7%	21.9%

Panel B Defense Firm Sample- % Defense (\$-billions)			
	High	Medium	Low
Sales	\$3,614	\$3,771	\$7,878
ROS	9.4%	8.3%	14.3%
ROA	9.9%	7.9%	5.9%
ROE	32%	36.9%	32.2%
Asset Turnover	1.051	0.948	0.415
Goodwill	\$1,178	\$504	\$2,273
Goodwill %	34.2%	12.7%	14.9%

This table presents the results of partitioning the defense firm sample's accounting-based profitability performance results. The results are partitioned based on relative firm size and based on the percentage of a firm's total sales that are derived from defense sales (% Defense). The results are for the total study period (1986-2019) and are not adjusted for inflation. The data was obtained from Compustat. Balance sheet amounts were based on end of fiscal year or calendar year results. The measurements are calculated as follows: 1) Return on Sales (ROS) equals Earnings Before Interest and Taxes (EBIT)/Sales; 2) Return on Assets (ROA) equals EBIT/Total Assets; 3) Return on Equity (ROE) equals EBIT/Total Equity; 4) Asset Turnover (AT) equals Total Assets/Sales; and 5) Goodwill % equals Goodwill/Total Assets. Panel A includes results partitioned by firm size. The defense firm sample was annually divided into terciles (Large, Medium, Small) based on the market capitalization of the sample's firms. Panel B includes the results partitioned by % Defense. The defense firm sample was annually divided into terciles (High, Medium, Low) based on the % Defense of the sample's firms.

**Table 6-6. Stock Market Return Performance**

Panel A- Cumulative Compound Returns						
	Period 1 (1986-1993)	Period 2 (1994-2001)	Period 3 (2002-2008)	Period 4 (2009-2016)	Period 5 (2017-2019)	Full Period (1986-2019)
Defense Sample	197.3%	471.5%	209.2%	397.7%	163.3%	12638.3%
Benchmark Sample	238.7%	295.3%	36.7%	425.0%	182.1%	7456.3%
S&P 500	290.5%	286.9%	-11.0%	293.7%	152.7%	3342.4%

Panel B- Average Annual Returns						
	Period 1 (1986-1993)	Period 2 (1994-2001)	Period 3 (2002-2008)	Period 4 (2009-2016)	Period 5 (2017-2019)	Full Period (1986-2019)
Defense Sample	8.9%	21.4%	11.1%	18.8%	17.8%	15.3%
Benchmark Sample	11.5%	14.5%	4.6%	19.8%	22.1%	13.5%
S&P 500	14.3%	14.1%	-1.7%	14.4%	15.2%	10.9%
Study years	8	8	7	8	3	34

This table shows stock market performance of the study's defense and benchmark firm samples and the Standard & Poor 500 (S&P 500) for the full study period (1986 through 2019) and for the five interim periods. The five interim periods used are consistent with the interim time periods used in the accounting-based profitability analysis (Table 6-4). Defense and benchmark firm returns were obtained from CRSP. S&P 500 returns were obtained from Investopedia. Annual returns are measured by the calendar year change in a firm's stock price and the dividends paid. Results are not adjusted for inflation. Panel A presents the cumulative compound returns for the five interim periods and the total study period for the defense firm sample, the benchmark firm sample, and the S&P 500. Panel B presents the average annual return for the five interim periods and the total study period for the defense firm sample, benchmark firm sample, and the S&P 500.

## **BIOGRAPHICAL SKETCH**

John Canzio was born in Fitchburg, Massachusetts. John received his Bachelor of Science degree with a major in Accounting from Quinnipiac University. John also has earned a Master in Business Administration from the University of Hartford, and a Master of Science in Entrepreneurship from the University of Florida. John is currently enrolled in the Doctor of Business Administration program at the University of Florida. John has been a licensed CPA in the state of Connecticut since 1982.

John's professional career spans over forty years. He was a senior audit manager at Price Waterhouse working on several Fortune 500 clients. John was also the Director of Internal Audit at Textron-Fafnir. More recently, John served as the CFO of Pratt & Whitney's Military Engines Division for over fifteen years. Pratt & Whitney is the world leader in jet engines for military fighter and transport planes. John also served as the CFO for Aerojet-Rocketdyne's operations until 2015.

John is currently a financial consultant specializing in aerospace, government contracting, and personal financial planning. He also serves on the Corporate Board and the Finance Committee of the Jupiter Medical Center in Jupiter, Florida.