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Economic Moat: A Line of Defense for the Defense Industry

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ECONOMIC MOAT: A LINE OF DEFENSE FOR THE DEFENSE INDUSTRY

THESIS

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Abstract

Defense contractor financial performance is traditionally measured using accounting profit. In academic literature, accounting profit has been proxied through different applications of accounting rates of return. However, the use of these rates pose certain limitations. First, accounting rates of return have been applied inconsistently. Next, academic research has not typically assessed accounting returns against a firm's opportunity costs. As a result, there is a literature gap in defense research that assesses whether defense contractors earn sustainable returns beyond the cost to produce those returns.

This exploratory research aims to address the research gap in defense contractor financial performance by examining economic profit. This thesis adopts the concept of competitive advantage as a measure of economic profit. Economic profit, proxied by economic moat, is superior to the current methods used in academic literature because it considers the following: Return on Invested Capital, an accounting rate of return, and Weighted Average Cost of Capital, an economic rate of return. Firms with economic moat possess attributes such as intangible asset investments, efficiency scale, cost advantages, and pricing power. Firms that have sustained competitive advantage with these attributes have built moats, or defenses, that prevent competition, preserve profits, and create long-term value.

This study finds that defense contractors' intangible assets investments are negatively associated with economic moat while efficiency scale is positively associated with economic moat. Neither cost advantages nor pricing power indicated significant relationships. An implication from this finding is that defense contractors' asset investments are a potential driver in sustained competitive advantage which is a critical element for the Department of Defense to advance its national defense strategies.

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I. Introduction

Background

The study of defense contractor financial performance has most often been motivated by scrutinizing levels of profitability. In academic literature, defense contractor profit levels traditionally have been measured by accounting rates of return. A commonly used rate is Return on Assets (ROA), but the vast scope of studies have also analyzed metrics such as share price appreciation and net worth. Accounting rates of return can be appropriate proxies to measure defense contractor profit because they are calculated from objective data such as financial statements. Especially for public defense contractors, accounting and financial reports are available through the U.S. Securities and Exchange Commission or through other publicly-accessible research databases. However, the use of accounting rates of return to assess contractors' profitability has certain limitations.

An issue observed in academic literature is that accounting rates of return have been applied inconsistently, which has been identified as a weakness by the U.S. Government Accountability Office (GAO, 1986). Another issue is that accounting rates of return defense contractor profit studies are not normally compared against defense contractor's opportunity costs. As a result, there is a lack of defense literature that compares defense contractors' returns beyond the cost to produce those returns. This comparison provides crucial implications on defense contractors' ability to enjoy long-term operational stability.

Motivation

Profit studies in defense research have traditionally used accounting rates of return which has created a literature gap in assessing financial performance as economic profit. This thesis adopts Morningstar's concept of competitive advantage as a measure of economic profit for defense contractors. Economic profit, proxied by economic moat, is superior to the current methods used in literature because it considers the following: accounting rate of return, or Return on Invested Capital (ROIC) and economic rate of return, or Weighted Average Cost of Capital (WACC). For accounting rates of return to derive useful information, they must be compared to economic rates of return.

Fisher and McGowan (1983) critique the use of accounting rates of return as an index of profit-relationships. They posit that accounting rates of return can be subject to measurement problems such as applying inconsistent financial reporting and neglecting to account for inflation. Further, Fisher and McGowan (1983) point to a more fundamental issue that accounting rates of return do not measure economic rates of return. They describe economic rates of return on an investment as a discount rate equal to the present value of a firm's expected revenue stream to its initial outlay. By this definition, an economic rate of return is the minimum return that a firm must earn from its revenue such that the revenue stream equals its initial investment. Additionally, an economic rate of return above the cost of capital promotes expansion in a competitive environment (Fisher and McGowan, 1983). An economic rate of a return indicates whether a project is feasible when compared to the project's capital investment. Additionally, where economic rates of return are positive, not only is the project feasible, but it is also a value-added project that may provide returns which can be re-invested.

Because of defense contractors' operational environment in serving a unique customer, the Department of Defense (DoD), it is relevant to assess their capabilities that enable sustained competitive advantage, known as "economic moat" (Morningstar Investment Research Database). A notable and practical interpretation of economic moat is explained by Warren Buffett, chairman and CEO of Berkshire Hathaway. At the 1995 Berkshire Hathaway annual shareholder meeting, Buffet described the principles that define moat, some of which are being a low-cost producer, having a natural franchise because of surface capabilities, having a certain position in the consumers' mind, or possessing a technological advantage. He also implores understanding the factors of a company's moat that enable it to successfully operate over decades-long periods (Buffet, 1995).

There are several reasons why economic profit, or economic moat, is a superior measure of defense contractors' financial performance. First, economic moat portrays more about a firm's operational performance than profit alone. Boyd (2005) found that firms with economic moat achieved high earnings, high stability, and stock growth relative to the market. Economic moat is also associated with share price appreciation (Boyd and Quinn, 2006) and less price volatility (Kanuri and McLeod, 2016) compared to broad-based stock market indices. Additionally, the study of economic moat addresses the literature gap of comparing defense contractor returns to the cost of producing those returns. If defense contractors demonstrate sustained returns above their capital outlays, then they are able to create "defenses" or barriers against competition. An implication of economic moat is that defense contractors can preserve profits from rivals and maintain long-term operations, which are critical elements for the DoD to achieve its national defense strategies.

As commercial enterprises, it is reasonable to expect defense contractors to pursue profits. Further, healthy financial performance is implicitly stated in Presidential decree. According to Executive Order 12919 (1994), the U.S. government's policy is to strengthen the domestic industrial and technological base to ensure full national security capabilities. Because national security is a provision by the federal government, the defense provided by the DoD is an essential public good. As a result, the DoD must look to industry contractors for defense acquisitions. The inseparability of private industry in producing a public good therefore necessitates operational profit, protected by economic moat, to sustain the domestic industrial base.

Specific attributes of companies with economic moat are intangible asset investments which prevent competitors from replicating intellectual property; efficiency scale which represents a limited market being efficiently served by one or very few companies; cost advantages that allow a firm to negotiate terms; and pricing power resulting from high customer switching costs (Morningstar Investment Research Center). A firm's network effect, which occurs when the value of a good or service increases as more people use that good or service, can also be a source of competitive advantage (Morningstar Investment Research Center). Many attributes of economic moat apply to the study of defense contractor financial performance due to the government acquisition environment and DoD customer requirements. The relevance of competitive advantage therefore directs this research to analyze variables not widely discussed in defense academic research.

Research Objectives and Questions

The objective of this exploratory research is to assess defense contractors' financial performance using economic profit. Fundamentally, this thesis is similar to defense profit studies which use a proxy profit, usually an accounting rate of return, that are assessed against relevant predictors in the defense industry. The novelty of this research, however, is measuring defense contractor performance by adopting competitive advantage as a proxy for economic profit. To measure competitive advantage, this thesis will leverage Morningstar's proprietary concept of economic moat which compares ROIC and WACC. Further, this thesis will analyze specific economic moat attributes, such as defense contractors' intangible asset investments and efficient use of capital assets, to assess their impact on moat.

Considering the attributes of economic moat, this research is directed by the following questions:

1. How is economic moat impacted by the capital investments in assets that defense contractors make?
2. What factors in defense contractors' operational environment represent efficiency and productivity measures that positively influence economic moat?
3. How does economic moat differ depending on the type of defense contracts held?

Thesis Overview

This thesis consists of five chapters. Chapter two synthesizes the academic research on defense contractor financial performance, economic moat, competitive advantage, and related studies. Chapter three describes the methodology, hypothesis development, and the data selection process. Chapter four presents results and analysis of the tests of hypotheses. Finally, chapter five concludes with key findings and suggestions for future research.

II. Literature Review

Overview

This chapter will first explore a range of literature on defense contractor profit to highlight the variety of performance measurements and research outcomes. The literature review will also cover ancillary research on cost shifting. The topics of contractor profit and cost shifting are frequently discussed together because cost shifting is seen as a systematic way for contractors to internally adjust costs and influence profit. Additionally, elements from public choice theory will be applied. The study of defense contractor financial performance warrants consideration of the public choice paradigm since corporate profit at the expense of American taxpayers highlights potential issues of inefficient government spending or waste in government resources. Finally, studies on economic moat and competitive advantage will be analyzed. Economic moat has mostly been conceptualized in practical investment research such as expert analyst reports used by investors. Limited academic research exists on moat but relevant studies on competitive advantage have been considered. These topics will enhance the understanding of economic moat and demonstrate its applicability to defense contractor performance.

Defense Contractor Profit Studies

The purpose of reviewing profit studies is to demonstrate the range of empirical analyses conducted and to summarize the conclusions researched. Studies from a range of different periods indicate that defense contractor performance has been assessed using different measurements from sales and profit metrics to market valuations as outlined in Table 1, but the most common metric is ROA. ROA has the potential to understate a firm's return from

assets since non-operational expenses have been accounted for. Additionally, a firm might not be employing every asset in its operations. For example, an intangible asset such as Goodwill measures the premium that an acquiring firm paid over the market value of the purchased firm. Accounting rules (FASB, 2017) permit the reporting of Goodwill, but as an asset it is not engaged in production in the same way that assets like plant and equipment are employed. The following table summarizes the range of profit measures used in the referenced literature. Notably, ROA is a commonly used proxy, but studies have applied different formulations.

Table 1 – Literature Summary of Profit Metrics

Effect Studied	Author	Proxy	Formula
Defense Contractor Profit	DFAIR (1985)*	Return on Assets (ROA)	Return on Investments (ROI)* was the designated formula, however investments were classified as "assets employed" for DoD contracts
	U.S. GAO (1986)		Operating income / Assets owned by company
	Lichtenberg (1992)		Operating income / Identifiable assets
	McGowan & Vendrzyk (2002)		Segment income / Segment assets
	Zhong & Gribbin (2009)		Income before extraordinary items & discontinued operations plus R&D expense / Avg. total assets for year t and year t-1 of firm i
	Wang & San Miguel (2012)		Net income / Total assets
	Chen & Gunny (2014)		Earnings before extraordinary items / Total assets
	Bohi (1973)	Profit as % of net worth	Profit as % of net worth
	Greer & Liao (1986)	Return on Sales	Unknown - Obtained from ValueLine
	Wang & San Miguel (2012)	Return on Common Equity	Net income / Common equity
		Profit Margin Ratio	Net income / Sales revenue
		Operating Margin Ratio	Earnings before interest & taxes / Sales
	Greer & Liao (1986)	Return on Net Worth	Unknown - Obtained from ValueLine
Shareholder Wealth	Pownall (1986)	Shareholder Wealth	Returns based on weighted NYSE market index
Economic Profit	Rogerson (1989)	Economic Profit	Share prices before & after contract award
Investment Returns	Stigler & Friedland (1971)	Profit of Investments	Investment returns on defense contractors relative to NYSE stocks

A variety of studies have compared defense contractor performance relative to industry peers. The comparison to industry provides implications on whether defense contractors earn superior profits than non-defense firms. Measuring profit rates as a percentage net of worth, LMI found that defense contractor profit rates on defense business are too low compared to commercial firms (LMI, 1970). Using the same profit metric as LMI, Weidenbaum found that defense profits are more excessive than commercial businesses of similar sales volume (Weidenbaum, 1986). Weidenbaum also concludes that defense business is becoming more profitable due to a higher concentration among fewer defense firms. Bohi's research, which

used the same profit rate, produced a different outcome from either of LMI's and Weidenbaum's findings. Bohi (1973) instead concluded that defense firms and non-defense manufacturing firms did not have significantly different profits during the period of analysis, 1960-1969.

Another comparison between defense and non-defense firms was conducted in 1985 by the Defense Financial and Investment Review (DFAIR). Using return on sales and return on investment or "assets employed," DFAIR's principal findings were that defense contractors had similar profit to commercial manufacturers with the exception of certain periods: from 1970 to 1979 defense contractors were 35 percent more profitable than commercial business, and from 1980 to 1983 defense contractors were 120 percent more profitable. In 1986, the U.S General Accountability Office (GAO) validated profit findings from DFAIR's 1985 report. Using return on assets (ROA) to measure profit, the GAO (1986) concluded that defense business was substantially more profitable than comparable non-defense firms during the period 1975 to 1983.

Recent research also compared defense and commercial business. Using ROA as a proxy for excessive profit, Wang and San Miguel defined "excessive profit" as the difference calculated between firm-year profit and the benchmark profit of the same firm-year. The explanation of observed profit levels was owed to certain predictors: corporate governance and industry consolidation after 1992 (Wang and San Miguel, 2012). What is meant by corporate governance is that a company CEO also holds a Chairman role. They posit that such dual authority leads to less oversight from the board of directors. As a result, management can engage in opportunistic behavior to impact financial outcomes. The other finding of defense industry consolidation after 1992 potentially explains excessive profits since fewer, less fragmented contractors face less

competition among each other. These contractors can therefore consolidate their bargaining power and exert more political influence in the defense acquisition process. Wang and San Miguel's industry consolidation hypothesis extends Weidenbaum's domestic convergence hypothesis that higher profit results from defense business concentration among fewer defense firms (Weidenbaum, 1968). However, the notion that defense business concentration impacts profit remains mixed.

Among firms that serve both defense and commercial customers, another relative measure of defense contractor profit is defense sales in proportion to total sales. Greer and Liao (1986) measured firms' return on sales (ROS) as a function of a percentage of defense sales and return on net worth as a function of a percentage of defense sales. In both tests, it was consistently found that defense business negatively impacted overall sales for corporate firms during 1963 to 1982 (Greer and Liao, 1986). Bohi (1973), however, found no such relationship. Interestingly, he noted that firms' individual profit rates did not necessarily move in the same direction as the percentage of defense business. Similarly, Lichtenberg (1992) compared profits of government business relative to non-defense business. He hypothesized that commercial business by government contractors is higher than profitability of commercial business by non-government contractors under a cost shifting premise. Using ROA, Lichtenberg demonstrated that profit increases as a contractor's ratio of governmental to total sales increases, concluding that defense contractors earn a range of 68-82 percent higher profit compared to non-government contractors; during the period 1983-1989 profit was almost three times higher for government contractors. Lichtenberg suggests that the relationship between profit and a firm's percentage of government sales to total sales is a positive linear function. Using the comparison

of firm defense sales (or government) to total sales, profit studies have also yielded mixed results on defense contractor financial performance.

Academic literature has considered defense contractor performance through metrics other than sales, also with mixed conclusions. Stigler and Friedland (1971) measured profitability of investments in prime defense contractors instead of profit from sales. They contend that using stock market data avoids potential inconsistencies reported through accounting data. Covering two decades of stock returns, Stigler and Friedland (1971) found that investments in defense contractors during the 1950's were twice as profitable compared to stocks listed in the New York Stock Exchange (NYSE). During this period, growth in stock prices was positively associated with a larger percentage of defense sales. However, in the 1960's, this pattern did not hold (Stigler and Friedland, 1971).

Rogerson (1989) includes the use of stock market data to measure defense contractors' economic profit. Rogerson's theory on prizes for innovation asserts that the regulatory system for defense contractors promotes innovative efforts by providing prizes, or economic profit in the form of stock price appreciation. Under this system, the innovative phase of a project earns negative economic profit while the production phase earns a positive profit. In his empirical analysis, Rogerson's evaluated defense contractors' security prices to determine their market value before and after the announcement of the winner and loser(s) of a prime contract. Changes in market value are used as a proxy for prize level because in absence of a prize, firms would not expect to receive economic profit and the stock market would respond indifferently to the announcement of prime contract winner. The analysis involved 12 major aerospace systems involving programs occurring through the 1960 and 1970 decades. Rogerson's findings indicate that every dollar of revenue earned on a prime contractor's production contract

generates 3.26 to 4.68 cents of economic profit. One of Rogerson's conclusions is that profit policy serves as a way to regulate the level of innovation among defense contractors. Where previous studies focused on relative levels of profit, Rogerson shifts the debate from whether contractors earn too much profit to whether there is an adequate level of innovation being produced.

Like Rogerson (1989), Zhong and Gribbin (2009) shift the focus of defense contractor profit away from scrutinizing profit levels to exploring a diversity of performance factors that explain profitability. Specifically, they investigated whether risk, innovation, and influence are attributes that are positively associated with defense contractor profitability. Unlike previous studies, Zhong and Gribbin did not assess profit relative to non-defense industry peers, but similarly used ROA to proxy profit. Zhong and Gribbin's examination was compelled in part by DoD defense policy which acknowledges that the determination of contractor profitability should consider the contractors' risk, difficulty of the task, and procurement resources. Zhong and Gribbin's empirical findings support their hypothesis that risk, innovation, and influence have a positive relationship with defense contractor profit rates.

The literature has demonstrated that many alternatives exist in assessing defense contractors' performance. ROA has commonly been used to represent firm profit, but ROA has also been applied differently among the various studies. Research has also considered defense contractor performance through metrics other than sales such as stock market valuation which is a relevant and applicable measure. To understand on relative profit levels, defense contractors' profitability has often been compared to non-defense industry peers. The variety performance metrics have accordingly led to a variety of conclusions on relative profit levels of defense contractors.

Cost Shifting Studies

The topic of cost shifting is relevant to the study of defense contractor performance because academic literature has explored cost shifting as an explanation of profit. Additionally, many profit proxies used in cost shifting research are similar to those used to defense contractor research that do not have a cost shifting focus. In defense contractor research, cost shifting implies that contractors will pass its commercial costs onto its government payer (McGowan and Vendrzyk, 2002). As a result, non-related government costs are potentially reimbursed through government-related contracts. Cost shifting occurs where there is both an opportunity and incentive to do so, such as compensating for losses in one segment by shifting costs to a profitable segment. Theoretically, cost shifting can occur throughout a firm's operational levels; for example, costs can be shifted among expense types, operating units, and customer bases. Quite possibly, cost shifting is more so a byproduct of a management decision rather than an objective. An entity might engage in cost shifting if the economics of a contract will warrant it--which may not be the case for every contract or business opportunity. The following literature demonstrates systematic ways in which cost shifting can occur and also how cost shifting can influence defense contractor profit levels.

Cost Shifting in Hospital Billing Studies

Although the empirical focus of this thesis is the defense industry, this section will first present research from the healthcare industry where cost shifting literature is prolific, especially pertaining to hospital billings. The healthcare and defense industries differ in the type of product and service each provide, but the two industries are also similar in certain areas. First,

by contracting with the government, hospitals and defense contractors are compensated through arrangements that are unique to federal acquisitions, such as reimbursement-type provisions. Next, these reimbursement structures are subject to certain regulations that attempt to control public spending; healthcare reform is subject to the Affordable Care Act (HealthCare.gov) and government contractors are subject to cost regulation set by Cost Accounting Standards (Acquisition.gov). As a result, much scrutiny is placed on public healthcare programs and defense spending because both are taxpayer-funded. Finally, the applicability of healthcare research in the study of defense contractor research lies in common characteristics that ensue cost shifting behavior.

In the healthcare industry, Medicare and Medicaid are the federal insurance programs that are either fully or partially funded by the government depending on the specific coverage plans (Medicare.gov). The reimbursement characteristic of these federal insurance programs present opportunities for hospital billing practices to influence the reimbursement outcome. But in addition to opportunity, incentive must also exist. Assume an environment in which patient healthcare costs are billed at a flat rate regardless of medical procedure. Additionally, the hospital recoups full payment for these costs through insurance coverage or through patients' personal funds. The hospital would therefore experience no difference in revenue received by medical procedures performed and by payment type. In this assumed scenario, there is no opportunity or incentive to shift costs from one patient to another because the cost and billing environments are homogenous. In reality, healthcare costs differ by the type of medical procedure, complexity of care, and specialization of treatments to name a few examples. Further, patients' ability to pay for their healthcare costs depends on having a range of coverage plans or no coverage at all. Medicare or Medicaid programs introduce a billing and pricing

dynamic such that patients with these coverage types pay reduced rates though expense subsidization by the government. Therefore, hospitals have both opportunity and incentive to shift costs among its patients, especially since hospitals set different rates for their services and experience different payment collectability between private and public payers. According to Medicare rate research, private insurance payments average 144.8 percent of cost while Medicare payments average 86.6 percent of cost (Altarum Healthcare Value Hub, 2020). As a result, cost shifting in hospital billings is often presumed to occur from public payers to private payers

Research by Eldenberg and Kallapur (1996) found that hospitals will strategically change their patient and service mix in order to garner maximum Medicare reimbursement. They compared hospital revenues before and after 1983 when the Medicare payment system was reformed. Previously, Medicare reimbursed hospitals for reported costs for all patient cases. After 1983, Medicare's reimbursement was based on inpatient or outpatient services, with inpatient services charged as a fixed cost. The cost reimbursement reform provided an opportunity for hospitals to reclassify services from an inpatient procedure into an outpatient procedure even if an inpatient procedure would be the normal classification. Eldenberg and Kallapur's (1996) findings indicated that after the 1983 change, revenue from Medicare outpatients had a rapid increase compared to non-Medicare revenue and that outpatient cost allocation also increased.

Eldenberg and Kallapur demonstrated how cost shifting systematically occurs at a transactional level. However, a macro-economic perspective explains why cost shifting may or may not be a pervasive phenomenon. Similar to defense contractors, cost shifting is one of the theories that underlies profit maximization among hospitals. This theory was articulated by

health economist Austin Frakt (2011) who conducted a comprehensive survey of hospital cost shifting literature since 1996. In his survey, cost shifting was defined relative to hospital billing where private payers are charged more in response to public payments shortfalls. One of the cost shifting debates in public health policy is that as public health payments go down, private payments go up. This notion implies a causality between the price charged for private and public payers. In Frakt's economic framework of cost shifting, he explains that cost-shifting cannot exist if hospitals already maximize profit. This is because hospitals who have exploited their market power through price increases can no longer impose more increases before driving insurers and customers away. Frakt concludes from this theoretical and empirical analysis that cost shifting has occurred in hospitals at low levels. However, there are prevailing factors to consider, such as market power and bargaining between hospitals and insurance providers that also influence cost shifting phenomena. Frakt's conclusion poses a similarity to defense contractors, especially considering Weidenbaum's (Bohi, 1973) and Wang and San Miguel's (2012) position that industry consolidation explained excessive profit.

Cost Shifting in Defense Contractor Studies

Academic literature suggests that the regulatory environment has potential implications on cost shifting behavior. In Eldenberg and Kallapur findings, the 1983 enactment of Medicare policy may have influenced how hospitals report patient mixes. In Pownall's (1986) study on the impact of cost regulation on shareholder wealth, cost shifting was seen as a potential reason for establishing the Cost Accounting Standards Board (CASB). Pownall hypothesized that cost accounting mechanisms allowed firms to report reimbursable costs to the government that

were not directly supportable or incurred by the contracted work. That the government paid for a reported but unrelated cost can be difficult to verify, but there are plausible examples to consider. In theory, a defense contractor may classify its operational expenses as defense-related and report the full cost incurred for reimbursement through its government contracts while the commercial side benefits without bearing a proportionate cost. A defense contractor may be motivated to so during times when government projects are funded compared to its commercial business. Without standards to monitor cost shifting behavior, defense contractors possess relative control over their cost reporting and have increased ability to extract cost reimbursements from the government on both related and unrelated endeavors. The CASB can limit contractors' ability to cost shift, which enables the government to measure actual contract costs. Through a number of standards that address the distinction of direct versus indirect costs, allocation of indirect costs, accounting for tangible capital assets, and accounting for credits, CASB governance strives for consistent cost reporting on government contracts (Code of Federal Regulations, Title 48, Chapter 99).

In Pownall's (1986) analysis, cost shifting is proxied through the shift from government wealth to defense contractors' shareholders. Wealth was measured as defense firms' stock returns relative to the NYSE index specifically before and after the enactment of cost regulation. Findings show that the extent of cost shifting varied as the regulation developed. During 1968 to 1970, the CASB was formed in two phases. The first phase considered diligence procedures that determined the need, scope, and feasibility of a regulatory body over uniform cost accounting standards. The second phase created a legislative process to establish the CASB. Pownall found that shareholder wealth decreased during the first phase of planning but increased during the second phase of enactment. Pownall suggests that the stock market had initial, negative

reactions to the cost accounting restraints placed on defense contractors. In the second phase however, market agents potentially anticipated increases in contractor profitability associated with CASB events (Pownall, 1986).

Rogerson's (1992) research theorizes that the regulatory process actually incentivizes cost shifting among firms with commercial and defense segments due to two features: cost sensitivity of defense products and cost accounting practices of defense contractors. In sole source procurements, a defense contractor's revenue from defense products is deemed cost sensitive because prices are largely based on the product's nominal cost. In contrast to commercial products with competitively-determined prices, commercial revenues are deemed cost insensitive because the dollar-for-dollar product price does not necessarily rise and decline in the same direction as production costs. A cost increase for commercial segments can lead to decreases in profit where a cost increase for defense segments can lead to more reimbursement from the government. Contractors calculate product costs that allocate a majority of costs in relation to overhead labor instead of a direct charge to products (Rogerson, 1992). As a result, contractors can strategically substitute labor for material costs between defense and commercial alternatives. In theory if a firm knows that it can recognize more revenue in the form of overhead costs allocated to defense contracts, then it will assign more labor from commercial to defense projects to report higher costs incurred. It is important to recognize that the firm is not actually overstating its overall expenditures. However, the firm is potentially engaging in wasteful resource management at the government's expense by over-allocating labor to defense contracts and under-allocating labor to commercial business.

Thomas and Tung's (1992) empirical findings on cost manipulation incentives also suggest that when a firm has a mix of non-government and government business, the costs

incurred by the non-government segment are potentially sourced for cost shifting practices. Thomas and Tung (1992) examined funding levels of defense contractors' pensions relative to defense revenue. They concluded that defense contractors tend to overfund their pensions when their employees work on defense contracts. Specifically, the potential exists for defense contractors to engage in certain pension overfunding strategies: "across-contract" or "across-time." Under the "across-contract" strategy, contractors who maintain pension plans under defense and non-defense activities can transfer employees between plans, generating cost reimbursements from defense contracts when employees are transferred to defense plans. Under the "across-time" strategy, contractors can manage pension plans by alternating the timing when plans are operated under defense contracts and non-defense business. Thomas and Tung also found that there is less of an incentive to overfund pensions when a firm solely contracts with the government.

Lichtenberg (1992) also studied non-government and government segment data and expands Rogerson's and Thomas and Tung's premise that if cost shifting occurs through mechanisms like overhead allocation or pension overfunding, then cost shifting may be the reason for government contractor profitability. This is because the shift of costs from a firm's commercial segment to its government segment results in lower commercial costs. A firm with government and non-government segments would therefore be more profitable compared to an entirely non-government firm even when the government-oriented firm earns normal profits on government business.

Conversely, McGowan and Vendrzyk (2002) examined profitability of government contractors using segment data to hypothesize cost shifting but found no evidence to support cost shifting as the cause. They instead attribute profitability to non-accounting reasons, such as

competition for defense contracts. McGowan and Vendrzyk hypothesized that within a mixed segment comprising commercial and defense revenue, managers have more opportunities to use accounting methods to allocate costs instead of across commercial or government segments, especially in a low-competition environment for defense contracts. They studied ROA of mixed segments during two periods: 1984-1989 when competition for defense contracts was low, and 1994-1998 when competition for defense contracts was high. During the low competition period, government segments were more profitable than their mixed segment or purely commercial segments. Further, no significant difference in profitability existsed between "ranked" and "unranked" contractors. Ranked contractors are those who place among the Top 100 defense contractors and yield higher market power and influence over unranked contractors not listed among the Top 100. During the highly competitive environment of 1994-1998, there was no significant difference in profit among mixed, government or commercial segments. McGowan and Vendrzyk's findings suggest that managers do not necessarily exploit opportunities to shift costs onto government contracts to achieve profit.

Newer research extends Thomas and Tung's "across contract" and "across time" cost shifting strategies. Specifically, Chen and Gunny (2014) reviewed government contractor profit relative to contract types. The different contracting mechanisms used by the DoD arguably lend itself to cost shifting behavior. Further, cost shifting is exacerbated by the fact that the DoD does not possess the same level of cost information as its contractors. Among the contract types that exist in the federal acquisition environment, cost-reimbursement type contracts may be more advantageous to cost shifting. In particular, a cost-type contract has an agreed-upon target cost plus a margin for the contractor's profit and provisions for the government to reimburse the contractor for allowable costs above the target. The government therefore bears more risk in a

cost-reimbursement scenario. Conversely, contractors bear the most risk on a fixed-price contract because the government and contractor agree on a pre-determined price that the government will pay regardless of the actual cost incurred by the contractor. Either contract type can be used to acquire goods or services depending on the project, technological maturity, and other factors. It is important to consider that there are immeasurable trades-off between the two contract types, even though cost-type contracts can potentially garner more reimbursement potential. Fixed-price contracts can be more advantageous for contractors from a revenue and cash collectability perspective. Since a fixed-price contract generally has no price adjustments compared to a cost-type contract, government agencies can better forecast budget and funding for a pre-determined amount particularly in multi-year contracts. The ability to plan for funding in the future is especially critical during years when government spending levels face congressional debate and the potential of being cut. Additionally, government contracts are subject to audits under Cost Accounting Standards (CAS). A contract audit by the Defense Contract Audit Agency can deem adjustments on costs that a contractor reports above the agreed-upon target in a cost-reimbursement contract. The impact of regulatory monitoring is also examined by Chen and Gunny in their study of government contractor profit.

Chen and Gunny's sample consisted of publicly traded U.S. companies with federal procurement contracts from 2005 to 2010, of which DoD agencies comprised approximately 69% of the tested sample. Expanding on Thomas and Tung's "across-contract" and "across-time" findings, Chen and Gunny first explore whether higher profit is observed in periods with cost-plus contracts compared to periods without cost-plus contracts. Next, they explore whether firms report more research and development costs (R&D) and selling, general, and administrative expense (SG&A), during periods with a cost-plus contract compared to periods

without any cost-plus contracts. Specifically, they exemplified a government contractor that theoretically incurs $100 million in R&D expenses, of which $20 million relates to government contracts and $80 million relates to the contractor's commercial segment. Through its cost-plus contract, the contractor can report $25 million of reimbursable costs thereby shifting costs from the commercial segment by $5 million. No matter how the costs are incurred, the contractor reports R&D in the financial statements as a consolidated amount of $100 million. Due to information asymmetry, the "across-contract" hypothesis is therefore more challenging to detect. The "across-time" or "inter-period" hypothesis however may be observed empirically. Chen and Gunny suggest that contractors engage in more R&D and SG&A in years with a cost-plus contract compared to those without. Assuming the same $100 million in R&D expense of which $20 million is incurred for the government, a contractor can increase R&D activities beyond what is necessary, thereby benefitting its commercial business. Assuming the increased costs amount to $5 million in additional costs, a total of $25 million in costs is reimbursed from the government. The inter-period hypothesis posits that the contractor will report $105 million in the year with the cost-plus contract and $100 million in the year without a cost-plus contract. Finally, Chen and Gunny test if there is a positive association between profitability and contracts subject to cost regulation. The amount of required regulation ranges from full compliance to modified coverage which requires compliance to subset of standards. As an example, full CAS coverage would apply to contractor business units that have been awarded a contract of $50 million or more (Code of Federal Regulations, Title 48, Chapter 99). Chen and Gunny observe that contractors' profit increases during years with cost contracts and that contractors report higher R&D and SG&A expenses during periods a contractor has a cost-plus contract.

Additionally, Chen and Gunny find that the implementation of regulatory standards mitigates the relationship between cost plus contracts and profitability.

The cost shifting hypothesis implies that cost shifting is a one-sided transaction benefitting the contractor due to information asymmetry. It is notable to consider however that governmental institutions, through the acquisition environment and bureaucratic process, arguably permit such behavior. The conditions for cost shifting may continue to endure especially when there is an incentive from the contractor and an opportunity provided by the DoD.

Public Choice Application

Defense contractors' financial performance and the hypothesis of cost shifting represent outcomes that occur at the transactional, firm-level but it is important to consider these topics under public choice theory. Defense contractors are beneficiaries of federal acquisition programs that are decided through a bureaucratic process. In academic and public discourse, defense contractor profit, especially excessive profit, is associated with high public spending that result in waste and inefficiencies on behalf of the government (Bohi, 1973). However, a generally positive view on defense acquisitions is provided by Rich and Dews (1987) who analyzed the history of defense acquisition reform under the traditional measures of cost, schedule, and performance. Rich and Dews (1987) found that in the 1970's and 1980's, modest success can be seen in lower cost growth of defense programs versus non-defense programs, less schedule slippage, an average of zero performance shortfalls with some exceptions, and generally no increase in the length of the acquisition life cycle.

Ultimately, without extensive reform on the defense acquisition and bureaucratic process, waste from government spending may be inseparable from the public interest of national security. Defense acquisition outcomes are part of a dynamic web of influences from defense program managers, members of Congress, and the defense industry (Jackson, 2011). Under a public choice paradigm, Dwight R. Lee shifts the focus away from criticizing government waste and instead highlights that waste is actually inevitable. Lee illustrates why waste is found and why attempting to reform a political process, such as military spending and the influence of the military industrial complex, may have negative long run effects.

First, by nature of being a public good, consumers' demand for defense is difficult to ascertain in the same way that consumer preferences for private goods can be communicated in the private marketplace. Generally, military spending is justified by citizens' desire for security. But the level of spending is shaped by organized interests between: 1) the political actors who desire payoffs in gaining constituent support by way of providing military programs, and 2) the suppliers of military programs.

Next, defense spending faces what Lee calls an "aroused versus apathetic public" that describes a lack of monitoring and difficulty of measuring defense. Members of the "aroused public" possess subjective feelings on whether defense should be increased or decreased. However, these members do not necessarily act on a sentiment to put public interest ahead of their own. Thus, the "aroused public" is not actually motivated to monitor military spending. Members of the "apathetic public" possess feelings on pursuing the good of the country. However, pursuing what is good for the country in terms of military spending will be difficult to ascertain. To exemplify, the optimal measure of threats avoided or adversaries killed does not directly translate to a quantitative measure of citizens' level of security. Unlike a consumer

good, defense is something for which price and quantity are immeasurable on a supply and demand curve. The complexities and ambiguities on behalf of the public consequently allows the military industrial complex to dictate the scope and level of defense spending.

Lee further asserts that government waste is actually by the government's own doing. Procedures such as inaccurate cost estimating, cost shifting among contractors, and high reliance on a few influential contractors result in inefficient and costly programs. The extent of Congressional micromanagement of defense spending results in expensive programmatic changes. This is because Congress is less motivated by efficient spending and more so by political advantage.

Finally, the public's inability to communicate its demand for defense is the fundamental cause for waste. As a result, the military industrial complex will continue to produce what it is engaged to do by the DoD which Lee argues will undeniably result in wasteful spending. In a scenario where defense spending is curbed, those funding resources would be reallocated to other goods for which spending is shaped by the special interest of political actors as previously outlined. It is possible that waste is simply diverted from one program to another. Not only does this pose a danger to national security, but the types of special interest groups and programs where resources are allocated might not rise to the level of importance as the country's security. Although waste is an outcome of defense spending, the public good nature of defense has a necessary place in society. Further, the military industrial complex remains an inseparable and essential part of enabling the nation's defense strategies.

Lee's analytical framework provides an additional consideration to the profitability observed in defense contractors. Because defense is a public good, the defense contractors who supply the public good must generate sustainable, long-term returns to support current and

future defense programs. But as the supply and demand for defense is immeasurable, so is the level of return or profit for the supplier, a defense contractor. At the minimum, a contractor's returns must match the cost incurred to produce the cost of goods sold to sustain operations. Arguably, the requirement for break-even or positive profit levels is inseparable from the requirement for national defense.

Economic Moat, Competitive Advantage, and the DoD

The DoD's defense strategies to outpace global rivals (DoD, 2018) demand that defense contractors develop products and technologies for the DoD to assert its superiority. Defense contractors must therefore raise and deploy capital towards research, investments, and production of technically sophisticated defense products. Specific defense requirements also entail contractors to face trade-offs in deciding what to feasibly pursue, from a range of products and services or a shift between defense and commercial business. In the example of a new weapon system build, defense contractors must make capital investments to create a prototypical design in hopes of winning a contract. Those who lose contracts face sunk costs from capital outlays on the prototype. Those who are awarded contracts must make additional investments towards production, which is possibly limited by the project's funding levels. The customization level for this weapon system also means that production capability may not be immediately scalable to other defense or commercial projects. These contractors face potentially large sunk costs for a relatively small production run of a highly sophisticated system.

Because of defense contractors' operational environment in serving a unique customer, the DoD, it is relevant to assess their capabilities that enable competitive advantage, known as

economic moat. Companies that have sustained competitive advantage have built "moats" or defenses that prevent or lessen competition, preserve profits, and create value without facing threats from rivals. The practical application of moat in investment analysis is done by Morningstar, which has a proprietary methodology of economic moat. To earn the Morningstar Economic Moat Rating, a company must exhibit a trend of excess ROIC over WACC and also demonstrate that it has attributes of competitive advantage (Collins, 2006; Kanuri and McLeod, 2016). To classify companies as wide moat, narrow moat, or no moat, Morningstar first reviews the spread between a firm's ROIC and its WACC. A historically positive spread between ROIC and WACC generally indicates that a company earns superior returns, thereby creating value that justifies economic moat. Morningstar's determination of economic moat also considers qualitative attributes. These attributes are intangible assets which prevent competitors from replicating intellectual property; efficiency scale which represents a limited market being efficiently served by one or very few companies; cost advantages that allow a firm to negotiate terms; pricing power resulting from high customer switching costs; and network effect which occurs when the value of a good or service increases as more people use that good or service (Morningstar Investment Research Center). By Morningstar's assessment, wide moat firms have competitive advantages that last more than 20 years, narrow moat firms can fend off competition for 10 years, and firms without moat have no competitive advantage and may dissolve as a business.

As a trademark measure, Morningstar's Economic Moat Rating is determined by a selection review committee (Kanuri and McLeod, 2016). The exact mechanics are thus unknown. Further, the academic literature on economic moat is scant and often limited to investment analyst reports. However, the comparison of ROIC to a firm's cost of capital, which is a

fundamental measure of economic moat, has been articulated by Professor Aswath Damodaran of New York University's Stern School of Business. To determine whether a firm generates a return from investments that exceeds the cost of funding the investments, the computed ROIC should be compared to the cost of capital (Damodaran, 2007). Under this measurement, a firm that generates excess returns on investments beyond the cost to raise capital will have share prices that trade at a premium compared to firms without excess returns (Damodaran, 2007).

Academic studies on economic moat have mostly corroborated Morningstar's position that firms with economic moat earn superior shareholder returns and will outperform competition. Of the few articles that address economic moat by Morningstar's definition, the majority have been published by David P. Boyd in the Journal of Business and Economics Research. Boyd (2005) found that firms classified as wide moat outperformed the market using the S&P 500 as a benchmark. Additionally, wide moat firms achieved high earnings, high stability, and stock growth relative to the market (Boyd, 2005). Boyd and Quinn (2006) studied Morningstar's hypothesis that wide moat companies will realize price appreciation over a ten-year period. By studying share price appreciation of companies with moat and no-moat Morningstar ratings, they found that firms with moat status achieved higher returns over a ten-year period but not a five-year period. Additionally, firms with moat had less share price volatility than those with no moat (Boyd and Quinn, 2006). Boyd and Yilmaz (2008) further studied moat under a paradigm of corporate stewardship. Motivated by mutual fund scandals, Morningstar developed a stewardship letter system to grade companies' corporate governance practices (Boyd and Yilmaz, 2008). Using this measure of stewardship and the Institutional Shareholder Services Corporate Governance Quotient, Boyd and Yilmaz (2008), found that there was no relationship between stewardship measures and companies' moat status.

Recent research by Kanuri and McLeod (2016) also studied the performance of companies classified as wide moat by Morningstar. Over the period 2002 to 2014, wide moat stocks annually outperformed the S&P 500 and Russell 3000 indices. During the financial crisis period of 2007 to 2009, wide moat stocks realized less value compared to these benchmark indices. Despite the relatively short time frame covered by economic moat studies and the few published articles, a common finding is that Morningstar's moat designation is consistent with superior financial performance and increased shareholder value compared to market indices.

Since economic moat is rooted in the concept of competitive advantage, this research has further sought literature in the area of strategic management. While a scholarly search on economic moat renders few results, competitive advantage is among the main research areas in strategic management. Features of Morningstar's economic moat methodology can be traced to Michael Porter's view of competitive advantage. The first feature is Morningstar's comparison of ROIC to WACC. Porter (1980) established the five competitive forces that determine industry profitability: potential entrants, buyers, substitutes, supplies, and industry competitors which are collectively known as Porter's Five Forces. Porter (1980) asserts that these five forces determine a firm's ability to earn average rates of return on investment in excess of the cost of capital. Porter's model does not explicitly express ROIC and WACC as the main determinants of competitive advantage, but his assertion provides the framework that Morningstar has adopted for their moat typology (Boyd, 2006).

Morningstar's set of qualitative attributes that define economic moat is another area that can be traced to Porter's work. According to Porter (1980), there are three generic strategies to outperform competitor firms in an industry: overall cost leadership, differentiation, and focus. Cost leadership requires that firms control costs through functions like constructing

efficient-scale facilities, controlling overhead, avoiding marginal customers, and minimizing operational costs. Differentiation can take many forms, such as a firm's design and brand, technology, customer service, and dealer network. Differentiation, especially across several dimensions, creates brand loyalty by customers and thus lower price sensitivity. Focus can also take many forms, but the focus strategy is built around serving a specific market such as a particular buyer, group, product segment, or geography. Porter's (1980) premise for this strategy is that a narrow focus allows a firm to target its market effectively or efficiently. If executed viably, these three strategies provide a firm with defenses to cope with the five competitive forces and ultimately protect profits.

Summary of Literature Reviewed

Among the literature considered, there are various measurements and conclusions on defense contractor performance. Often, the focus of defense contractors' performance is whether profits earned are unnecessarily high or concerningly low. Alternative explanations for observed profit levels, such as industry consolidation, or risk and innovation, have been introduced by recent research. However, it is still important for defense contractors to maintain a strong industrial base to enable the DoD's national security requirements.

The literature has also demonstrated systematic ways for contractors to influence profit. Cost shifting in particular has been theoretically and empirically examined as an explanation for defense contractor profits. With this method, contractors can execute tactics like billing manipulations, allocations between expense types or between segments, or cost shifts "across-

time" or "across contract." As a result, cost shifting potentially allows contractors to extract higher reimbursements from the government.

Under public choice theory, defense contractor profit and even cost shifting are proxies for wasteful government spending. Waste in government spending highlights potential government failures, but additional focus should be placed on sources of waste. Lee demonstrated how waste is inseparable from defense spending due to the public good nature of defense, political coalitions, and the influence of special interest groups. As a public good, it is difficult to measure the quantity and quality of defense demanded by the public. Accordingly, it is subjective to assess whether contractors earn either excessive or inadequate profit. At the minimum, contractors must earn a sufficient return to sustain operations to enable the DoD's national defense strategies.

Among the studies that scrutinize defense contractor financial performance, there is generally a lack of DoD literature that assesses financial performance as economic profit. This research adopts the concept of competitive advantage as a measure of economic profit. Economic profit, proxied by economic moat, is superior to the current methods used in literature because it considers both an accounting rate of return and an economic rate of return. Defense contractor profit studies have primarily assessed accounting rates of return, but for this metric to derive useful information, it must be compared to economic rates of return (Fisher and McGowan, 1983).

The use of economic moat through Morningstar's calculation of ROIC less WACC addresses the literature gap of comparing accounting and economic rates of return to each other. Virtually no academic studies exist that operationalize economic profit in the way this research has done. Most studies on economic moat only corroborate Morningstar's claim that

moat status creates superior shareholder returns. However, Morningstar's economic moat methodology can be traced back to Porter's Five Forces methodology which states that the five competitive forces are the determinants of a firm's ability to earn average rates of return on investment in excess of the cost of capital (Porter, 1980).

III. Methodology and Hypothesis Development

Overview

Chapter three covers the methodology to examine defense contractor performance from a perspective of competitive advantage, known as economic moat. This section will provide the calculations used to measure economic moat, develop hypothesis statements, and introduce the theoretical model to test the hypotheses. For the empirical analysis, this section will also go over the period of study, describe the data collection, and define the sample.

Measuring Economic Moat

To operationalize economic moat, certain variables must be considered that are not typically discussed in defense contractor research. The referenced academic studies have mostly used ROA as a proxy to measure defense contractor research (GAO, 1986; Lichtenberg, 1992; Zhong and Gribbin, 2009; Wang and San Miguel, 2012; Chen and Gunny, 2014). ROA, which is a firm's net income divided by total assets, is a form of an accounting rate of return or accounting profit since it is measured from explicitly reported items in a company's financial statements. Net income accounts for income (or loss) from operations and non-operational items such as taxes, interest expense or one-time transactions such an extraordinary gain or loss. Consequently, ROA is not the best portrayal of defense firms' operational performance.

By contrast, there additional metrics that portray a firm's operational performance as well as opportunity costs. Specifically, Return on Invested Capital (ROIC) and Weighted Average Cost of Capital (WACC) are proxies to analyze accounting rates of return and economic rates of return, respectively. The following section will justify why ROIC less WACC represents economic

moat. Drawing on financial literature, a firm's ROIC provides a measure of the return earned from capital investments relative to the capital provided toward that investment (Damodaran, 2007).

Figure 1 – ROIC Formula (Damodaran, 2007)

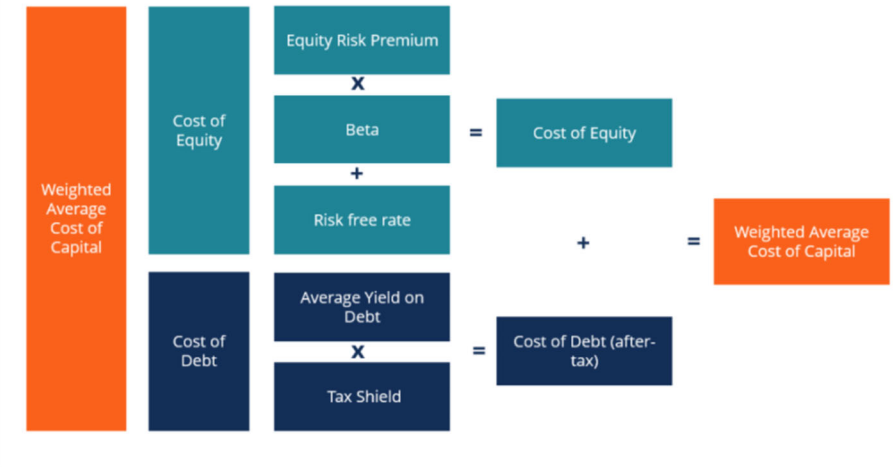
$$\text{Return on Capital (ROIC)} = \frac{\text{Operating Income}_t \ (1 \ - \ \text{tax rate})}{\text{Book Value of Invested Capital}_{t-1}}$$

ROIC's numerator uses after-tax operating income which is calculated as a company's revenue less operational expenses and income taxes at time *t*. Operating income reflects a company's earnings (or loss) from its primary business activities and does not account for non-operational expenses as ROA does. Next, the denominator uses the book value instead of market value of invested capital at time (t – 1). In financial accounting for a public firm, book value reflects the stated value of a company's assets, equity, and liabilities as recorded on its balance sheet. In contrast, market value reflects a firm's worth as measured by its publicly traded stock price. For the purposes of ROIC, book value is used instead of market value because book value is an objectively verifiable measure of a firm's invested capital sources which comprise debt (liabilities) and equity. Finally, there is a timing difference in the book value of invested capital of (t – 1) compared to the after-tax operating income at time t. The difference is that capital investments made during the course of a year will not start generating income immediately due to matters such as the start-up of operations financed by the capital. As such, invested capital at (t – 1) represents capital at the start of the year which serves as the divisor to operating income earned for that year (Damodaran, 2007). Practically stated, ROIC provides a measure of how much operating income a firm receives for every dollar of capital invested.

The use of ROIC as an accounting metric is most insightful when compared to a firm's cost of capital (Damodaran, 2007). The cost of capital can be expressed as an opportunity cost. This is because, in practice, firms must choose among alternative projects and feasible investments. Further, firms incur some type of cost for financing needs, whether through interest rates on loans and notes or through relinquishing partial firm ownership in exchange for funding. Placing a value on these options requires the analysis of both implicit and explicit measures, such as the opportunity cost of financing projects. The two main ways that firms secure capital are stock issuance and loans (or credit) which are respectively reported on the balance sheet as equity and debt. Of the two types of capital, the cost of debt is an explicit measure because debt financing is normally secured through a note or credit line with stated interest rates and terms. In contrast, the cost of equity is implicit because it is measured by the firm's market capitalization at a given period. The market capitalization is further adjusted for risk factors such as the firm's stock volatility relative to a broad stock market index. As such, the cost of capital implicitly measures the rate of return that investors demand, which represents a "cost" to the firm in the form of profit-sharing, or dividends. Collectively, a firm's creditors and shareholders comprise its capital providers.

The cost of capital is represented in investment analyses and financial literature as the Weighted Average Cost of Capital (WACC) and is represented in Figure 1.

Figure 2 – Decomposition of WACC from the Corporate Finance Institute



In the WACC formula, a firm's capital structure is weighted by the proportion of equity and of debt. Considering these main sources of capital, WACC measures the hurdle rate demanded by a firm's capital providers in exchange for the capital provided. In particular, the Capital Asset Pricing Model (CAPM) is applied which relates the required return on an investment to the risk of that investment (Perold, 2004). To determine the cost of equity, the CAPM requires the overall market's risk premium and the stock's beta relative to the market (Perold, 2004). WACC as a singular measure does not necessarily specify whether the cost of capital is too high or too low unless it is compared to relative measures. To derive value from its meaning, WACC should be compared to ROIC because the relationship between the two rates determines whether a firm is earning a return above its capital cost.

When applied as an economic rate of return, the WACC can be considered a minimum rate of a return that a firm must earn to service capital costs. When a firm's ROIC exceeds WACC, this positive difference indicates that the firm is investing in projects that generate a return above its capital cost, which can otherwise be described as economic moat. When ROIC is

greater than WACC (i.e., positive economic profit), a firm possesses attributes that allow it to meet the minimum hurdle rate and generate additional value (Morningstar; Collins, 2006). When a firm's ROIC is less than WACC (i.e., negative economic profit), the firm is possibly engaging in projects that are non-value added. Given the time horizon from when initial investment occurs to when it starts to generate income, the difference between WACC and ROIC should be evaluated over a long term.

It is important to note the distinction between the types of costs analyzed in the WACC formulation and the types of cost analyzed in the defense cost shifting and profitability literature. The referenced academic research has examined explicit operational costs such as overhead, personnel, pensions, R&D, and SG&A. Since WACC represents an opportunity cost, WACC is not a directly reported metric on defense contractors' publicly available financial statements. Instead, WACC is a proxy for the cost of capital raised.

Despite the distinction in costs analyzed, the variables of ROIC and WACC remain relevant to the study of defense contractors. When a firm earns negative economic profit, the provision of defense as a public good faces a threat if contractors decide to scale back on defense projects or exit the defense industry altogether. In contrast, if economic profit is positive, defense contractors generate value that may be placed towards defense research or future defense projects. Therefore, understanding how certain attributes impact a defense contractors' economic provides insight on the factors that enable or pose a risk to contractors' sustained competitive advantage.

Hypothesis Statements

The approach for developing hypothesis statements is examining defense contractors' structural attributes that relate to economic moat. Since the concept of moat represents a firm's overall competitive advantage, moat is assessed at the firm level instead of a firm's defense or public sector segment, or business related to government sales.

The first topic to consider is whether a firm's investment in intangible assets has a significant association with economic moat. Contractors' investments in intangible assets allow them to protect defense research and innovations and also capitalize on valuable technologies. The federal government even encourages maximum commercial use of inventions created under government contracts (Code of Federal Regulations, Title 48, Chapter 1). Defense contractors' intellectual property portfolio can therefore be leveraged for future defense business and even complement commercial business. Additionally, intangible assets are ways for firms to keep competitors at bay because intangibles such as limited government permits present a barrier to entry (Boyd, 2005).

Among the research reviewed, intangible assets have not been explicitly measured as a predictor of defense contractor performance. However, Zhong and Gribbin's findings on risk one that proxied intangible assets as a measure of capital intensity. Specifically, their measure of risk was intangible assets and property, plant, and equipment scaled by total sales. This reasoning was aligned with the DoD profit policy which acknowledges that risk factors for defense contractors are their capital investments (Zhong and Gribbin; DFAIR, 1985, VI). Leveraging Zhong and Gribbin's measure of capital intensity, a firm's intangible asset attribute can be measured as net intangible assets (less Goodwill) scaled by total sales. This calculation appropriately measures a firm's intangible asset attribute because capital intensity considers the

level of intangibles to employ to order to generate a dollar of revenue. Since defense firms' intellectual property can be utilized in defense and commercial applications and potentially bars competitors, intellectual property is predicted to have a positive association with moat. The first hypothesis is as follows:

H1: Defense contractors' intangible asset investments are positively related to economic moat, all else held constant.

The next second topic to consider is whether defense contractors' efficiency scale is associated with economic moat. A critique on the military acquisition process suggested that enabling the defense industrial base to produce efficiently will achieve the necessary improvements that meet future objectives (Rich and Dews, 1987). The defense industry characterizes efficiency scale because it serves a limited market, the DoD, whose requirements are produced by a concentration of a few large companies. Specifically, the DoD's prime contractors of Lockheed Martin Corporation, The Boeing Company, General Dynamics Corporation, Raytheon Company (pre-merger), Northrup Grumman Corporation, and United Technologies Corporation are the few companies who historically comprise the top contractor positions by obligation amount according to the U.S. federal government Top 100 Contractors reports (GSA, 2019). Efficiency scale can also be conceptualized from Wang and San Miguel's (2012) defense industry consolidation findings as fewer firms result in a less fragmented industry.

Efficiency scale is also a metric not normally conducted for testing in defense contractor performance. However, investment analytics look to ratios of Fixed Asset Turnover and Total Asset Turnover as measures of firm efficiency (Morningstar Investment Research Center). Fixed

Asset Turnover, calculated as revenue divided by average property, plant, and equipment, is an indicator of productivity levels as it measures how effective a firm is at generating sales from its fixed assets. Total Asset Turnover, calculated as revenue divided by average total assets, is a "catch-all" efficiency ratio (Morningstar Investment Research Center) that highlights management's effectiveness in using both short-term and long-term assets. In particular, the Total Asset Ratio would be an appropriate efficiency measure for contractors like service firms that do not require the same plant asset infrastructure as manufacturing firms. Generally, the higher ratio, the better. The ability to successfully invest in capital-intensive assets also presents a barrier to market entry for smaller producers. The second hypothesis is as follows:

H2: *A defense contractors' asset base positively explains economic moat, all else held constant.*

The third topic to be considered is whether cost advantages and pricing power explain defense firms' economic moat. These two attributes are not mutually exclusive and can be considered together within the defense contracting environment. Of the economic moat attributes considered, cost advantages and pricing power are areas where cost shifting can theoretically influence profit. Due to externalities, this test is not conducted to empirically observe cost shifting. However, this section will describe the motivations for analyzing certain variables that influence contractor performance.

In government acquisitions, cost-type contracts place a higher risk level on the government to reimburse potential cost overruns which can impact contractors' profit margins on programs acquired under cost-type contracts. In fact, in the 1960's the Office of the Secretary of Defense discouraged cost-type contracts in favor of fixed-price and incentive

contracts as a way to gain more control over government costs (Fox, 2011). Another dynamic of defense acquisitions is that the government cannot easily switch among alternative firms when costs increase due to limited firm options, especially providers that produce specialized weapons systems. Effectively, defense contractors exert a level of pricing power and cost advantage as they can raise the price paid by the government without losing the government as a customer. For example, the government does not have an easily substitutable provider for Lockheed Martin's Joint Strike Fighter as it would have a replacement for a commodity like office chairs. The government might deem it more feasible to pay price increases imposed by the contractor instead of finding another provider.

Thomas and Tung (1992) and Chen and Gunny (2014) suggested that contract types are mechanisms for reporting higher reimbursable costs to the government which influences higher profit levels. Among the contract options, cost-type contracts in particular are assumed to exert more pricing power due to their reimbursement nature. In contrast, fixed-price contracts are assumed to possess low pricing power because the DoD's price will not change based on the contractor's cost incurred. This test of hypothesis predicts that cost contracts will have a positive association with moat.

H3: *Cost-type contracts positively impact economic moat, all else held constant.*

The final hypothesis test relates to another cost shifting premise. Lichtenberg (1992) suggested that the relationship between profit and a firm's percentage of government sales to total sales is a positive linear function, which highlights an important consideration. A firm's reported government sales is agnostic with regards to contracting types because transactions occur through other mechanisms like sales orders, blanket purchase agreements, and

government purchase cards, for example. As a result, a firm's total sales attributed to government business must also be accounted for. The fourth hypothesis statement is as follows:

H4: Revenue from government sales is positively associated with economic moat, all else held constant.

Model Design and Variables of Interest

The dependent variable for the hypothesis tests is Moat which is a proxy for a firm's competitive advantage, or ability to receive returns above capital costs. Moat is measured as ROIC less WACC. To examine the effect of moat attributes, the main independent variables are as follows: Intangible Assets calculated as intangible assets less Goodwill divided by total sales; Fixed Asset Turnover calculated as total revenue divided by average property, plant, & equipment; Total Asset Turnover calculated as total revenue divided by average total assets; Cost Contracts % which is a percentage of firm's total sales attributed cost type government contracts; and Defense Sales % which is a percentage of a firm's total sales attributed to defense revenue. A summary of variables is outlined in Table 2 along with descriptive statistics in Table 4.

Control variables of firm size, industry, and time have also been considered to separate the effects of confounding data. McGahan and Porter (1997) highlighted the influence of year, industry, and business-specific effects on U.S. corporate profits. Research on corporate performance also suggests firm size and industry as effect variables due to different growth opportunities and complexity (Core et al, 1999). These findings are particularly applicable to the study of defense contractors who represent a diverse range of company sizes and industries,

from heavy construction providers, prescription druggists, and aircraft manufacturers to name a few. Additionally, the ability for the DoD to engage contract work depends on an ever-evolving budgetary environment subject to fluctuations over time. To control for firm size, Total Sales will be selected as a proxy. To control for firm industry, the Standard Industrial Classification (SIC) will be selected as a proxy. Finally, the final control considered is time, which is represented by Year. Table 2 summarizes the theoretical model along with variable descriptions.

Table 2 – Theoretical Model & Variable Descriptions

Theoretical Model

$$Moat_{it} = \beta_0 + \beta_1 Intangible\ Assets_{it} + \beta_2 Fixed\ Asset\ Turnover_{it} + \beta_3 Total\ Asset\ Turnover_{it} + \beta_4 Cost\ Contracts\ \%_{it} + \beta_5 Defense\ Sales\%_{it} + \beta_6 Total\ Salesit + \beta_7 SIC_{it} + \beta_8 Year_{it} + \varepsilon_{it}$$

Variable	Role	Description
$Moat_{it}$	Dependent Variable	Calculated as ROIC less WACC. Measures firm *i*'s ability to receive a return from operations above its capital cost at time *t*. Represents competitive advantage.
$ROIC_{it}$	*Calculates DV*	Return on invested capital for firm *i* at time *t*. Measures the return earned from capital investments relative to the capital provided toward that investment.
$WACC_{it}$	*Calculates DV*	Weighed average cost of capital for firm *i* at time *t*. Represents economic rate of return. Measures a firm's hurdle rate required by capital providers in exchange for capital provided.
$Intangible\ Assets_{it}$	Proxy for intangible assets	Measured as intangible assets less Goodwill divided by total sales for firm *i* at time *t*.
$Fixed\ Asset\ Turnover_{it}$	Proxy for efficiency scale	Measured as total sales divided by avg. property, plant, & equipment for firm *i* at time *t*.
$Total\ Asset\ Turnover_{it}$	Proxy for efficiency scale	Measured as total sales divided by avg. total assets for firm *i* at time *t*.
$Cost\ Contracts\ \%_{it}$	Proxy for cost advantage & pricing power	Measured as percentage of total sales attributed to cost type government contracts for firm *i* at time *t*.
$Defense\ Sales\ \%_{it}$	Proxy for cost advantage & pricing power	Measured as percentage of total sales attributed to defense sales for firm *i* at time *t*.
$Total\ Sales_{it}$	Control Variable	Measured as total annual sales for firm *i* at time *t*
SIC_{it}	Control Variable	Measured as one of ten dummy variables represented by the first two SIC digits for firm *i* at time *t*
$Year_{it}$	Control Variable	Measured as one of nine dummy variables representing each year from 2010-2019 for firm *i* at time *t*
ε_{it}	Error Term	Unobservable error term for firm *i* at time *t*

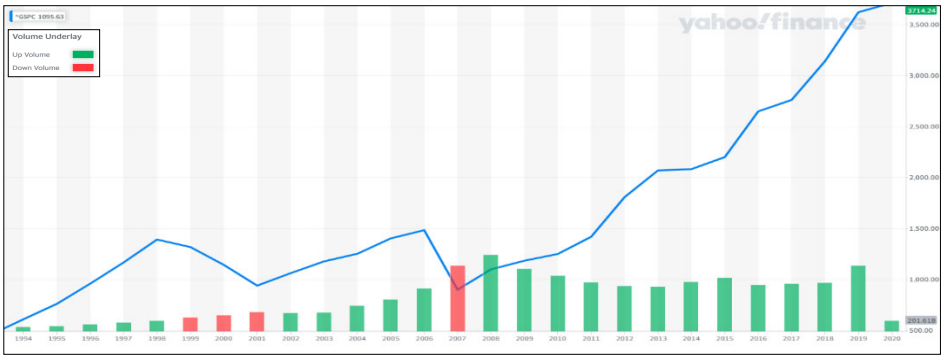
Coefficient of Interest	Predicted Relationship	Hypothesis Test
β_1	+	H1 explores the relationship between defense contractors' intangible asset investments and economic moat
β_2 ; β_3	+	H2 explores the relationship between defense contractors' asset base (efficiency scale) and economic moat
β_4	+	H3 explores the relationship between cost-type contracts and economic moat
β_5	+	H4 explores the relationship between a firm's total revenue attributed to defense sales and economic moat

Period of Study

The period of study is from 2010-2019 which has been chosen due to global market anomalies that occurred prior to this period. The calculation of economic profit, particularly WACC, is impacted by external factors such as the corporate lending environment and stock market volatility. From approximately 2007-2009, world financial markets were undergoing a historic crisis, which was followed by severe credit shock for global companies (Campello et al., 2010). In a study of how firms managed liquidity during the 2008-2009 period, Campello et al. concluded that when firms are unable to access credit lines, firms choose between saving or investing during a crisis. An implication from their study is that the ability to continue capital investments depends in part by access to credit sources for liquidity. As such, the credit shock during 2008-2009 may be a limiting factor on the level of capital investments made by firms compared to a non-crisis period.

Stock market volatility also impacts capital investments. Stock investors who anticipate losses during a crisis tend to make fewer new investments and will either withdraw, hold their positions, or shift to less risky assets. According to the Standard & Poor's 500 (S&P 500) Index, lower trading volume was observed during volatile periods around 1990's to early 2000 and 2006-2007 as indicated in Figure 2. The S&P 500 Index is benchmarked for market performance because 80% of available market capitalization is represented by the 500 large-cap U.S. equities comprising this index (S&P Global). The period of 2010-2019 provides the appropriate historical framework due to market growth and stability.

Figure 3 – S&P 500 Weighted Index from 1994 to 2020 obtained from Yahoo! Finance



Data Collection and Sample Description

The defense contractors identified for the sample population were obtained from the 2010-2019 annual Top 100 Contractors Reports containing top U.S. federal government contractors by federal agency and by obligation amount. The Top 100 Contractors ("Top 100") is made available through the federal government's System for Award Management website; this website provides publicly available acquisition award data that enables analyses on the impacts of federal spending and acquisition policies (GSA, 2019). Accordingly, the Top 100 reports are deemed a reliable basis from which to select contractors most significant to the study of defense contractor profitability. The following inclusion and exclusion criteria were applied to select the sample population.

Table 3 – Inclusion & Exclusion Criteria

No.	Parameter	Inclusion Criteria	Exclusion Criteria
1.	Study Period	2010 to 2019	Periods before 2010 and after 2019
2.	Contractor Type	Listed in the U.S federal government Top 100 Contractors Report	Not listed in the U.S federal government Top 100 Contractors Report
3.	Firm Type	Publicly traded companies based in the United States	Private companies, international-based companies, non-profit organizations, educational institutions
4.	Financial Data	Publicly available income statement and balance sheet data from 10-K reports; historical stock prices and stock beta from Yahoo!; risk-free bond yields from U.S. Department of the Treasury; financial ratios from Morningstar; corporate finance valuation data from NYU. Data must be reported as a nominal value or ratio.	Delisted companies whose income statement, balance sheet, and financial ratios are not available from 10-K, Morningstar, and Yahoo!
5.	Periods	Five or more consecutive years during Study Period	Four or less consecutive years during Study Period

The first criterion ensures that a period of market stability was analyzed. The second criterion ensures that only firms incurring defense business are included. These initial criteria resulted in 100 contractors over 10 years, or 1,000 firm-year observations. The third and fourth criteria ensure that sufficient data exists for ROIC and WACC variables to be determined. These exclusions eliminated a substantial portion of contractors such as privately held companies, educational institutions, private equity firms, and international corporations. The remaining contractors were 38 public-listed U.S. firms.

During the selection process for defense contractors, it was noted that a number of firms had undergone mergers or acquisitions (M&A) during the 2010-2019 period. For example, Raytheon Company appeared annually in the Top 100 contractor reports and ranked among the top five obligation amounts. In April of 2020, Raytheon Company completed its merger with United Technologies Corporation to form Raytheon Technologies. Due to the defunct status of its previous ticker, RTN, Raytheon Company's certain data necessary for this analysis were inaccessible through the investment research databases consulted such as Morningstar Investment Research Database which reports the metric ROIC.

There were additional observations of M&A activity of candidate firms. Health Net Inc. appeared annually in the Top 100 report until 2016 when it was acquired by Centene Corporation at which time Centene Corporation replaced Health Net Inc.'s position in the report. Harris Corporation and L3 Technologies Inc. each appeared annually in the Top 100 report through 2018. In 2019, Harris Corporation completed its merger with L3 Technologies Inc. to create L3Harris Technologies. L3Harris Technologies replaced Harris Corporation and L3 Technologies Inc's positions in the Top 100 list as of 2019. Due to the third and fourth criteria, the number of candidate firms with actively-traded ticker symbols was reduced to 35 firms.

The fifth criterion ensures that there is sufficient historical data to derive valuable meaning from economic moat. The five-year consecutive period is motivated by Morningstar's economic moat principle which explains that over a five-year period, wide moat stocks (those with sustainable competitive advantage) will generate shareholder value through increased earnings power and price appreciation. Due to this criterion, the number of candidate firms was reduced to 30 contractors. Table 8 provides a listing of the firms that were included in the final sample detailed by firm-year observation and SIC.

It was considered whether a form of data normalization should be performed to account for the unbalanced nature resulting from M&A activity. However, because the variables of interest are percentages, they are effectively scaled. It was also noted that M&A activity occurred across diverse industries of manufacturing, healthcare, and information technology and can be deemed a standard occurrence in the normal course of business. Further, these mergers potentially mirror the moat characteristic of efficiency scale through industry consolidation.

Data Limitations and Sample Size

A major limitation was the accessibility of financial data which could be facilitated through the use of a broader databank such as Bloomberg or Compustat. The financial metrics used in this analysis were manually obtained from publicly available sources such as the SEC website or Morningstar's research database. Additionally, different fiscal years among firms posed a limiting factor because this impacted availability of historical ratios. Morningstar Investment Research Database reports ten years of historical data, going back from a firm's most recently reported 10-K. At the time of this analysis, some firms have already published their 2020 fiscal year statements which means that historical data in Morningstar would be available from 2011 through 2020, eliminating the 2010 observation. Although some ratios like ROIC may be independently calculated, Morningstar's database provided a consistent, investment-grade calculation of this variable. Due to unavailable, missing, or non-reported financial data, the final sample consisted of 30 contractors and 274 contractor-year observations. The attached appendix describes the list of selected contractors by name and industry.

Another limitation in this study is the manual calculation of WACC which is not a metric reported by companies or research databases. Using the relevant financial information from the referenced sources, the data input and calculation for WACC was manually performed for each individual firm-year observation. Results were verified against a WACC calculator using online sources from Professor Damodaran at NYU's Stern School of Business.

Panel Data Analysis

The analysis of defense contractors' economic moat over time appropriately describes the sample as a panel dataset. Due to a number of yearly observations not reported for certain contractors, the sample analyzed is an unbalanced panel. When applying a pooled-cross section regression model to panel data, the dataset is treated as a cross-section dataset and the error term is idiosyncratic for each observation. Alternatively, panel analysis assumes the error term has two components: 1) a time-invariant component that is different for each company but that does vary over time for the same company; and 2) a time-variant component (i.e., idiosyncratic) that is different for each company during each time period. When the time-invariant component of the error term is assumed to correlated with the independent variables, a fixed-effect model can be used to account for this violation of exogeneity. The fixed-effects model effectively removes the time-invariant component from the error term. A fixed-effects panel model will thus be selected to conduct the tests of hypotheses.

Summary

Chapter three covered the methodology to analyze defense contractor performance. In particular, the variables of ROIC and WACC were described as an accounting rate of return and economic rate of return, respectively. The difference between these two rates can operationalize the concept of economic moat, or competitive advantage. Four hypothesis statements were developed to examine defense contractors' attributes of economic moat, which are intangible asset investments, efficiency scale, cost advantages, and pricing power. As a result of the methodology and hypothesis development, a theoretical fixed-effects model for panel data was selected.

IV. Analysis and Results

Overview

Chapter four summarizes the analysis and results of this study. First, descriptive statistics of the sample will be presented. Next, a regression using a fixed-effects panel model will be conducted. Finally, the regression results will be outlined to identify significant attributes that impact defense contractors' economic moat.

Descriptive Statistics

Table 4 displays descriptive statistics of the variables considered. Two sample sets are presented: N = 274, referred to as the "initial sample," and N = 136, referred to as the "subset." The difference between the initial sample and subset is as follows. The initial sample of N = 274 represents the set of contractor-year observations resulting from the inclusion and exclusion criteria outlined in Table 3. In order to conduct tests of hypothesis, specifically H3 and H4, using the variables listed in Table 2, additional data was collected to obtain firm sales attributed to government cost type contracts (variable Cost Contracts %) and sales attributed to defense customers (variable Defense Sales %).

Of the 30 defense contractors in the initial sample, 16 defense firms reported cost contract sales and defense sales, resulting in an unbalanced panel data set of N = 136 contractor-year observations. The final model was conducted on the subset of N = 136 because this subset of data possessed all variables to test the theoretical model. However, some metrics may not be considered valid measures for measuring a firm's economic moat due to different financial reporting requirements and features of the federal acquisitions process that are not

applicable across all defense contractors. To account for these differences, a sensitivity analysis will also be conducted on which results will be discussed below. A list of the firm-year observations for the initial sample of N = 274 and N = 136 subset have been outlined in Table 7.

Table 4 – Descriptive Statistics

N = 274	Mean	Median	Min	Max	Std Dev
MOAT %	0.04	0.04	-0.78	0.75	0.12
ROIC %	0.12	0.11	-0.68	0.85	0.12
WACC %	0.07	0.07	0.01	0.13	0.02
Intangible Assets %	0.05	0.04	0	0.46	0.06
Fixed Asset Turnover	32.14	17.27	1.60	328.17	40.98
Total Asset Turnover	1.61	1.23	0.19	5.91	1.06
Total Sales $	35,334,439,657	12,863,284,000	588,430,000	214,000,000,000	45,788,268,658

N = 136	Mean	Median	Min	Max	Std Dev
MOAT %	0.07	0.06	-0.20	0.75	0.13
ROIC %	0.15	0.13	-0.11	0.85	0.13
WACC %	0.07	0.07	0.02	0.12	0.02
Intangible Assets %	0.06	0.04	0	0.40	0.07
Fixed Asset Turnover	32.38	19.03	3.21	328.17	45.15
Total Asset Turnover	1.28	1.14	0.53	2.73	0.46
Defense Sales %	0.63	0.75	0.09	1.00	0.33
Defense Sales $	10,623,460,735	5,171,373,680	327,800,000	42,425,000,000	11,521,205,883
Cost Contracts %	0.49	0.48	0.02	0.99	0.23
Total Sales $	22,244,616,390	9,534,500,000	1,107,709,000	101,127,000,000	25,304,154,462

Tests of Hypotheses

Regression analysis was conducted using the RStudio "plm" package. A "twoway" fixed-effects model was employed to account for potentially significant effects for time and individual firms. A significance level of $\alpha = 0.05$ was chosen to determine statistical significance of the parameter estimates and overall model, however other significance levels were considered for potential implications. The final model is specified as follows:

$$Moat_{it} = \beta_1 \, Intangible\ Assets_{it} + \beta_2 \, Fixed\ Asset\ Turnover_{it} + \beta_3 \, Total\ Asset\ Turnover\ \%_{it} + \beta_4 \, Cost\ Contracts\ \%_{it} + \beta_5 \, Defense\ Sales\%_{it} + \varepsilon_{it}$$

Prior to interpreting results, additional diagnostic tests were performed to evaluate the validity of the model estimates. Because the panel data covers observations over a 10-year period, a possible problem that may be encountered is autocorrelation, which occurs when the error term in a given period is in some way correlated with the previous period (Hilmer and Hilmer, 2014). Another issue that may arise is heteroskedasticity which occurs when the error terms have nonconstant variance (Hilmer and Hilmer, 2014). The implications of the presence of autocorrelation and heteroskedasticity are that the parameter estimates are unbiased, they do not have minimum variance among all unbiased estimators, and the standard errors and associated calculations are incorrect (Hilmer and Hilmer, 2014). To detect autocorrelation, the Breusch-Godfrey test for serial correlation was employed for each of the models. To detect the presence of heteroskedasticity, the Breusch-Pagan test was employed for each of the models. As a result of the diagnostics, no additional corrections were necessary to refine the regression's parameter estimates. The regression results for the final model are summarized in Table 5.

Table 5 – Final Model Summary

Final Model: Fixed-Effect Panel Model

$$Moat_{it} = \beta_1 Intangible\ Assets_{it} + \beta_2 Fixed\ Asset\ Turnover_{it} + \beta_3 Total\ Asset\ Turnover\%_{it} + \beta_4 Cost\ Contracts\%_{it} + \beta_5 Defense\ Sales\%_{it} + \varepsilon_{it}$$

Unbalanced Panel: n = 16, T = 3-10, N = 136		Total Sum of Squares:	0.75346
Residuals:		Residual Sum of Squares:	0.6079
Minimum	-0.1991269	R-Squared:	0.19318
1st Quartile	-0.0295961	Adj. R-Squared:	-0.027549
Median	0.0003804	F-statistic:	5.07612 on 5 and 106 DF
3rd Quartile	0.0253604	p-value:	0.00032755
Maximum	0.3764404	Breusch-Godfrey Test:	Fail to reject
		Breusch-Pagan Test:	Fail to reject

	Dependent Variable: $Moat_{it}$				
Independent Variables	**Predicted Relationship**	**Observed Relationship**	**Coefficient**	**t-value**	**p-value**
$Intangible\ Assets_{it}$	+	-	-0.37420780	-1.8282	0.070333 .
$Fixed\ Asset\ Turnover_{it}$	+	+	0.00017262	0.5332	0.595042
$Total\ Asset\ Turnover_{it}$	+	+	0.13983210	3.3016	0.001311 **
$Cost\ Contracts\%_{it}$	+	-	-0.06445280	-0.5704	0.569615
$Defense\ Sales\%_{it}$	+	+	0.00203764	0.0193	0.984646

. Significant at the 0.10 level

** Significant at the 0.01 level

Coefficient of Interest	Hypothesis Tested & Conclusion
β_1	H1 explores the relationship between defense contractors' intangible asset investments and economic moat. At α = 0.10, the coefficient is statistically significant. The negative sign indicates that moat is negatively impacted by the scaled measure of intangible assets.
β_2 ; β_3	H2 explores the relationship between defense contractors' asset base (efficiency scale) and economic moat. Fixed Asset Turnover is not statistically significant. Total Asset Turnover is statistically significant at α = 0.01. The coefficient is positively associated with economic moat as predicted.
β_4	H3 explores the relationship between cost-type contracts and economic moat. The parameter estimate is not statistically significant; H3 is rejected.
β_5	H4 explores the relationship between a firm's total revenue attributed to defense sales and economic moat. The parameter estimate is not statistically significant; H4 is rejected.

Panel Model Regression Results

The final model was conducted on the sample subset of N = 136 and was statistically significant at the $\alpha = 0.05$ level. It was noted that the model had a relatively low R-Squared of 0.19318 which indicates there is a high level of unexplained variation in the model. Given the novelty of the effect variable examined, it is unknown whether there is an acceptable standard of R-squared measures if comparable studies were conducted. This subset of data mainly comprised of contractors in the aircraft manufacturing, aeronautics, construction, and professional services industries. The model produced two statistically significant results: Intangible Assets with a negative parameter estimate of -0.3742078 significant at the 0.10 level; and Total Asset Turnover with a positive parameter estimate of 0.1398321 significant at the 0.01 level. The variables Cost Contract % and Defense Sales % which proxied cost advantages and pricing power were not found to be statistically significant.

The Intangible Assets results relate to the first test of hypothesis recalled here:

H1: *Defense contractors' intangible asset investments are positively related to economic moat, all else held constant.*

The predicted effect was positive under the assumption that intangible asset investments position contractors to protect their intellectual property and even capitalize on their portfolio for commercial use. The observed negative effect suggests that a firm's intangible asset portfolio may not be a value-add to the firm's competitive advantage. A possible consideration is that contractors' intangible assets, such as patents developed from highly specialized defense technologies, have a very limited commercial application.

The Intangible Assets results can also be related back to Zhong and Gribbin's finding on risk and profitability which used a similar capital intensity measure of intangible assets and net

property, plant, and equipment scaled by total sales where this study only uses intangible assets in the numerator. Zhong and Gribbin's analysis show that when intangible assets and plant assets are scaled together, the effect is positive on profit. However, this study shows that intangible assets may be an impediment to competitive advantage. An implication can be that the capital intensities of intangible assets and plant assets have different effects on defense contractor performance and should therefore be analyzed separately.

The Total Asset Turnover results related to the first test of hypothesis which is recalled here:

H2: *A defense contractors' asset base positively explains economic moat, all else held constant.*

The predicted effect was positive under the assumption that defense contractors can gain efficiencies by serving a limited defense market and that their capital-intensive asset base presents a barrier to market entry for smaller firms. Two variables were analyzed to study the effect: Fixed Asset Turnover, with no statistically significant results on a positive coefficient, and Total Asset turnover with statistically significant results on a positive coefficient. This finding suggests that there is no significant effect on economic moat from sales generated by the use of property, plant, and equipment. However, when considering a firm's entire asset ownership, including plant assets, intangible assets, and short-term assets, defense contractors do possess the efficiency scale that positively impacts competitive advantage.

Sensitivity Analysis – Initial Sample

The analysis conducted for the final model included variables that are not necessarily relevant across all defense contractors based on certain criteria. First, public corporations are required to report government sales figures when they represent 10 percent or more of annual total sales (FASB, 1979). The firms that did not report government sales data in their public financial statements were primarily courier and healthcare companies such as FedEx, Cardinal Health, and Centene Corporation whose businesses do not specifically specialize in the defense industry and whose offerings serve a diverse customer base. The DoD may not represent a significant customer in terms of sales amounts, but these companies are significant to the DoD in terms of obligation amounts. Additionally, federal acquisition contracts that are typically used in weapon system programs are not always applicable to all categories of firms. For example, the healthcare and courier firms described qualify as Top 100 DoD contractors, but their products and services offerings are inherently different from traditional defense products. Therefore, features such as cost-reimbursement contracts are not considered normal acquisition mechanisms. To account for these differences, the effect of Cost Contracts % and Defense Sales % were removed from the final model to test H1 and H2. A sensitivity analysis was then conducted on the initial sample of N = 274 through an fixed-effects panel model regression. Results are summarized in Table 6.

Table 6 – Sensitivity Analysis

Sensitivity Analysis: Fixed-Effect Panel Model

$$Moat_{it} = \beta_1 Intangible\ Assets_{it} + \beta_2 Fixed\ Asset\ Turnover_{it} + \beta_3 Total\ Asset\ Turnover\ \%_{it} + \varepsilon_{it}$$

Unbalanced Panel: n = 30, T = 6-10, N = 274		Total Sum of Squares:	1.93
Residuals:		Residual Sum of Squares:	1.8253
Minimum	-0.7145760	R-Squared:	0.054267
1st Quartile	-0.0271744	Adj. R-Squared:	-0.11287
Median	0.0065877	F-statistic:	4.43749 on 3 and 232 DF
3rd Quartile	0.0348151	p-value:	0.004697
Maximum	0.4044664	Breusch-Godfrey Test:	Fail to reject
		Breusch-Pagan Test:	Fail to reject

Dependent Variable: $Moat_{it}$

Independent Variables	Predicted Relationship	Observed Relationship	Coefficient	t-value	p-value	
$Intangible\ Assets_{it}$	+	-	-0.14917732	-0.9470	0.34461	
$Fixed\ Asset\ Turnover_{it}$	+	+	0.00010018	0.2919	0.77064	
$Total\ Asset\ Turnover_{it}$	+	+	0.07709043	3.0373	0.00266	**

** Significant at the 0.01 level

Coefficient of Interest	Hypothesis Tested & Conclusion
β_1	H1 explores the relationship between defense contractors' intangible asset investments and economic moat. At α = 0.10, the coefficient is statistically significant. The parameter estimate is not statistically significant; H1 is rejected.
β_2 ; β_3	H2 explores the relationship between defense contractors' asset base (efficiency scale) and economic moat. Fixed Asset Turnover is not statistically significant. Total Asset Turnover is statistically significant at α = 0.01. The coefficient is positively associated with economic moat as predicted.

The regression results for the sensitivity analysis only indicates one statistically significant variable, Total Asset Turnover, with a positive effect. This result suggests that even over a broader set of industries, defense contractors consistently possess the efficiency attributes in their total asset base to positively influence competitive advantage.

Summary of Results

Panel data analysis was conducted to examine each attribute's relationship with defense contractors' economic moat. The empirical evidence produced two statistically significant results: intangible assets investments were found to be negatively associated with economic moat while efficiency scale was found to be positively associated with economic moat. Neither cost advantages nor pricing power indicated statistically significant relationships. An implication from this finding is that defense contractors' structural asset base is a potential driver in sustained competitive advantage which is a critical element for the Department of Defense to advance its national defense strategies.

V. Conclusions

This thesis conducted exploratory research on defense contractors' financial performance using economic profit. Specifically, a measure of competitive advantage, known as economic moat, was proxied as economic profit. Defense contractor performance is often scrutinized in literature under various measures of accounting rates of return to measure profit. However, the formulation of economic moat as ROIC less WACC addresses the literature gap of comparing accounting rates of return to economic rates of return. The understanding of defense contractors' economic moat provides a novel view on identifying competitive advantage attributes that enable long term, sustainable operations to maintain a necessary industrial base for the provision of national security. Specifically, the empirical analysis sought to understand how economic moat is impacted by the intangible asset investments that defense contractors make, whether defense contractors have efficiency and productivity measures to positively influence economic moat, and whether moat differs depending on the type of defense contracts held or the amount of defense sales recognized.

Statistically significant results were observed which suggest that defense contractors' investment in intangible assets are negatively associated with economic moat. However, when considering contractors' total asset base to include intangible assets, plant assets, and short-term assets, contractors possess the structural defense that generate sufficient returns to sustain competitive advantage.

Future Research

The study of defense contractor performance may benefit in the following ways. Although academic literate suggests the study of accounting rates of return relative to economic rate of return, a plausible analysis would be to examine if either rate is impacted more so by certain attributes. As such, economic moat attributes can be studied against ROIC and WACC individually. Rogerson's study found that positive economic profit in the form of increased market value for prime contract award winners. Following this notion, it is reasonable to consider that firms awarded with government contracts, either cost reimbursement or fixed price, can expect higher share prices, especially if shareholders perceive additional value in the government or defense business segment of a firm. Higher share prices have the ability to increase a firm's WACC because a higher return is demanded by shareholders which increases a firm's hurdle rate to service its capital providers.

Future research can conduct similar analyses by expanding the sample size. In particular, System of Award Management is a publicly available government database which reports historical government contracting detail. Some financial metrics such as revenue attributed to certain contract types were not consistently reported among contractors, however the use of a federal database may expand the data availability to explore more criteria. The government reporting is expressed in government terms of obligations and commitments. By contrast, contractors' public financial data is expressed in terms of income statements, balance sheets, and statements of cash flow. If government data was compared against contract data, research must consider whether the timing of government obligations is consistent with industry revenue recognition.

Economic moat can also be assessed across other metrics such as costs reported by type of acquisition programs. The variety of technologies used across defense products requires different levels of capital investments by defense contractors. As a result, a specific program type may yield higher or lower levels of economic moat for a defense contractor which may dictate contractors' decisions on which defense programs to feasibly pursue. This research can be advanced by reviewing defense contractors' financial statements relative to cost reporting by programs provided in the government Form 1921-3 known as the Contractor Business Data Report. As of the timing of this study, Cost Assessment Data Enterprise (CADE) was undergoing a modernization of government-mandated reporting and formatting. According to CADE, the cost data provided by contractors in Form 1921-3 will have improved allocation reporting. Additionally, the reported contractor labor and overhead rates will align with Final Proposal Revisions, Defense Contract Audit Agency audits, proposals and negotiations, pricing models, and more importantly will provide the DoD with enhanced insight into contractor cost rates.

Appendix

Table 7 – Summary of Literature on Profit and Cost Shifting of Government Contractors

Author(s)	Topic	Date	Summary of Results	Period Studied	Data Analyzed
Weidenbaum	Profit	1968	Defense contractors have greater profitability relative to typical industrial corporations	1952-1955; 1962-1965	Firm-level financial data
Stigler & Friedland	Profit	1971	Investments in defense contractors during the 1950's were 2x profitable compared to stocks listed in NYSE. Defense contractor stocks did as well as NYSE stocks in the 1960's.	1948-1961; 1958-1968	Stock market data
Bohi	Profit	1973	Defense and manufacturing firms do not have significant difference in profit; there is no significant association between a firm's percentage of defense business and profitability; and defense contractors profit on both civilian and military business at the same rate	1960 - 1969	Firm-level financial data
Greer & Liao	Profit	1986	Defense business negatively impacted overall sales for corporate firms	1963-1982	Firm-level financial data
Pownall	Cost Shifting	1986	CASB regulation is a deterrent to contractors' ability to extract excessive cost reimbursements	1968 - 1970	Stock market data
Rogerson	Profit	1989	Regulatory system for defense contractors promotes innovation by providing prizes in the form of economic profit	1960's - 1970's	Stock market data
Rogerson	Cost Shifting	1992	Regulatory process incentivizes cost shifting among firms with commercial and defense segments due to cost sensitivity of defense products and cost accounting practices of defense contractors	N/A; Theoretical analysis	N/A; Theoretical analysis
Thomas & Tung	Cost Shifting	1992	Defense contractors tend to overfund pensions when employees work on defense contracts by using overfunding strategies "across-contract" or "across-time"	1970's - 1980's	Firm-level pension data; actuarial data
Lichtenberg	Cost Shifting	1992	Profitability of commercial business by government contractors is higher than that of commercial business by non-government contractors; profit increases as a contractor's ratio of governmental to total sales increases	1983 - 1989	Firm-level financial data
McGowan & Vendrzyk	Cost Shifting	2002	No evidence that excess profitability of defense contractors is due to cost shifting	1984 - 1989; 1994 - 1998	Firm-level financial data
Zhong & Gribbin	Profit	2009	Risk, innovation, and influence have a positive relationship with defense contractor profit rates	1984 - 1999	Firm-level financial data
Wang & San Miguel	Profit	2012	Defense contractors earn excessive profits compared to industry peers; excessive profit is more pronounced post-1992 after significant industry consolidation; and profitability increases with poorer corporate governance	1950 - 2010; post-1992	Firm-level financial data
Chen & Gunny	Cost Shifting	2014	Government contractor profitability and discretionary expenses increase during periods with cost-plus contracts relative to years without	2005 - 2010	Firm-level financial data

Table 8 – Sample Firm-Year Observations by SIC Code & Firm

Major Group	SIC	SIC Description	Ticker	No. of Observations	Ticker	No. of Observations
16	**1600**	HEAVY CONSTRUCTION OTHER THAN BUILDING CONST CONTRACTORS	FLR	10		
			GLDD	10		
			KBR	9		
			J	10	J	9
36	**3600**	ELECTRONIC & OTHER ELECTRICAL EQUIPMENT (NO COMPUTER EQUIP)	GE	10		
37	**3711**	MOTOR VEHICLES AND PASSENGER CAR BODIES	OSK	9		
	3720	AIRCRAFT AND PARTS	AIR	9		
			TXT	8		
	3721	AIRCRAFT	BA	9	BA	9
	3724	AIRCRAFT ENGINES & ENGINE PARTS	RTX	10	RTX	10
			HON	10		
	3730	SHIP AND BOAT BUILDING AND REPAIRING	GD	10	GD	10
			HII	9	HII	9
	3760	GUIDED MISSILES AND SPACE VEHICLES AND PARTS	LMT	10	LMT	10
38	**3812**	SEARCH, DETECTION, NAVIGATION, GUIDANCE, AERONAUTICAL SYS	LHX	10	LHX	3
			NOC	10	NOC	10
	3829	MEASURING AND CONTROLLING DEVICES, NEC	CUB	9	CUB	7
45	**4513**	AIR COURIER SERVICES	FDX	9		
51	**5122**	WHOLESALE-DRUGS PROPRIETARIES & DRUGGISTS SUNDRIES	ABC	9		
			CAH	9		
			MCK	9		
59	**5961**	RETAIL CATALOG AND MAIL ORDER HOUSES	CDW	7		
63	**6324**	HOSPITAL & MEDICAL SERVICE PLANS	CNC	10		
73	**7373**	SERVICES COMPUTER INTEGRATED SYSTEMS DESIGN	CACI	9	CACI	9
			LDOS	10	LDOS	10
			SAIC	6	SAIC	6
87	**8711**	SERVICES ENGINEERING SERVICES	ACM	9	ACM	9
	8741	SERVICES MANAGEMENT SERVICES	MANT	10	MANT	10
	8742	SERVICES MANAGEMENT CONSULTING SERVICES	BAH	9	BAH	9
	8744	SERVICES FACILITIES SUPPORT MANAGEMENT SERVICES	VEC	6	VEC	6
				N = 274		**N = 136**

Table 9 – Sample of Contractors by Ticker and Company Name

Ticker	Company Name
ABC	AmerisourceBergen Corporation
ACM	AECOM
AIR	AAR Corp
BA	The Boeing Company
BAH	Booz Allen Hamilton Holding Corporation
CACI	CACI International Inc
CAH	Cardinal Health, Inc
CDW	CDW Corporation
CNC	Centene Corporation
CUB	Cubic Corporation
GLDD	Great Lakes Dredge and Dock Company
FDX	FedEx Corporation
FLR	Fluor Corporation
GD	General Dynamics Corporation
GE	General Electric Company
HII	Huntington Ingalls Industries
HON	Honeywell International Inc
J	Jacobs Engineering Group Inc
KBR	KBR, Inc
LDOS	Leidos
LHX	L3Harris Technologies
LMT	Lockheed Martin Corporation
MANT	ManTech International Corporation
MCK	McKesson Corporation
NOC	Northrop Grumman Corporation
OSK	Oshkosh Corporation
RTX	Raytheon Technologies Corporation
SAIC	Science Applications International Corporation
TXT	Textron Inc
VEC	Vectrus

Table 10 – Variable Averages by SIC and Company Name

SIC Description (Code) and Company Name	Average MOAT %	Average ROIC %	Average WACC %	Average Intangible Assets %	Average Fixed Asset Turnover	Average Total Asset Turnover	Average Total Sales
HEAVY CONSTRUCTION OTHER THAN BUILDING CONST CONTRACTORS (1600)	**-3.16%**	**5.25%**	**8.35%**	**2.01%**	**21.05**	**1.57**	**$ 9,580,818,133**
Great Lakes Dredge and Dock Company	-4.82%	3.23%	8.04%	0.31%	1.95	0.88	$ 710,021,300
Fluor Corporation	-4.50%	5.50%	9.90%	0.46%	22.51	2.55	$ 20,216,858,900
KBR, Inc	-4.00%	4.60%	8.80%	3.71%	26.30	1.32	$ 6,450,200,000
Jacobs Engineering Group Inc	0.67%	7.67%	6.67%	3.55%	33.45	1.53	$ 10,946,192,333
ELECTRONIC & OTHER ELECTRICAL EQUIPMENT (NO COMPUTER EQUIP) (3600)	**-5.40%**	**0.00%**	**5.30%**	**11.58%**	**2.16**	**0.25**	**$ 123,950,500,000**
General Electric Company	-5.40%	0.00%	5.30%	11.58%	2.16	0.25	$ 123,950,500,000
MOTOR VEHICLES AND PASSENGER CAR BODIES (3711)	**0.89%**	**12.33%**	**11.44%**	**8.57%**	**17.08**	**1.49**	**$ 7,271,922,222**
Oshkosh Corporation	0.89%	12.33%	11.44%	8.57%	17.08	1.49	$ 7,271,922,222
AIRCRAFT AND PARTS (3720)	**-1.81%**	**7.32%**	**9.19%**	**4.60%**	**6.09**	**1.01**	**$ 7,617,630,833**
AAR Corp	-3.36%	4.52%	7.89%	4.68%	6.68	1.09	$ 1,874,886,667
Textron Inc	-0.25%	10.13%	10.50%	4.51%	5.51	0.94	$ 13,360,375,000
AIRCRAFT (3721)	**31.67%**	**40.00%**	**8.11%**	**3.47%**	**7.99**	**0.98**	**$ 86,264,333,333**
The Boeing Company	31.67%	40.00%	8.11%	3.47%	7.99	0.98	$ 86,264,333,333
AIRCRAFT ENGINES & ENGINE PARTS (3724)	**6.75%**	**14.00%**	**7.35%**	**16.63%**	**7.14**	**0.77**	**$ 49,804,650,000**
Raytheon Technologies Corporation	6.40%	12.70%	6.50%	24.48%	7.05	0.72	$ 61,224,000,000
Honeywell International Inc	7.10%	15.30%	8.20%	8.77%	7.23	0.82	$ 38,385,300,000
SHIP AND BOAT BUILDING AND REPAIRING (3730)	**7.55%**	**15.58%**	**8.03%**	**5.36%**	**6.48**	**1.04**	**$ 20,051,200,000**
General Dynamics Corporation	8.10%	15.50%	7.50%	4.28%	9.45	0.92	$ 32,806,400,000
Huntington Ingalls Industries	7.00%	15.67%	8.56%	6.45%	3.51	1.16	$ 7,296,000,000
GUIDED MISSILES AND SPACE VEHICLES AND PARTS (3760)	**28.60%**	**34.80%**	**6.30%**	**3.87%**	**9.48**	**1.19**	**$ 48,726,600,000**
Lockheed Martin Corporation	28.60%	34.80%	6.30%	3.87%	9.48	1.19	$ 48,726,600,000
SEARCH, DETECTION, NAVIGATION, GUIDANCE, AERONAUTICAL SYS (3812)	**6.45%**	**13.00%**	**6.55%**	**7.98%**	**7.15**	**0.87**	**$ 16,412,585,000**
L3Harris Technologies	4.30%	10.90%	6.60%	14.69%	7.20	0.81	$ 5,545,170,000
Northrop Grumman Corporation	8.60%	15.10%	6.50%	1.26%	7.10	0.93	$ 27,280,000,000
MEASURING AND CONTROLLING DEVICES, NEC (3829)	**-1.42%**	**5.71%**	**7.13%**	**6.16%**	**19.41**	**1.16**	**$ 1,347,285,000**
Cubic Corporation	-1.42%	5.71%	7.13%	6.16%	19.41	1.16	$ 1,347,285,000
AIR COURIER SERVICES (4513)	**0.78%**	**9.33%**	**8.67%**	**0.57%**	**2.43**	**1.36**	**$ 51,679,777,778**
FedEx Corporation	0.78%	9.33%	8.67%	0.57%	2.43	1.36	$ 51,679,777,778
WHOLESALE-DRUGS PROPRIETARIES & DRUGGISTS SUNDRIES (5122)	**7.33%**	**12.15%**	**4.74%**	**1.49%**	**91.27**	**4.16**	**$ 136,104,430,815**
AmerisourceBergen Corporation	12.11%	15.00%	2.56%	1.17%	111.64	5.08	$ 127,637,292,444
Cardinal Health, Inc	4.67%	10.00%	5.22%	1.37%	67.08	3.87	$ 115,676,000,000
McKesson Corporation	5.22%	11.44%	6.44%	1.91%	95.10	3.52	$ 165,000,000,000
RETAIL CATALOG AND MAIL ORDER HOUSES (5961)	**7.65%**	**13.40%**	**5.75%**	**7.57%**	**83.65**	**2.11**	**$ 14,182,585,714**
CDW Corporation	7.65%	13.40%	5.75%	7.57%	83.65	2.11	$ 14,182,585,714
HOSPITAL & MEDICAL SERVICE PLANS (6324)	**4.70%**	**9.30%**	**4.70%**	**1.65%**	**36.49**	**2.86**	**$ 29,169,742,500**
Centene Corporation	4.70%	9.30%	4.70%	1.65%	36.49	2.86	$ 29,169,742,500
SERVICES COMPUTER INTEGRATED SYSTEMS DESIGN (7373)	**2.49%**	**9.58%**	**6.90%**	**5.24%**	**46.50**	**1.57**	**$ 5,659,723,259**
CACI International Inc	1.00%	8.22%	7.00%	5.35%	51.52	1.25	$ 3,940,569,778
Leidos	1.64%	8.51%	6.87%	5.20%	29.33	1.46	$ 8,724,600,000
Science Applications International Corporation	4.83%	12.00%	6.83%	5.18%	58.64	2.00	$ 4,314,000,000
SERVICES ENGINEERING SERVICES (8711)	**-3.00%**	**4.33%**	**7.67%**	**1.80%**	**29.87**	**1.43**	**$ 14,077,642,222**
AECOM	-3.00%	4.33%	7.67%	1.80%	29.87	1.43	$ 14,077,642,222
SERVICES MANAGEMENT SERVICES (8741)	**-0.40%**	**6.70%**	**7.00%**	**8.31%**	**65.42**	**1.28**	**$ 2,119,021,500**
ManTech International Corporation	-0.40%	6.70%	7.00%	8.31%	65.42	1.28	$ 2,119,021,500
SERVICES-MANAGEMENT CONSULTING SERVICES (8742)	**9.78%**	**14.67%**	**4.78%**	**4.13%**	**38.69**	**1.81**	**$ 5,783,211,333**
Booz Allen Hamilton Holding Corporation	9.78%	14.67%	4.78%	4.13%	38.69	1.81	$ 5,783,211,333
SERVICES FACILITIES SUPPORT MANAGEMENT SERVICES (8744)	**7.37%**	**15.83%**	**8.46%**	**0.29%**	**191.19**	**2.39**	**$ 1,225,201,000**
Vectrus	7.37%	15.83%	8.46%	0.29%	191.19	2.39	$ 1,225,201,000
Sample Average	**4.53%**	**11.75%**	**7.20%**	**5.18%**	**35.17**	**1.64**	**$ 34,572,856,301**

Table 11 – Variable Formulas and Description

Variable	Role	Formula	Description
$Moat_{it}$	DV	ROIC - WACC	Measure of firm i's ability to receive a return from operations above its capital cost at time t. Represents sustainable competitive advantage.
ROIC $_{it}$	*Calculates DV*	Operating $Income_{t-1}$(1 - tax rate) / Book Value of Invested Capital $_{t-1}$	Return on invested capital for firm *i* at time *t*. Measures the return earned from capital investments relative to the capital provided toward that investment.
WACC $_{it}$	*Calculates DV*	(E/V x Re) + ((D/V x Rd)* (1 – T)) Where: E = value of the firm's equity (market capitalization) D = value of the firm's debt (book value) V = total value of all equity and debt capital (E + D) E/V = ratio of total capital that is equity D/V = ratio of total capital that is debt Re = cost of equity (required rate of return) Rd = cost of debt (yield to maturity on existing debt) T = tax rate	Weighed average cost of capital for firm *i* at time *t*. Measure of a firm's hurdle rate required by capital providers in exchange for the capital provided. As an economic rate of return, WACC is the minimum return that a firm must earn from investing this capital.
Intangible $Assets_{it}$	IV	Intangible assets less Goodwill / Total revenue	Measure of a firm's capital intensity for firm *i* at time *t*. Measures revenue generated per dollar of intellectual property. Proxy for economic moat attribute of intangible asset investments.
Fixed Asset $Turnover_{it}$	IV	Total revenue / Avg. property, plant, & equipment	Measures firm effectiveness in generating sales from fixed assets for firm *i* at time *t*. Proxy for economic moat attribute of efficiency scale.
Total Asset $Turnover_{it}$	IV	Total revenue / Avg. total assets	Measures firm effectiveness in generating sales from long-term and short-term fixed assets for firm *i* at time *t*. Proxy for economic moat attribute of efficiency scale.
Cost $Contract_{it}$	IV	% of total sales attributed to cost contracts	Percentage of total sales attributed to cost reimbursement contracts for firm *i* at time *t*. Proxy for economic moat attributes of cost advantage and pricing power.
Defense $Sales_{it}$	IV	% of total sales attributed to defense sales	Percentage of total sales attributed to defense sales for firm *i* at time *t*. Proxy for economic moat attributes of cost advantage and pricing power.
SIC_{it}	Control Variable	N/A	Control variable for industry for firm *i* at time *t*.
Total $Sales_{it}$	Control Variable	N/A	Control variable for size for firm *i* at time *t*.
$Year_{it}$	Control Variable	N/A	Control variable for time for firm *i* at time *t*.

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14. ABSTRACT

Defense contractor financial performance is traditionally measured using accounting profit. In academic literature, accounting profit has been proxied through different applications of accounting rates of return. However, the use of these rates pose certain limitations. First, accounting rates of return have been applied inconsistently. Next, academic research has not typically assessed accounting returns against a firm's opportunity costs. As a result, there is a literature gap in defense research that assesses whether defense contractors earn sustainable returns beyond the cost to produce those returns.

This exploratory research aims to address the research gap in defense contractor financial performance by examining economic profit. This thesis adopts the concept of competitive advantage as a measure of economic profit. Economic profit, proxied by economic moat, is superior to the current methods used in academic literature because it considers the following: Return on Invested Capital, an accounting rate of return, and Weighted Average Cost of Capital, an economic rate of return. Firms with economic moat possess attributes such as intangible asset investments, efficiency scale, cost advantages, and pricing power. Firms that have sustained competitive advantage with these attributes have built moats, or defenses, that prevent competition, preserve profits, and create long-term value.

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