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PROFITABILITY MEASUREMENTS OF DEFENSE INDUSTRY FIRMS IN GREECE AND THE USA

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Despite the consistently high level of defense expenditures, Greece's defense industrial base (DIB) has not been a major sector of its economy. The reasons for that include the late and limited industrialization of the country, the emphasis on armaments imports, the fierce competition by foreign conglomerates, and the particular characteristics of the defense market itself. Through this thesis, I attempt to address a knowledge gap about the Greek DIB at the company level. To achieve this, I use the 2015–2022 publicly disclosed financial statements of the companies, which are included in the Hellenic Defence Industries Catalogue, as a basis for a ratio analysis. Additionally, I use unsupervised machine learning methods to cluster the companies to specific profiles. This knowledge empowers policy makers to tailor a more efficient development strategy for the sector and can also serve as a benchmark amongst the companies.

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ABSTRACT

Despite the consistently high level of defense expenditures, Greece's defense industrial base (DIB) has not been a major sector of its economy. The reasons for that include the late and limited industrialization of the country, the emphasis on armaments imports, the fierce competition by foreign conglomerates, and the particular characteristics of the defense market itself. Through this thesis, I attempt to address a knowledge gap about the Greek DIB at the company level. To achieve this, I use the 2015–2022 publicly disclosed financial statements of the companies, which are included in the Hellenic Defence Industries Catalogue, as a basis for a ratio analysis. Additionally, I use unsupervised machine learning methods to cluster the companies to specific profiles. This knowledge empowers policy makers to tailor a more efficient development strategy for the sector and can also serve as a benchmark amongst the companies.

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LIST OF ACRONYMS AND ABBREVIATIONS

ART	accounts receivables turnover ratio
C&CE	cash & cash equivalent
CBRN	Chemical, Biological, Radiological and Nuclear
COGS	cost of goods sold
DIB	Defense Industrial Base
DOD	U.S. Department of Defense
EAS	Hellenic Defence Systems
EBIT	earnings before interest and tax
EBT	earnings before tax
FASB	Financial Accounting Standards Board
FIFO	First in, First out inventory accounting method
GAAP	Generally Accepted Accounting Principles
GAO	Government Accountability Office
GDDIA	General Directorate of Defence Investments and Armaments
GDP	Gross Domestic Product
HAF	Hellenic Air Force
HAI	Hellenic Aerospace Industry
HELDIC	Hellenic Defence Industries Catalogue
HMoD	Hellenic Republic Ministry of National Defence
IFRS	International Financial Reporting Standards
IGR	Interquartile range
ITR	Inventory turnover ratio
LIFO	Last in, First out inventory accounting method
NATO	North Atlantic Treaty Organization
NSPO	NATO Support and Procurement Organization
PMR	(Net) Profit Margin Ratio
R&D	Research and Development

ROA	Return on Assets
SG&A	Selling, General and Administrative expenses
SIPRI	Stockholm International Peace Research Institute
TATR	Total Assets Turnover Ratio
UHC	Union of Hellenic Chambers of Commerce

EXECUTIVE SUMMARY

Greece's defense expenditure has always been a significant share of the overall public spending, putting pressure on its national debt. At the same time, the lion's share of those expenditures has been directed towards imports of weapon systems and other military capabilities. While the overall effect of the substitution of those imports and the development of the indigenous defense industrial base (DIB) is not either straightforward or significant, there have been historical cases where the focus on those aspects has helped the national economy. A similar focus could resolve both the security concerns and the national deficit in the future, revitalizing at the same time the anemic employment figures in Greece. However, any amount of government regulation could not replace the need for a competitive private industry sector.

To assess the competitiveness of the sector, I collected financial data from the annual financial statements of Greek DIB firms for the years 2014–2022. As a benchmark, I used corresponding data of major DOD contractors. For both groups I calculated the Return on Assets (ROA) ratio. Furthermore, I analyzed this ratio to its constituents, profit margin ratio (PMR) and total assets turnover ratio (TATR). In turn, I analyzed those to ratio one step further. Specifically, I analyzed PMR into the ratio of cost of goods sold (COGS) to revenues and the ratio of selling, general and administrative expense (SG&A) to revenues. Finally, I analyzed TATR to account receivables turnover ratio (ART) and inventory turnover ratio (ITR).

With the exception of SG&A/Revenues ratio, every other metric examined was significantly different between the two groups. On the first level, U.S. DIB firms achieved on average significantly better ROA in comparison with their Greek counterparts (median value of 10% vs. 3%). However, the driver of this difference was the PMR difference (7% vs. 3%), since surprisingly the Greek companies managed higher TATR performance (0.63 vs. 0.89). At the third level of analysis, U.S. companies were outperforming Greek ones in COGS/Revenues (71% to 75%), ART (5.89 to 0.96) and ITR (6.82 to 4.19), while no statistical difference was proved for SG&A/Revenues (18% to 17%). Even though the Greek DIB demonstrates a characteristic duality, with a couple of big, underperforming

state-owned firms and an ecosystem of smaller private entities, the results remained the same when the former were excluded from the comparison. The discrepancy between the better TATR and worse ART and ITR performances of the Greek companies implies that they were much better at utilizing the rest elements of their asset class, particularly their fixed assets.

In conclusion, this thesis set benchmarks for the defense industry companies, which can be used by internal or external stakeholders, as well as revealed the different approaches a typical U.S. and Greek DIB company uses to get to profitability. These differences denote different managerial abilities and possible complementarity between them.

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Finally, if this thesis reflects anything at a deeper level, it is not my knowledge, work, or achievements, but rather the unconditional love, encouragement, and sacrifices of my parents, Konstantinos and Maria, every single day of my existence. They are my North Star, the only idols I have ever had, and the best people anyone knows. My only desire is to make them proud and to embody even a fraction of the kindness they exude to the world around them.

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I. INTRODUCTION

Defense expenditures absorb a large chunk of a polity's coffers, irrespective of the era, the technological level, or the form of political organization. Efficient defense spending is critical for the survival of the state. While Greece traditionally has one of the biggest conventional armaments globally, especially in relation to the size of its economy, most of those weapons are in the form of imports by foreign companies (Kolliniatis & Kollias, 2020). This is a problem because it causes increases in the trade deficit, limits the strategic autonomy of the country, and minimizes the development potential of the indigenous defense companies sector (Doulos et al., 2021). To mitigate the problem, defense procurement practitioners for the Hellenic Armed Forces need to have a thorough knowledge of the local market, its potential, and its shortcomings. That way, the capability requirements can be fulfilled in the most economical and sustainable way.

Kolliniatis and Kollias (2020) provide a general overview of the historical demand level and the sector's publicly owned companies, supplemented with a cursory review of the latest trends for private companies. Ploumis (n.d.) contributes a more detailed view on the subject, but still only for a subset of larger companies that act mainly as subcontractors to major foreign companies. Additionally, the data collected is by now 10 years old, limiting its usefulness in the current environment. While both studies can be used as valuable resources for country-level comparisons, their work lacks the granularity, completeness, and timeliness necessary to formulate policy and assist in the creation of long-term business plans at today's sector or company level. This lack, in turn, underlines the need for a systematic and current analysis of the Greek defense industrial base (DIB) to act as an analytical framework for all sides involved in the public procurement of armaments. The government side can use this analysis as a screening mechanism for potential contractors and for policy formulation, while the DIB companies can benchmark themselves against their local and international competition, identify gaps in the market, and pursue synergies that would allow them to enhance their competitive position in the international market.

Moving from another angle, Plakoudas (2023) assesses the current state and future possibilities of Greek DIB companies through a qualitative review of the recent headline deals between the DIB companies and foreign prime contractors. He argues that besides the structural challenges of the sector, there is room for optimism regarding future production, employment, and export levels (Plakoudas, 2023). However, to get there, there is still the need for a more detailed statistical analysis to pinpoint specific and measurable critical key performance indicators. Plakoudas (2023) also proposes the establishment of a policy directing organization at an under-secretary level, a suggestion shared with numerous others academics (Ploumis, n.d.) and DIB practitioners (Ptisi, 2023). An organization of that kind has to base its analysis and recommendations in proven, predictive quantitative tools and detailed knowledge of the competitive advantages and challenges the DIB companies are facing. I attempt in this thesis to initiate the construction of such a framework by examining the publicly available financial statements of a broad cross-section of the DIB companies.

This thesis will help solve the problem of limited knowledge about the DIB, its current standing, and its potential for development by analyzing trend patterns in the financial statements of the defense-sector companies. The knowledge gained through this analysis will help policy makers as well as practitioners in the public procurement stage to formulate and enact measures suitable for the development of the DIB in the most efficient way. After all, it is a statutory requirement (Δημόσιες Συμβάσεις Έργων, Υπηρεσιών και Προμηθειών [Public Procurement of Goods, Services and Works], 2011, art. 59) that the public organization should evaluate the financial status of the offerors as a prerequisite of the source selection process. The findings will also help the companies themselves to benchmark their operations and strategic planning, as well as to identify market gaps and potential cooperation opportunities.

II. BACKGROUND

A. GREEK DEFENSE EXPENDITURES

In this section, I provide an overview of the history of Greek defense expenditures, from the beginning of the 19th century until today. I underline the circumstances, both historical and geopolitical, that forced Greece to consistently spend a large part of its revenue in defense. These reasons will probably remain the drivers of increased defense spending in the future, compounded by the rising costs of newer and more technologically capable weapon systems. I examine the current status of research linking defense expenditure with broader economic development, and finally, I note some benefits a robust DIB can have on the efficiency of the resources used. Greece has already assumed some policies in that direction, and there are additional proposals for a more holistic approach.

For the biggest part of its modern history, Greece has devoted significant resources to its defense. This unwavering need stems from various geopolitical reasons. Even during the Greek Revolution, the then-unrecognized state conducted two loan agreements with international financiers, a big part of which were earmarked for armaments procurements (Ζωγράφου, 2020). For the first century of its existence, Greece needed credible armed forces not only to protect its own borders, but also with the view to liberate and integrate ethnically Greek populations living beyond its borders at that time, a policy known as *Megali Idea* ("The Great Idea"). According to research on Greek public spending for the period of 1842–1938 (Kollias et al., 2021), defense expenditures accounted for 9.4% of the gross domestic product (GDP) annually. During the Cold War, multiple crises with Turkey eventually culminated in the 1974 Turkish invasion of the island of Cyprus, which was in violation of Cyprus' right to self-determination and sovereignty. For most researchers (Doulos et al., 2021; Kamaras, 2023; Plakoudas, 2023), this was also the turning point for the stipulation of a national policy on an indigenous DIB. Additionally, two of Greece's northern neighboring states (Albania and Bulgaria) were members of the Warsaw Pact, keeping the need for defense spending at high levels. In the 1980s–90s, however, Greece began scaling back its defense spending. The relative drop, in terms of defense expenditure as a percentage of GDP, has been attributed to the strategic choice of joining the EU in

1981 (Karampekios, 2014). While during the 1990s, many countries enjoyed the peace dividend after the dissolution of the Soviet Union (Clements et al., 2021; Ippolito, 1994), the Yugoslav Wars and the escalating tensions in the Aegean Sea prevented Greece from decreasing its defense spending and conserving public funds (Kollias et al., 2016). The rise and fall of the Greek economy during the next two decades was reflected in the volume of the defense spending. Researchers had identified early in the Greek Debt Crisis (Dokos & Kollias, 2013) that a new approach was needed to optimize the efficiency of the shrinking defense budget. Data collected by the Stockholm International Peace Research Institute (SIPRI) and World Bank, shown in Figure 1, demonstrates the fluctuations of Greek defense spending both in terms of current U.S. dollars and as a percentage of the Greek GDP. Greece's defense expenditure reached as high as 23.9% during the Greek–Turkish War of 1919–1922 (Kollias et al., 2021), while even the lowest value (2.4% in 2014) remained higher than the 2% guideline set amongst North Atlantic Treaty Organization (NATO) member-states in 2006 (NATO, 2023).

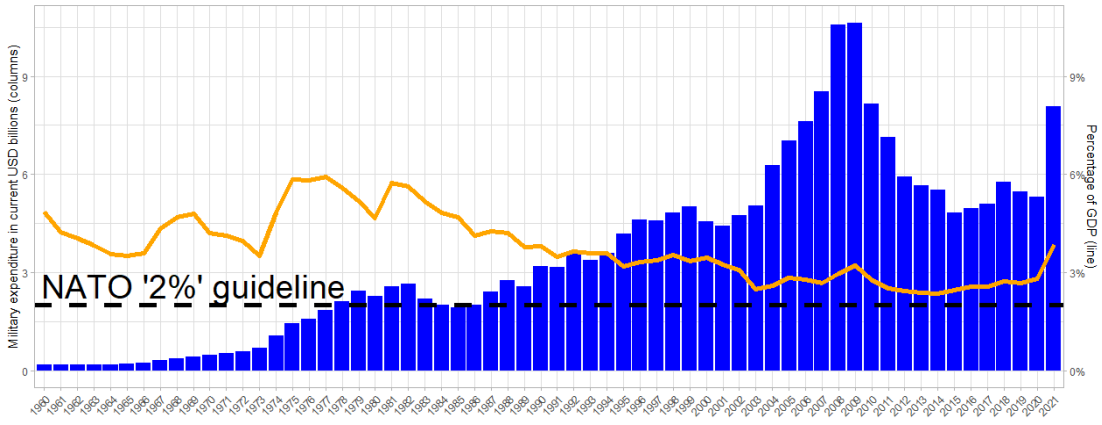

Figure 1. Military expenditure in current USD (billions) and as a percentage of Greek GDP, 1960–2021. Adapted from World Bank Open Data (2023).

Geopolitical considerations are pivotal to understanding the need for the Hellenic Republic's substantial defense expenditures. In strategic terms, Greece is located at the crossroads of three continents (Africa, Asia, and Europe). Beyond the traditional sense of state-level conflict, this is also important for new kinds of security threats, from

international networks of illicit trade to mass migration flows (Karatrantos, 2021). Additionally, the particularities of Greece's geography contribute to its need for increased deterrence and defense capabilities (Özsaraç, 2022). The multitude of islands and islets, the proximity to the Bosporus Straits and the Suez Canal, and the pivotal role Greek shipping is playing in world trade impose the need for a sizeable and capable Navy, especially until the United Nations Convention of the Law of the Sea (UNCLOS) is signed and ratified by all of the countries of the region.

Globally, defense expenditures are on the rise (Tian, N. et al.,2023). In its recent report (Oakley, 2023), the U.S. Government Accountability Office (GAO) found that *"*rising modernization costs, production inefficiencies, and supply chain challenges drove the majority of costs*"* of significantly fewer major defense acquisition programs between 2020 and 2022 (p. 2). These trends of high levels of defense expenditures and persistent costs will most likely continue for the foreseeable future. The Lowy Institute Asia Power Index (2023) expects that by 2030, the United States will spend just under $1 trillion in defense, with other major countries raising their spending as well.

Another reason to expect increased future defense expenditures is the rising cost of weapon systems. As technological innovation expands the action repertoire for states' adversaries, either in traditional or newfound domains of conflict (Rolenc, 2020), states have to provide for both high-end and redundant defense capabilities. These capabilities need extensive investments for research and development (R&D) and sourcing rare components from monopolistic markets (Salim et al., 2022). States also require spending in developing and integrating their tactical and strategic use through realistic war-gaming and exercises. Lastly, the ever-accelerating pace of technological innovation makes the estimation of life-cycle costs more variant and thus more difficult to project costs in the future (Jones et al., 2014).

One way to counter cost escalation is to abandon technological superiority on the battlefield by procuring weapon systems with mature designs and proven usage, often importing them as a secondhand user. Greece has followed this paradigm before (Kolliniatis & Kollias, 2020) and will probably do so in the future. The most recent high-profile example of this policy was the acquisition of a combination of new and used Rafale

fighter jets from Dassault Aviation (Έγκριση Σχεδίων Συμβάσεων Στον Τομέα Της Άμυνας [Draft Defense Contract Ratification], 2021). Especially within the NATO community, this paradigm confers benefits to both sides of the transaction. For a country with a smaller economy, like Greece, buying weapon systems from its allies, either as the initial user or as a secondary one, abates fiscal restraints while ensuring interoperability and transfer of operational knowledge. Additionally, especially in the past, this was a way to assume some maintenance, support, and industrial upgrade responsibilities through offset benefits, although the evaluation of the impact of such measures was lukewarm at best (Antonakis, 2014). For the bigger countries of the alliance, like the United States, these exports help to recoup some of the cost of developing the new weapon systems and provide a relatively cheap and proven way to enhance their allies' capabilities (Beard, 1995).

However, as the events following the Russian invasion in Ukraine in 2022 have shown, this paradigm is insufficient in times when a surge in industrial capacity and swift adaptation to the battlefield are needed (Acquisition Research Program at NPS, 2023). To create a complete strategy, this paradigm, reminiscent of a core-periphery setup, can be supplemented with a more evenly distributed defense–industrial capacity (McGinn & Roche, 2023). This alternative could raise issues of coordination amongst the member-states of NATO, but on the other hand, it could also provide a new impetus for investing in developing the defense industrial capabilities of all of the countries of the alliance. Greece has already tried to leverage such synergies, both as a part of NATO initiatives like the NATO Support and Procurement Agency (NSPA; 2023) and High Visibility Projects (McInnis & Fata, 2023) and with European Union (EU) initiatives like the Permanent Structure Cooperation, the European Defence Fund (European Defence Agency [EDA], 2023) and the EDA (Karampekios, 2015).

Notwithstanding the purely operational reasons for a prosperous DIB, there is still no consensus on the effect of military spending on economic growth. Karamanis (2022) provided research evidence accumulated over time for both sides of the argument and concludes that irrespective of the correlation sign between the two variables, overall military spending levels and economic growth measured as GDP growth display a rather modest and non-linear relationship. On the other hand, Guay (2007) argues that

development, and particularly globalization, of the DIB confers benefits in aspects that traditional analyses ignore, like technology transfer and the creation of a highly skilled associated workforce. Hall et al. (2014) identify a way to industrialization through small arms, ammunition, or sub-components production. For the case of Greece, multiple researchers (Andreou et al., 2013; Zombanakis, 2014) have proposed a gradual substitution of imports with domestic production as a way to reduce the challenges on the balance of payments.

In summary, throughout its history, Greece has committed a significant part of its revenues for defense. This spending pattern, which stems from both historical and geopolitical factors that are now coupled with the increasing technological complexity of new weapon systems, will most likely continue in the future. A combination of a new acquisition profile, with a mixture of newer and older systems, and synergies within the EU and NATO framework are already in place. Development of the DIB has been proposed as a further measure to increase the effectiveness of Greece's defense spending, not only in terms of economic growth but also as a counterweight to fiscal pressures.

B. GREEK DEFENSE INDUSTRY

In this section, I examine the history and current structure of the Greek DIB. The Hellenic Defence Industries Catalogue (HELDIC), which is published by the General Directorate for Defense Investments and Armaments (*ΓΔΑΕΕ* [GDDIA]) of the Hellenic Republic's Ministry of National Defence (*ΥΠΕΘΑ* [HMoD]), is the nexus of the analysis. Additionally, I evaluate some key points in the history of the DIB's state-owned companies, as well as some of the latest developments on the private side of Greece's DIB.

As Doulos et al. (2021) notice, with the exception of the Greek Powder and Cartridge Company (PYRKAL), the small arms ammunition manufacturer that was nationalized in 1982 after more than a century as a private company, Greece attempted to create an indigenous DIB more as a response to external geopolitical shock than as a long-term coherent industrial strategy. During the 1980s, the competitiveness of the sector's state-owned companies was undermined by favoritism and party politics (Plakoudas, 2023). Smaller private companies also started operating during this decade, although the

majority of the companies included in the HELDIC were established during the period between 1992–2006, when Greece was experiencing a generally growing economy (see Figure 2).

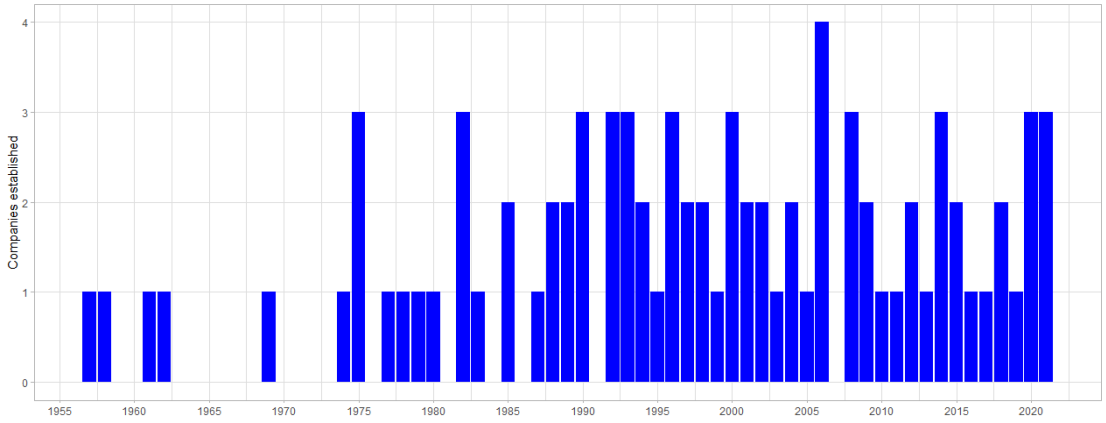

Figure 2. Number of companies in HELDIC by establishment year

The current composition of HELDIC (GDDIA, 2023) shows a gradual transformation from *"*the two faces of Janus*"* Kolliniatis and Kollias (2020; p. 246) noticed in the past. By examining the 2018 edition of HELDIC, they noticed a dualism both in terms of employment and corporate efficiency, as described by turnover and profit realized by employees (Kolliniatis & Kollias, 2020). While the state-owned Hellenic Aerospace Industry (HAI) and Hellenic Defence Systems (EAS) remain among the largest employers, several other companies offer considerable—by Greek standards—employment to the sector, as shown in Figure 3. Of course, it should be noted that the main reasons for this increase in the private companies' employment sizes are their exporting activity and, above all, the dual nature of their production, with both military and civilian applications (Ploumis, n.d.).

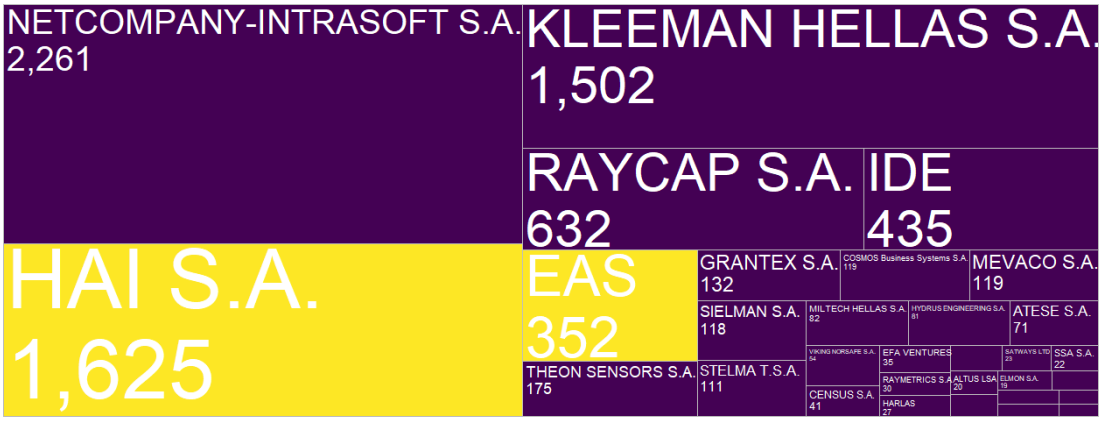

Figure 3. Personnel count for HELDIC 2023–2024 companies

Starting with the history of the state-owned companies, HAI was established in 1975 and, beyond the support it provides to the Hellenic Air Force (HAF), contributes significantly (30%) to the production of F-16 aircraft fuselage as a sole source supplier for the global market (EAB A.E. [HAI S.A.], 2023). It has by far the largest shareholders' equity of the companies examined in this thesis (€297.2 million in 2021) and is the biggest defense-only company by employment numbers.

EAS, on the other hand, has a shorter but much more turbulent history. Initially established in 2004 by the merger of the two practically bankrupt state-owned defense companies of the time (PYRKAL and Hellenic Arms Industry [EBO]), it did not perform better financially and needed restructuring just a decade later (*Ε.Α.Σ. Α.Ε. [EAS S.A.]*, 2023). Since then, successive governments have been trying to infuse private capital into the struggling company, either through strategic agreements with foreign companies or through the sale of part of the shares, along with the day-to-day management functions (OnAlert, 2023). This practice has already been used in similar cases, like the sales of Elefsis and Hellenic Shipyards to foreign and local bidders, respectively, during the last year (Capital, 2023; Newsroom, 2022), and the one of the Hellenic Vehicle Industry (*ΕΛΒΟ* [ELVO]; 2023) in 2020.

Regarding the private firms of the sector, they, too, have attracted the interest of investors, due mainly to their exporting focus and dual-use operations. The most recent examples are the acquisition of Greek company Intracom Defense (IDE) by Israel

Aerospace Industries (IAI) and the agreement between Engineering Office Deisenroth Hellas (EODH) and German company Krauss-Maffei Wegmann (KMW). Both of these agreements were conducted during the 2023 "Defence Exhibition Athens" (DEFEA) exhibition, which aspires to act as the springboard to higher visibility for the Greek DIB (DEFEA, 2023). A full rundown of the entities used as a sample for the dataset can be found in Appendix B.

In this section, I examined the history of the Greek DIB and its duality as is expressed in terms of its customer base (both military and civilian) and employment status. I also reviewed some basic facts around the history of the state-owned companies and their need for an investing reinvigoration. Lastly, I noted the dynamism private companies of the DIB exhibit in the international market, mainly through partnerships and the absorption of foreign direct investments.

C. FINANCIAL STATEMENTS

In this section, I present the basic elements around the public disclosure of financial statements in Greece. Also, I review the companies' individual statements that give a momentary picture of their financial health (balance statement), a review of their operating performance (income statement), a report on their cash level changes (statement of cash flow), and an account of their use of net profit (statement of stockholders' equity).

Financials statements are the principle way for a company to communicate with its shareholders and the wider public, usually as a part of its annual report (Stickney et al., 2009). They are composed of the balance sheet, the income statement (also known as the statement of profit and loss), the statement of cash flows, the statement of shareholders' equity, the accompanying notes to those statements, and the auditor's report and opinion on the whole information package. Greek law permits some allowances in the fullness and the detail of these disclosures to avoid the added cost of compliance; these allowances are mainly based on the size and the legal status of the company. Specifically, according to Article 8 of N. 4965/2022 (Εξυγίανση των Ναυπηγείων Ελευσίνας και άλλες διατάξεις αναπτυξιακού χαρακτήρα [Reclamation of the Elefsis Shipyards and Other Economic Development Provisions], 2022), sole proprietorships (Ομόρρυθμη Εταιρεία; Ο.Ε.),

limited partnerships (Ετερόρρυθμη Εταιρεία; E.E.), and single sole proprietorship (Ατομική Επιχείρηση) are excluded from publishing their annual reports and financial statements in public records (General Registry [ΓΕΜΗ], 2023). Additionally, companies with limited revenue are allowed to publish only a general overview of their balance sheet and income statement with the annual report. On the other hand, every type of corporation of a sufficient size, namely limited liability companies (Εταιρεία Περιορισμένης Ευθύνης-Ε.Π.Ε.), private capital companies (Ιδιωτική Κεφαλαιουχική Εταιρεία-Ι.Κ.Ε.), incorporated companies (Ανώνυμη Εταιρεία-Α.Ε.), and other specialized ventures, irrespective of whether or not they are publicly traded, are obligated to produce a full set of financial statements. The detailed provisions of the related law (Ελληνικά Λογιστικά Πρότυπα [Greek Accounting Standards and Related Provisions], 2014) can be found in Table 1 in Appendix A. As a side note, it should be noted that publicly traded companies face additional and more frequent disclosure requirements; however, less than five of the companies that constitute the Greek DIB fit this description.

A balance sheet is *"*a list of the assets, liabilities, and stakeholders' equity as of a specific date*"* (Warren, 2018, p. 14). This specific date is the end of the reporting period, which in most Greek companies coincides with the end of the calendar year (i.e., December 31 of each year). Companies have the liberty to choose a different ending date, and some do so, especially if their operations fluctuate with different periodicity (e.g., tourist-related companies or professional sports teams). The balance sheet is considered a snapshot of what the company owns, collectively called assets, and who has claims on those assets, known as liabilities and stockholders' equity. As such, the basic *accounting equation* (Assets = Liabilities + Stockholders' Equity) is always balanced through the practice of double-entry accounting.

According to the International Financial Reporting Standards (IFRS), which are periodically reviewed by the International Accounting Standards Board (IASB), an asset of an entity is *"*a resource controlled by the entity as a result of past events and from which future economic benefits are expected to flow to the entity*"* (Kapsis & Brown, 2015, p. 6). This definition outlines the key requirements for the inclusion of a resource on the list of company's assets. Furthermore, assets are categorized based on their ability to turn into

cash either as long-term (fixed) or short-term (current). The former are divided further to tangible and intangible as well as long-term investments, while major categories of the latter include inventory, receivables, and cash & cash equivalent (C&CE).

On the other side of the accounting equation, liabilities are similarly divided based on the time period they become due. Current liabilities must be paid within the next operating period (typically one year), while long-term liabilities are due beyond that (Warren, 2018). Liabilities include all of the debts owed to third parties. The residual claim on assets, once all liabilities have been met, is called the shareholders' equity (Stickney et al., 2009). It consists of the par value of common stock and any additional paid-in capital (APIC) contributed by the stockholders, as well as reserves (mandated or not by law) and the retained earnings/accumulated deficit of the company's operations so far. With the founding law for incorporated companies (Περί Ανωνύμων Εταιρειών [Regarding Incorporated Companies], 1920), the Greek state already imposed restrictions on the level of stockholders' equity in order to ensure the *going concern* (i.e., typical operation) of the business.

If a balance sheet is thought of as a snapshot of the health of a company, the income statement is a video recording that tries to document the economic performance of the companies between two successive balance sheets. Income statement categorizes and summarizes the revenues and expenses made on an accrual basis during the previous year and, by doing so, allows the interested parties to gain insight on the level and efficiency of a company's operations. The *matching concept* (i.e., the connecting accounts between the balance sheet and the income statement) is key to the understanding of the income statement (Warren, 2018). Operating expenses are deduced from the operating revenue to get to the operating or gross profit. Subsequently, extraordinary non-recurring income and expenses are added to reach the earnings before interest and tax (EBIT), an often-quoted value. Further adjustments to account for the net interest changes and the tax burden reveal the company's *net income*, colloquially known as the bottom line.

The statement of cash flow focuses on the change of cash during the reporting period, since cash is key in meeting the daily needs of any company and proper cash flow management creates a cushion from external shocks. The cash flow is particularly crucial

for companies of the DIB, since major weapon systems and their associated outlays often present a "lumpy" pattern (Thompson, 1987). In this case, the cash change equation (Stickney et al., 2009) provides the key balancing mechanism. Stickney et al. (2009) also provide a step-by-step explanation of the two different methods (direct and indirect) to get to the proper figures to include in the cash flow statement. Irrespective of the method followed, cash flows are grouped by fundamental business activities, namely operating, investing, and financing. While every company hopes and expects to have a consistently positive operating cash flow, negative investing cash flow can indicate increased investment in fixed assets for the future expansion of operations, while negative cash flows from financing can occur by paying debt down or distributing dividends (Warren, 2018).

The shareholders' equity statement documents the account's changes over the reporting period. The two main items that contribute to changes involve common stock and retained earnings (Warren, 2018). With the use of those two accounts, the residual claim of the owners on the assets is connected to the balance sheet and the income statement respectively. Other important actions included in this statement are the distribution of dividend and the buy-back of stocks by the company itself. Especially regarding the latter, the strained financial position of most DIB companies, their need for investment to compete against global competitors, and the strict pan-EU legal framework created to fight market abuse (Regulation [EU] No 596/2014 of the European Parliament and of the Council of 16 April 2014 on Market Abuse [Market Abuse Regulation] and Repealing Directive 2003/6/EC of the European Parliament and of the Council and Commission Directives 2003/124/EC, 2003/125/EC and 2004/72/EC, 2014) practically invalidate this option.

In this section, I reviewed the fundamental publicity requirements according to Greek corporate law and touched on the components and use, of and connections between the four major financial statements. While the IASB and the Financial Accounting Standards Board (FASB), which issues the U.S. Generally Accepted Accounting Principles (US GAAP), are on a long road to homogenization (Gillani & Harris, 2023), there are still some differences in definitions and application. Furthermore, the IFRS themselves allow

some leeway in their application, permitting each company to customize the IFRS' use in the manner most suitable for the kind of operations in which the company is involved.

III. DATA AND METHODOLOGY

A. DATA SOURCES

This thesis is based on three major data sources. The first one is the HELDIC for 2023–2024, as mentioned previously. The catalogue is published periodically by the GDDIA and shares similarities with corresponding publications from the United Kingdom, France, Spain, the Netherlands and India. In its latest edition, the HELDIC presents 85 companies, along with the sectors of their activities, the types of capabilities they provide, and the level of sophistication of their products. The distinct categories are presented in Table 1.

Table 1. Categories of sectors, capabilities, and levels. Source: GDDIA (2023).

	Sectors		**Capabilities**
1.	Aerospace, Avionics & Related Systems/ Services	1.	Research & Technology
2.	Ground Vehicles, Vetronics & Related Systems/Services	2.	Conception/Development
3.	Naval Platforms & Related Systems/ Services	3.	Manufacturing & Exporting
4.	Armament, Ammunition, Explosives & Related Services	4.	Assembly/ Integration/Validation
5.	Electronics, Communication & IT Systems/Services	5.	Test & Evaluation
6.	Unmanned Systems/Services	6.	Support & Services
7.	CBRN protection & Personal Gear		
8.	EO & RF Sensors		**Levels**
9.	Machinery, Mechanical Components, Material & Structures	1.	Services
10.	Electronic Components, Assemblies & Harnesses	2.	Components
11.	Energy & Power Systems	3.	Subsystems or Equipment
12.	Consulting, Engineering & Training	4.	Integrated Platforms
13.	Field Infrastructure, Logistics & Services		
14.	Labs, Calibration		
15.	Other Activities		

As shown in the table, the sectors cover mainly the domain where the system is used or the activity it performs. On the other hand, the capabilities show the evolution of a system from the enabling technology research to support and services post-procurement. Finally, the levels denote the complexity of the activity all the way from individual services to an integrated platform.

Obviously, self-reporting of a company's activities has its limitations. Companies will typically try to increase their footprint in the industry to demonstrate to prospective clients that they can offer an integrated solution to the clients' needs. Also, the level, expertise, and experience a company has accumulated will differ from sector to sector and from capability to capability. Lastly, the definitions of the categories themselves are inevitably introducing either some blind spots or some overlapping sectors, which makes clear-cut distinctions much harder. Nevertheless, an overview of the total number of the companies in each domain can help identify the ones with greater competition as well as those that are less developed and ripe for exploitation (Figure 4).

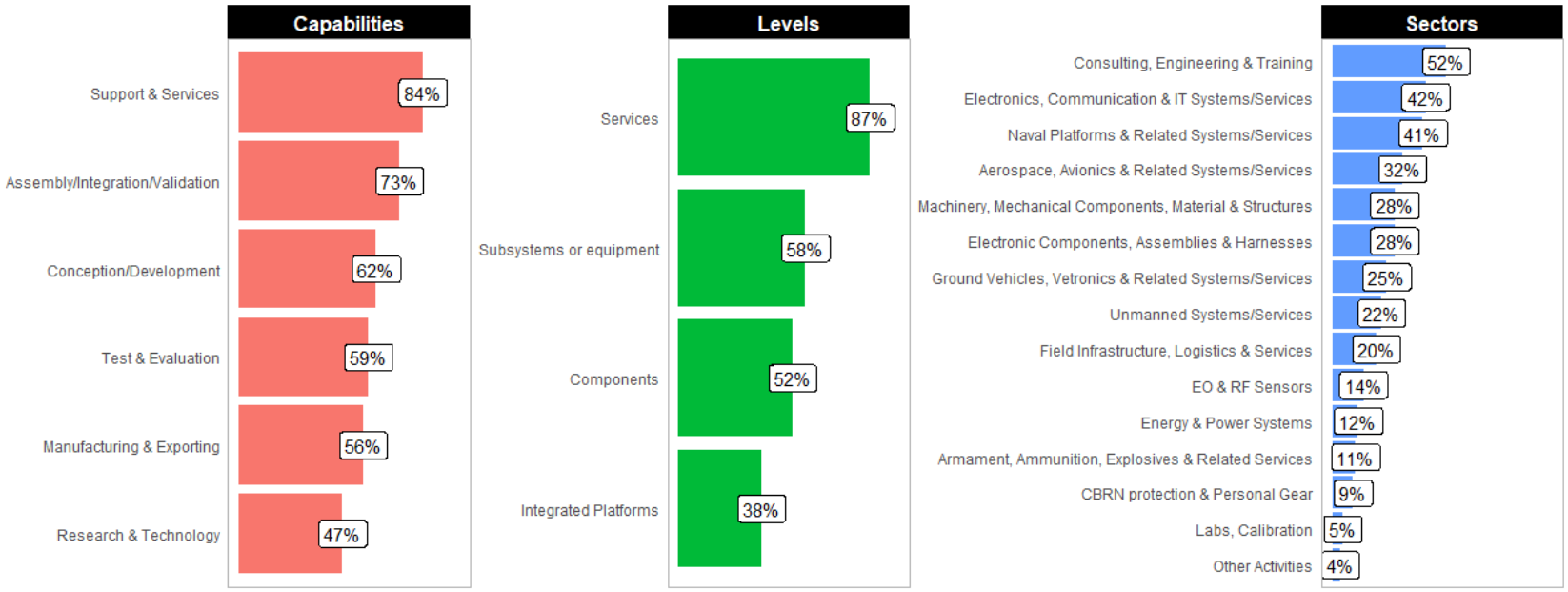

Figure 4. Percentages of active Greek DIB firms' capabilities, levels and sectors. Source: GDDIA (2023).

From the breakdown, there emerges a relative balance in terms of available capabilities within the Greek defense industry. However, relatively few of the companies offer an Integrated Platforms level of service by themselves, which underlines the importance of proper acquisition collaborations and joint ventures from multiple firms to establish ownership of the whole of the value chain. Lastly, in terms of the sectors covered, there is a bias towards services and sectors that have lower needs for big upfront investments. Moreover, there is greater coverage of the naval sector, since this sector can also provide civil needs in a traditionally maritime-focused nation. On the other hand, sectors like ammunition; chemical, biological, radiological, and nuclear (CBRN); and personal gear and calibration are supported by fewer local players and could be a potential investing or diversifying opportunity for other companies to explore.

The second major data source is the financial statements of the companies, as they are filed at Search for Publicity Data in General Registry (ΓΕΜΗ) website (https://publicity.businessportal.gr/), a website administered by the Union of Hellenic Chambers of Commerce (UHC). This website contains various data regarding the types of companies registered to any Greek Chamber of Commerce, chiefly their financial statements from 2014 onwards. Since each company formats its annual report in a different way, I downloaded all relevant files and populated the dataset by hand. This method introduced some assumptions, as the companies have some leeway on interpreting the IFRS standards for their accounts and some of the companies did not provide financial statements due to their legal form or their recent incorporation. To compensate for those omissions, which led to the exclusion of five companies, I added to the sample seven well-known companies with a presence in the defense industry and of varying sizes and offerings.

The third source of data was financial data for the major U.S. defense contractors. First, I used information published September 5, 2023, on the USAspending website (www.usaspending.gov) to identify the current major U.S. Department of Defense contractors. After that, I summarized the value of those awards per contractor parent company and shortlisted the 500 biggest values. Then, since only publicly traded companies are obligated to publish their financial statements according to U.S. law, I isolated the 95 of them that fulfill that requirement. From that list, my thesis Advisor

Professor Wang was able to retrieve key financial ratios from the Compustat (2023) database (www.refinitiv.com). As a result, I ended up with 540 observations from 2014 to 2022 by 67 distinct companies. The full list of those companies can be found at Appendix C.

Finally, from all of the variables comprising the dataset, I decided to focus on the necessary ones to evaluate the profitability of the companies in depth. Those are shown by category in Table 2 and are further explained in the following section.

Table 2. Typology of the variables used in the analysis

Category of Variables	**Variables**
General Information	company name, financial year (used in tandem as identifiers)
Variables from Balance Sheet	fixed assets, inventory, accounts receivable, total assets
Variables from Income Statement	revenues from sales, cost of goods sold (COGS), administrative expenses, selling expenses, R&D expenses, earnings before tax (EBT), net income
Calculated Ratios	Return on Assets (ROA), Profit Margin ratio (PMR), Total Assets Turnover ratio (TATR), COGS ratio, SG&A ratio, accounts receivable turnover (ART), inventory turnover ratio (ITR)

Regarding the software used for the capture and manipulation of the data, as well as the visualizations used in this thesis, I used Microsoft Excel® for the collection of the data and the programming language R for the rest of the tasks. In the realm of statistical analysis, R has emerged as a versatile and powerful tool that is widely used by researchers, statisticians, and data scientists. R was started in the early 1990s by Ross Ihaka and Robert Gentleman at the University of Auckland, New Zealand, as an open-source tool for statistical computing and data analysis, much like the commercial packages like the Statistical Analysis System (SAS) and the Statistical Package for the Social Sciences (SPSS) (Ihaka, n.d.). Gradually, with the contributions of an active and growing

community, R has become a very popular tool for data manipulation, visualization, and modeling. Its flexibility and adaptability made it suitable for a wide range of applications beyond traditional statistics, including machine learning, data mining, and bioinformatics. R advantages (specialized packages, visualization capabilities, etc.) made the analysis of the following chapter much easier and more efficient.

B. VARIABLES USED

In this section, I present the characteristics (distribution, range, etc.) of the variables I use for the analysis. This knowledge is crucial, both as a way to gain some domain expertise and to check the statistical properties of the variables, in order to choose the appropriate statistical methods of analysis. The all-encompassing term for this process is exploratory data analysis. This workflow typically includes the visualization of the distribution of each variable, as well as the relationships between them, both through a scatter plot and through the calculation of the correlation coefficient for each pair. Moreover, it examines outliers, which are observations with values at the edges of variable's distribution, as a way to check for either errors in data input or *sui generis*, or unique, cases, which influence the rest of the dataset heavily.

1. Company Name

The first variable is relatively self-explanatory and was used as the identification key between the entities. In total, there are 83 distinct Greek entities and 67 American ones.

2. Financial Year

It is important to note that the financial year is a more flexible notion than the calendar year is. According to accounting standards and international practices, every company can choose when the end of one financial year will be and when and the start of the new one will be. Additionally, there are instances where a financial year can have a duration that is different than a calendar one. For example, a company that decides to set its financial year to end on December 31 of each calendar year, and is established near that date, can add these remaining days to the next financial year and have it last more than 365 (or 366) days. Conversely, a company can—seldom and only with the approval of the

competent authorities—move the end of its financial year for managerial reasons. This instance will create two consecutive financial years that will have both a different duration between them and a different duration from future financial years, which will once again be 365 (or 366) days. For example, if a company that currently ends its financial year on December 31 wishes to change it to January 31, the previous financial year will have a duration of 13 months, the current one will have a duration of 11 months, and then the company will revert to the normal 12 months. For this thesis, I used all of the financial years between 2014 and 2022 if the companies had published their financial statements at the time of data collection.

In the dataset, practically every Greek company follows the calendar year to define its financial year, with only EODH S.A (business register number: 58661504000) and Aerophoto Co LTD (business register number: 131372806000) using the end of June as the end of each financial year. On the other hand, most of the American companies use either the end of the calendar year or the end of the public budget year (September 30) in order to be in harmony with the public procurement cycle. Fortunately, the Compustat (2023) database calculates the required ratios on a monthly basis, so I was able to acquire the ratios from the end of the calendar year to have values that would be directly comparable between the two countries.

3. Company-Financial Year

The combination of the previously mentioned variables creates the identifying variable for each row of the dataset. There are in total 1,092 unique observations, almost equally divided between Greek and American companies (552 and 540, respectively). Not all companies have entries for every financial year, either because they did not operate for the whole duration under review or because they have not yet filed their 2022 financial year statements. The bar plot in Figure 5 depicts the breakdown of the observations by country and financial year. It is important to note that financial year (FY) 2014 was excluded from the Greek companies because the calculations of some of the ratios analyzed, as described at a later point in this thesis, necessitated values from the FY2013 financial statements, which were unavailable. Specifically, ratios that combine values from

variables of the income statement (which are being accumulated during the financial year) and values from variables of the balance sheet (which capture a snapshot at the end of the financial year) have to adjust the latter by averaging their two last financial years.

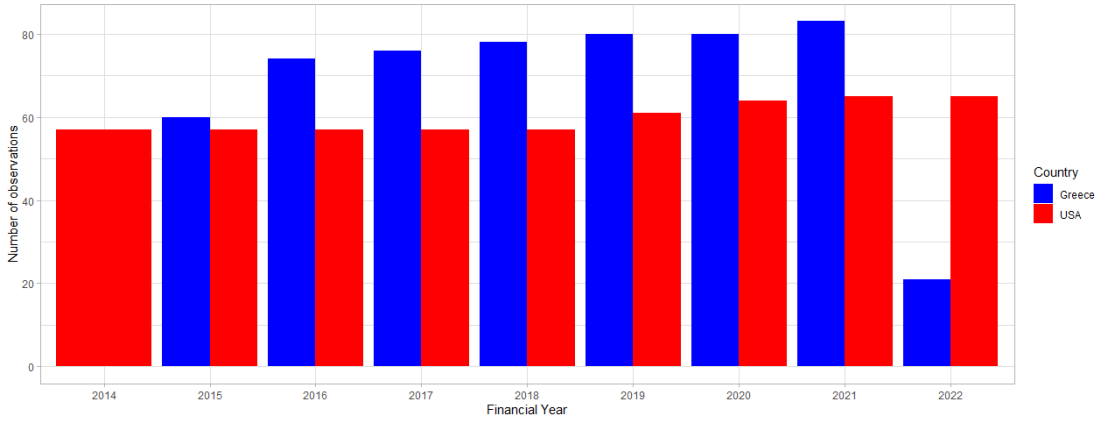

Figure 5. Number of observations by financial year and country of incorporation

4. Fixed Assets

For several reasons, fixed (or non-current) assets are of paramount importance for the defense industry. The related companies are often involved in large, complex projects that require substantial time to complete, such as developing advanced weapon systems, military vehicles, and aerospace technologies. The sector is characterized by rapid technological advancements, so continuous investing in non-current assets is critical, if only to keep the company competitive, even before those investments transform to a competitive advantage and raises entry barriers for potential competitors. Additionally, many defense projects require significant production capacity and scalability, which can only be met by significant non-current asset levels. Lastly, large non-current asset investments support national capability, and thus security, while increasing opportunities for international cooperation, such as the PESCO and EDF programs.

Fixed assets, which are technically called "property, plant and equipment," are initially recorded as acquisition costs for the amount paid or an applicable fair value (Stickney et al., 2009, p. 771). After that, they are gradually reduced (*depreciated*) along

their expected service life using a variety of methods, the commonest of which is a straight line (i.e., a simple division of the aforementioned numbers). For the non-periodical reduction of the remaining value, the IFRS and GAAP diverge. The IFRS would conditionally accept upward re-evaluation of the value of fixed assets, while GAAP would not. Additionally, for downward re-evaluation, termed *impairment*, the two standards have some subtle differences. This re-evaluation is usually taking place when conditions indicate that a significant decrease in fair value, either man-made (e.g., technological innovation) or not (e.g., earthquake, flooding etc.), has occurred.

In practice, fixed assets are divided into three categories. The first, tangible assets, is for all assets of physical form; these are the most convenient to evaluate since there is either a production process or a market where the assets are being created and exchanged for consideration. In the intangible assets category fall all of the non-physical critical and long-term means the company uses to create value. Two of the most prominent examples are patents and rights and goodwill. The former may have been purchased in an exchange and thus reveal their value. On the other hand, internally developed intangible assets are hard to evaluate, and both accounting standards take a conservative approach on them. Goodwill is a special accounting item that "refers to various unidentifiable intangible resources of a firm, such as a well-trained labor force or a reputation for quality products or customer service" (Stickney et al., 2009, p. 625). Goodwill is reviewed annually for impairment, and high volatility of its value is typically a troubling sign for the company. Lastly, long-term investments like bonds constitute the third part of the fixed assets and are valued at their market value of the reporting day.

In the sample of Greek companies, fixed assets demonstrate great variability, as shown in Table 3. This dispersion is caused by a handful of very large, traditionally industrial companies and a trove of smaller companies providing services requiring a small amount of upfront investments.

Table 3. Characteristics of the distribution of the Fixed Assets account for Greek DIB firms. Source: Adapted from General Registry (2023).

Observations	640 (1 NA)
Minimum value	€0
1st Quartile value	€108,914
Median value	€884,675
Mean value	€15,055,271
3rd Quartile value	€3,703,257
Maximum value	€357,825,751

5. Inventory

Inventory is a critical current asset category for companies across various industries, including the defense sector. It represents goods held by an entity for sale in the ordinary course of business, in the process of production, or for use in rendering services. Practices for re-evaluating inventory follow the patterns of those for fixed assets that were discussed previously, but here these should be not only accurate but timely as well. Managing inventory in the defense sector has some added nuances not frequently encountered elsewhere. Firstly, the need for security and secrecy adds restrictions to the transfer, warehousing, inspection, and reporting of inventory levels as companies try to avoid any erosion of a technological advantage, even between allied countries and companies in joint ventures. Secondly, the lumpy nature of big defense contracts, as shown in Chapter I, precludes a routine linear optimization of the inventory levels. Moreover, security and redundancy of the supply chain, especially during emergencies and geopolitical tensions, alter the practices of the armed forces, to which the companies must respond promptly, which may force them to increase their inventory just in case, thus hurting their efficiency and, ultimately, their profitability.

One key accounting difference between the IFRS and GAAP is the way the two evaluate ending period inventories, which have been formed with purchases in various times and costs. GAAP provides greater flexibility for the companies to employ either a first-in, first-out (FIFO), a first-in, last-out (LIFO), or a weighted average of those, enabling firms to manage their working capital and taxable income better. In contrast, the IFRS does

not permit the use of LIFO, fearing that its liberal use could distort the reported financial results.

Due to the exemptions related to the legal form and size detailed in Appendix A, many of the Greek companies in the dataset are not required to provide detailed inventory reports, obscuring the analysis somewhat (Table 4). Those who do report indicate a direct relationship between the average level of the inventory account and the general size of the firm, as already measured by fixed assets. The two big state-owned companies and a minority of established, export-oriented private ones are dominating for all of the periods under examination.

Table 4. Characteristics of the distribution of the Inventory account for Greek DIB firms. Source: Adapted from General Registry (2023).

Observations	632 (9 NA)
Minimum value	€0
1st Quartile value	€9,468
Median value	€254,640
Mean value	€5,105,555
3rd Quartile value	€2,325,961
Maximum value	€154,490,859

6. Accounts Receivable

Traditionally, only a portion of the transactions between companies are done with a direct and immediate exchange of cash for a good or service. Accounts receivables is the accounting category that reports the cash a company expects to receive from its customers within 1 year, minus any amount they deem too uncertain to receive (Stickney et al., 2009). In a sense, through this account, the company eases the cash flow burden of its customer, practically financing the customer's operations. Obviously, the firm itself takes advantage of this practice when it is the customer itself. As a major part of the current assets account, company policies and practices regarding accounts receivables directly influence cash

management, working capital, and collecting efficiency, metrics important both to external investors and the company's management.

Since solvency and continuing operation of firm's customers is not certain, the IFRS and GAAP require a contra account to monitor bad debt, usually called *allowance for uncollectibles*. Analysts tend to worry when the accounts receivables value rises quicker than sales do, since this denotes that the company offers very generous repayment terms to its customers, using them as the only way to stay competitive. In addition, a big accounts receivables value decreases the rate at which the company eventually gets its cash and increases the risk for bad debt.

Both of the previously mentioned issues are reflected in the accounts of the Greek companies, as there are some with so much bad debt that their net accounts receivables turns negative, and on the other end there is HAI, which is extremely lenient towards its customers and has over half a billion receivables at the end of each financial year. These disparities, as presented in Table 5 below, coupled with those of fixed assets, accumulate a large range of values for total assets, underlying the need to use ratios, not absolute values, to have a more comparable analysis.

Table 5. Characteristics of the distribution of the Receivables account for Greek DIB firms. Source: Adapted from General Registry (2023).

Observations	634 (7 NA)
Minimum value	€-973,881
1st Quartile value	€175,142
Median value	€698,084
Mean value	€12,839,703
3rd Quartile value	€2,700,954
Maximum value	€598,776,668

7. Revenues from Sales

Also known as *the topline*, sales include all of the revenue generated on an accrual basis by the company's everyday operational activities and covering the duration of each

financial year. Sales serve as the starting point for calculating a company's profitability, as companies gradually deduct different categories of expenses. Monitoring trends in the sales category is crucial for assessing a business's growth trajectory, market demand, and overall financial health. Fluctuations in sales revenue can provide insights into consumer behavior, competitive pressures, and the effectiveness of sales and marketing strategies.

The importance of revenue is more than obvious. This is the raison d'être of any company and the clearest sign that the company produces something of value for its customers. At the same time, high levels of revenues reward management decisions and allow for investing in new projects, either with direct funding or due to increased investor interest. Most performance bonuses are connected to revenue levels, and revenues earned is the main metric used to calculate the market share of each company. In the defense industry, revenue additionally may signify a strong exporting character and thus a positive effect on the trade balance, especially for countries with relatively small domestic markets, like Greece.

In the dataset, the distribution of the sales figures is shown in Table 6. The most surprising result is that the mean value is significantly higher not only than the median value but even than the value of the 3rd quartile (i.e., the point that 75% of the observations fall below). This signifies a highly unequal distribution, with many small-sized companies and a couple of relative behemoths. In particular, there are only four companies with average yearly sales more than €100,000,000, and on the other hand, 67 out of the 87 companies (77%) bring less than €10,000,000 on average every year. Lastly, the median yearly increase of sales stands at a healthy 10.77% across all companies.

Table 6. Characteristics of the distribution of the Revenues from Sales account for Greek DIB firms. Source: Adapted from General Registry (2023).

Observations	641
Minimum value	€0
1st Quartile value	€790,014
Median value	€2,819,013
Mean value	€17,488,055
3rd Quartile value	€10,356,642
Maximum value	€416,480,097

8. Cost of Goods Sold

The cost of goods sold (COGS) is an expense that measures the cost of inventories sold to customers or the cost to provide the resulting services. It is not uncommon, especially for manufacturing firms, for COGS to constitute the single largest expense account, and its relation with the topline describes the pricing power of a company as well as its ability to create added value. At the same time, COGS is a nexus between the balance sheet and the income statement since it relates the inventory account described earlier with the direct operating expenses.

From a different vantage point, COGS can hint at the market type a defense company faces for its resources. A more competitive raw materials market will suppress the cost, while a monopolistic one will diminish the gross margin ratio a company can achieve. Since high technology and exotic raw materials are commonly used for the development of their products, defense industry companies regularly face markets tilting to the latter type, which worsens their negotiating position and lowers the gross profit.

Once again, the small size of most of the Greek companies reduces their visibility at the COGS level by a significant amount, around 20% of the whole dataset. For the rest, the familiar pattern of great variability repeats itself at Table 7, logically following the revenue distribution.

Table 7. Characteristics of the distribution of the COGS account for Greek DIB firms. Source: Adapted from General Registry (2023).

Observations	510 (131 NA)
Minimum value	€0
1st Quartile value	€1,101,011
Median value	€2,726,875
Mean value	€16,786,361
3rd Quartile value	€10,082,281
Maximum value	€335,086,282

9. Selling, General, and Administrative Costs

Beyond the direct value of the inventory sold, which is reflected in the COGS discussed previously, companies incur other expenses, like salaries, rents, and insurance costs. Additionally, a defense industry firm typically has high research and development (R&D) costs in order to create a competitive advantage both for itself in the market and for the end-user in the field of battle. Those expenses can sometimes be amortized, but either way are a great burden on the company's revenue.

To provide homogeneity for the research, I include all non-COGS and non–debt-related operational costs to the overarching category of selling, general, and administrative (SG&A) costs. This also resolves any inconsistences, changes, and different reporting approaches the Greek companies would have either internally or in comparison to their peers. Just as in COGS, a large portion of the dataset consisted mainly of the smaller companies with no requirement to report these expenses, but for the rest that do, the pattern of substantial differences is once again present (Table 8). These results may look useless and repetitive, but they provide a detailed look at the shape of the market and help with the calculations of the ratios later on.

Table 8. Characteristics of the distribution of the SG&A Account for Greek DIB firms. Source: Adapted from General Registry (2023).

Observations	503 (138 NA)
Minimum value	€300
1st Quartile value	€344,025
Median value	€794,655
Mean value	€4,028,992
3rd Quartile value	€2,202,108
Maximum value	€70,597,621

10. Earnings before Tax

Earnings before tax (EBT), often referred to as pre-tax earnings or profit before tax, represents the profit a company generates before accounting for income tax expenses but after deducting all of its operational and financial expenses. By focusing on EBT, businesses can assess their core operational efficiency and profitability, excluding the influence of tax rates and regulatory factors.

This independence from the regulatory framework is even more important for a globalized industry, such as defense. From punitive taxes and tariffs to outright subsidies, national governments tend to adopt a more interventionist policy for the sector, due to its significance beyond the economic space. EBT helps to—at least partially—get the companies to a level field. Additionally, EBT is a key input in calculating a company's net income, which is the final profit figure and main object of the analysis that follows.

In contrast to the values presented up to this point, EBT can become negative for a poorly performing company. That would mean that the company is unable to cover its COGS, SG&A, and interest expenses with its current level of revenue. With all of these moving parts, negative EBT is usually a multi-factor problem, but there are also instances where a blow to the reputation of company that sinks its sales, uncontrollable borrowing that balloons the interest payments, or feather-bedded and inefficient operations can be the driving factor. The latter seems to be the case for the Greek sector, since the two state-owned companies (EAS and HAI), marred with repeatedly documented inefficiencies and

favoritism (Antonakis, 2014; Plakoudas, 2023), by themselves outdid all of the profits the rest of the sector combined had during the 2014–2022 financial years (combined EBT losses of 617,520,935 € against EBT profits of 504,346,745 €). Table 9 provides an overview of key distribution characteristics of EBT value from the Greek companies.

Table 9. Characteristics of the distribution of the EBT Account for Greek DIB firms. Source: Adapted from General Registry (2023).

Observations	640 (1 NA)
Minimum value	€-129,457,409
1st Quartile value	€9,632
Median value	€111,731
Mean value	€-176,835
3rd Quartile value	€577,783
Maximum value	€36,521,926

11. Net Income

Net income is the difference between every revenue and every expense account. It is also known as earnings or comprehensive income, although the latter is more connected to the balance sheet than the income statement (Stickney et al., 2009). Colloquially called the bottom-line, net income is both the de jure and de facto single measurement of the performance of a firm as a profit maximizer. It puts companies either in the black or in the red and gives to potential investors a direct signal of financial health. As shown later in this thesis, it is usually the nominator of every efficiency ratio calculated by analysts and management alike.

In the defense industry, the net income presents some defining features. Due to the size of defense acquisition contracts, net income follows revenues to some extent in terms of their volatile nature. On the other hand, the need for extended funding lowers the direct relationship between measures like revenues and gross profit to the net profit. Lastly, net profit at the country level enhances the trade balance and is an export-focused, high-paying jobs creator, as well as a sign of status for the country.

Net profit, as shown in Table 10, is the final non-ratio variable used for this analysis and also the last variable for which observations are available only for the Greek companies. The correlation between net income and EBT values is practically perfect, which means that the same conclusions and issues apply here as well. At the same time, the net profit values show that overall, despite the volatility at the economy level in general, the stance of the Greek governments of the period under review regarding the taxation of the companies was generally uniform.

Table 10. Characteristics of the distribution of the Net Income Account for Greek DIB firms. Source: Adapted from General Registry (2023).

Observations	641
Minimum value	€-129,726,666
1st Quartile value	€3,611
Median value	€74,652
Mean value	€-487,555
3rd Quartile value	€411,324
Maximum value	€28,598,323

12. Effective Tax Rate

As I noted previously, tax policy has been transformed to a crucial lever to balance overall private investment and sufficient public revenue amongst the various states. At the same time, to accommodate for specific occasions, tax policy structure is rather complicated and often quite byzantine. Lastly, the high turnover of governments and the pressing need to balance public accounts led Greek authorities to frequently change their corporate tax provisions and add multiple special cases, waivers, and exemptions. The companies, for their part, are trying to optimize those provisions and minimize the actual tax burden.

Because of these factors, it is far more useful to concentrate on the effective tax rate at which the companies were taxed rather than the theoretical provisions. To do that, I divided the sum of the actual tax payments with the sum of the EBT for the whole sample

of the Greek companies. The result is an effective tax rate of 25.7%, which is almost exactly in the middle of the range of the most commonly used nominal rates (22–29%; (*Νόμος 4172/2013*, n.d.). Armed with this value, I could now calculate the profit margin numerator net of income tax savings.

For the U.S. firms, the calculation of the effective tax rate was more straightforward as the dataset provided had already calculated the effective tax rate of each observation. The average and median values were practically identical (27.6% and 27%, respectively) and within a small distance of their equivalents among the Greek companies, as calculated previously. The similarity of effective tax rates between the countries is not only a subject for analysis on its own but also an added bonus to the analysis for this thesis, since the similarity minimizes the effects of taxation policy on the managerial decisions across the two markets.

13. Return on Assets

As the following several paragraphs deal with the ratios generated by the previously analyzed variables, I point to Chapter I as a refresher on the advantages and disadvantages of using those ratios. In addition to those ratios, I should note that some of the ratios calculated here get to extreme values, atypical of their range, usually due to a very small or large value used as a denominator. The actual cause of this problem is commonly values from start-up companies or ones with exceptional results after their proper operations. Even with those limitations, median values of ratios are usually more robust along time, countries, and industries. Return on assets (ROA) is a first-level metric useful for understanding the level of profitability and the main ratio I examine in this thesis.

As noted earlier, the role of assets, both current and non-current, are crucial in the defense industry. Normalizing the relationship between assets and profits can reveal patterns irrespective of financial year or size of the company. ROA measures how efficiently a company uses all of its assets to generate net income (Stickney et al., 2009). To calculate the ROA ratio, I used as nominator the net income, increased by the interest expenses net of income tax savings. This is the reason that calculating the EBT and effective tax rate variables was crucial, because if net income was used without this

correction, financing mix decisions and tax policies would affect the final outcome. For the denominator, I use the average level of total assets between the end of the current financial year and the end of the previous one. As noted in the previous paragraph about total assets, this calculation reduces the overall number of observations for the Greek companies from 641 to 441. Fortunately, this number of observations is similar to the corresponding number for the U.S. companies (462), so the total dataset is rather balanced. But while the observations are numerically balanced, their values show already significant differences. The statistical evaluation of those differences, presented in the Table 11 below, is the main focus of the next chapter, but it is already clear that the U.S. firms achieved a much smaller, higher range of ROAs in comparison with the ROAs from Greece. The drivers of these results to which the ROA can be disaggregated, profit margin ratio (PMR) and total assets turnover ratio (TATR), are analyzed next.

Table 11. Characteristics of the distribution of the ROA ratio for Greek and U.S. DIB firms. Source: Adapted from General Registry (2023) and Compustat (2023).

Country	Greece	USA
Observations	441	462
Minimum value	-72.5%	-6.3%
1st Quartile value	0.5%	7.6%
Median value	2.7%	10.0%
Mean value	5.2%	10.6%
3rd Quartile value	8.5%	13.1%
Maximum value	141%	76.1%

14. Profit Margin for ROA

The profit margin ratio is one of the two constituents of the ROA calculations. At the same time, it has great value on its own, as it is the primary metric used to assess the profitability of a company relative to the company's size. Profit margin, often referred to as net profit margin or net margin, measures the proportion of each dollar of revenue that translates into net income. It signifies a company's pricing strategy, cost management, and

competitive positioning. A higher profit margin indicates that the company retains a larger portion of its revenue as profit after accounting for all costs and expenses.

Beyond its usefulness in management decisions, profit margin ratio is also key for various stakeholders. Investors, current and prospective, can quickly gauge the attractiveness of an investing proposition and compare alternatives using this ratio as a holistic measurement of profitability. Competing firms can evaluate themselves vis-à-vis this benchmark and decide on new investment plans based on the marginal effect of those alternative on profits. Lastly, even regulators can use profit margin ratio as a proxy of the level of competition within an industry, since a higher profit ratio could indicate a departure from a fully competitive market.

In the specific context of the defense industry, this last function becomes even more crucial. Profit margin for defense-related goods and services has to achieve a fine balance due to the peculiar nature of both the competitors and the customers. On one hand, a company can achieve exceptionally high margins by offering technologically superior products. This is a frequent case in this industry, as intellectual property rights are buttressed by huge research and development investments, often receive state help, and benefit from special draconian laws regarding technology transfer and end user rights. However, those net profit margin ratios can attract criticism from the public and politicians if they are the result of monopolistic behavior that balloons the burden on public funds. On the other hand, slim net profit margin ratios may indicate a more competitive market, but they may handicap indigenous companies against global competition. Additionally, small margins usually lead to market consolidation in search of synergies and economies of scale. This new landscape, while more attractive for the remaining companies, could lead to shifts in the bargaining balance between industry and public procurement agencies as well as increased life-cycle costs, such as for systems deemed by the companies to be uneconomical to produce or support. This interplay of the profit margin with the spheres of technology, global trade, and public finance makes any outright, generalized, and sweeping comments on its appropriate level unfeasible.

Table 12 shows the key values of the net profit margin distribution for the U.S. and Greek firms in the sample. While the single extremely negative observation in each group

is dragging down the mean net profit margin, the generally much larger U.S. entities display a much more reasonable and healthy range. They are more profitable at every point of the distribution in comparison with their Greek counterparts, a quarter of which barely breaks even. The extreme values of the distribution of PMR for the Greek DIB are due to the results of the state-owned firms (EAS and, to a lesser extent, HAI). EAS went through a major restructuring during this period, which resulted in the company posting a heavily inflated PMR, both on the positive and the negative sides, as well as making the mean value of the group negative. If the state-owned companies are excluded, the range of the PMR distribution gets smaller than even that of the American firms, and while the rest of the Greek companies still achieve smaller values of PMR, the comparison is much closer.

Table 12. Characteristics of the distribution of the PMR ratio for Greek and U.S. DIB firms. Source: Adapted from General Registry (2023) and Compustat (2023).

Country	Greece	Greece (*non-state-owned firms*)	USA
Observations	441	425	462
Minimum value	-1,419.8%	-27.1%	-37.4%
1st Quartile value	0.7%	0.9%	2.6%
Median value	2.9%	3.1%	6.6%
Mean value	-5.9%	2.7%	7.3%
3rd Quartile value	7.7%	7.8%	11.8%
Maximum value	258.3%	48%	59.7%

15. Total Assets Turnover Ratio

The other second-level constituent element of ROA is related to the way a company turns its assets to sales, known as the total assets turnover ratio (TATR). It is calculated by dividing the revenues from sales by the average total assets of a company for the corresponding financial period. As noted previously, since this ratio uses values from both the income statement and the balance sheet, the average of the current and preceding financial year ending values should be used to create a more robust metric. This ratio can be used to account for the different company sizes and currencies used and provide a

comparable measurement within the industry. Asset turnover ratio evaluates how efficiently a company utilizes its assets to generate revenue. A higher ratio implies efficient asset utilization and operational optimization. On the other hand, low values of this ratio point to underutilized assets or inefficiencies in production and sales processes.

Asset levels and usage are especially crucial in the defense industry. While the actual value of the ratio may vary widely depending on the economic cycle and the type of goods or services provided, even small changes have cascading impacts. At the same time, given the requirements in R&D investments and the lumpy nature of sale revenues, it would be difficult for a company to maintain a consistently high total assets turnover ratio. The correlation coefficient between two consecutive financial year values of the total assets turnover ratio is 0.63 for the U.S. companies and just 0.45 for the Greek ones. This means that while last year's performance with respect to asset utilization provides some information for the next year, that performance is by no means a foregone conclusion. Management should therefore always and constantly monitor its company's performance and not rely on old processes as good enough. As the size of a company grows, this ratio becomes more stable, as many of the smaller companies offer engineering, managerial, or other bespoke services where the value-added component is the intellectual capital, not the physical capital, they possess.

The key takeaways from the distribution figures shown in Table 13 are the quite small interquartile range (IGR) of the U.S. companies showing a more homogenous industry and the relative similarity of the median values between the countries, implying similar levels of asset utilization efficiency.

Table 13. Characteristics of the distribution of the TATR ratio for Greek and U.S. DIB firms. Source: Adapted from General Registry (2023) and Compustat (2023).

Country	Greece	USA
Observations	441	462
Minimum value	0.019	0.039
1st Quartile value	0.581	0.390
Median value	0.891	0.628
Mean value	1.113	0.731
3rd Quartile value	1.280	0.991
Maximum value	13.331	2.731

Analyzing PMR and TATR in tandem provides valuable insights into the drivers of ROA by dividing the potential value space to four quadrants, as shown in Figure 6. It is important to note that the graph only includes a subset of the whole group of observations and is used as a visual aid for the following analysis.

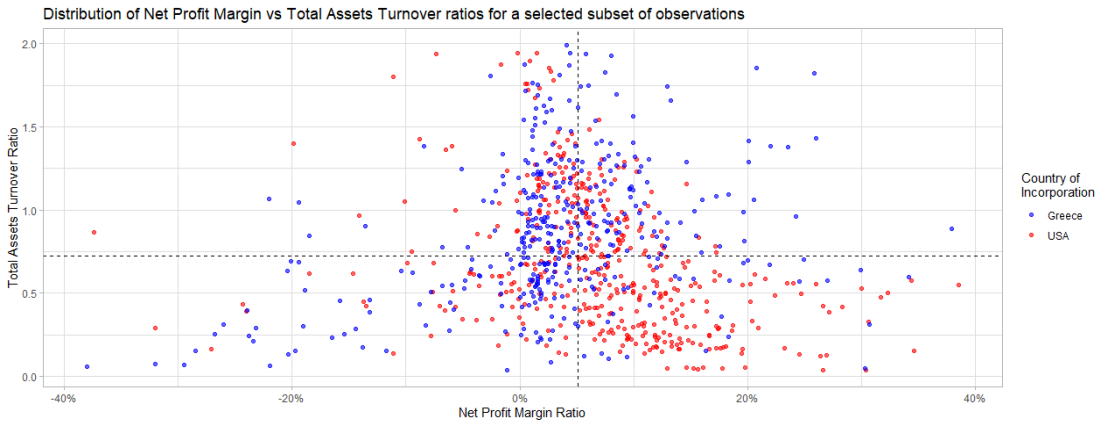

Figure 6. Scatterplot of the two principal constituents of ROA (PMR and TATR) for each observation

An examination of the scatterplot reveals the following observations:

- Upper right quadrant (high PMR, high TATR): When both profit margin and total asset turnover ratios are high, the company efficiently converts

its assets into revenue while maintaining healthy profitability. This combination contributes to a high ROA.

- Lower right quadrant (high PMR, low TATR): A high profit margin can compensate for a lower total asset turnover, resulting in a competitive ROA. This scenario might be observed in industries where companies have strong brand recognition and can command premium prices and in industries selling permanent goods. The biggest sales in the defense industry are for weapon systems, which are of the permanent type of goods, so most of the companies should fall in this category. Additionally, it is obvious that this quadrant is disproportionally populated by American companies, demonstrating that they possess the aforementioned characteristics to a greater degree than do their Greek competitors.

- Upper left quadrant (low PMR, high TATR): A company with a low profit margin but a high asset turnover can still achieve a respectable ROA. This might be typical in industries with thin profit margins but rapid asset turnover, like retail. Also, smaller defense subcontractors who have a negotiating disadvantage with their larger customers are the typical phenotype of firms that fall into this quadrant.

- Lower left quadrant (low PMR, low TATR): When both profit margin and asset turnover are low, the company's ROA could suffer, indicating potential challenges in both profitability and operational efficiency. Even after excluding companies with extreme values from the graph, it is obvious that there is a majority of Greek companies positioned here, a clear sign of their struggling competitiveness and profitability. Logically, a company can't stay in that quadrant for long. It would have to either emigrate to one of the others, preferably the upper right one, or face the possibility of closure.

16. Accounts Receivables Turnover

Before getting even deeper in the disaggregation of ROA, it is useful to recap this conceptual division, since the analysis now proceeds to its 3rd level. Figure 7 encapsulates this gradual construction, where ROA is analyzed in stepwise fashion firstly compared to the Profit Margin and Total Assets Turnover ratios, as shown previously. Next, each of those ratios can be analyzed compared to some indicative ratios. For example, PMR can be correlated with the gross profit margin ratio and the earnings before interest and tax (EBIT) ratio, where the former can provide hints on possible overcharging and thus creating excessive profits by the companies, and the latter can differentiate the companies with operating efficiency and larger output of the overhead costs. On the other half of this analysis, TATR main contributors are efficient in recycling parts of the assets class, like inventory and accounts receivables.

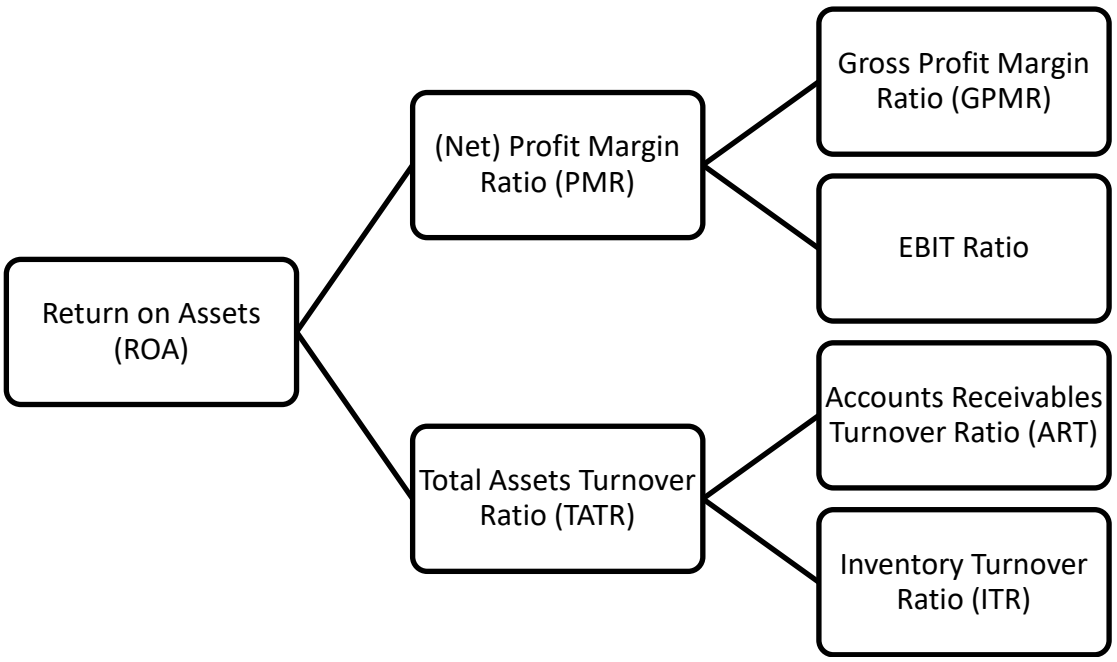

Figure 7. Breakdown of ROA in two consecutive levels

In this part, I analyze all of the ratios presented in Figure 7, starting with the latter. The accounts receivable turnover (ART) ratio is a financial metric that measures how efficiently a company manages its accounts receivable. Accounts receivable refers to the

outstanding payments a company is owed by its customers for goods or services delivered on credit. This ratio provides insight into how quickly a company collects payments from its customers. A high turnover ratio indicates that the company is collecting payments quickly, which can improve cash flow. Since, in a sense, the level of credit payments in an industry points to industry's funding affluence, it also provides an assessment of the overall health of it.

ART is calculated by dividing the revenues from sales by the average amount of accounts receivables for the financial year, following the same methodology as with TATR. The level of ART depends heavily on the balance between the credit and cash flow policies decided by the management in order to both meet short term obligations and offer competitive terms to the company's customers. A declining ratio can serve as an early warning sign of potential collection issues or waning liquidity.

Defense industry firms have to balance accounts receivables particularly well. The interconnectivity of the sector and the search for any competitive advantage against a global set of competitors raises the importance of management decisions related to ART. In this thesis's sample (Table 14), the difference between Greek and U.S. companies is startling. Greek companies recycle their accounts receivable with far slower speed, both in comparison to the U.S. companies and in general. This very lenient creditor policy is possibly the result of the lower liquidity level of the sector or a desperate measure to stay competitive by offering very attractive payment terms. In contrast, U.S. firms display higher values of ART ratios and a rather small interquartile range, indicating the possible spread of best practices across the local industry.

Table 14. Characteristics of the distribution of the ART ratio for Greek and U.S. DIB firms. Source: Adapted from General Registry (2023) and Compustat (2023).

Country	Greece	USA
Observations	437 (4 observations with no accounts receivables)	462
Minimum value	0.020	0.084
1st Quartile value	0.572	4.554
Median value	0.963	5.887
Mean value	1.935	6.275
3rd Quartile value	1.638	7.626
Maximum value	115.323	18.085

17. Inventory Turnover Ratio

From a calculating perspective, swapping average accounts receivables with the average level of inventory and revenues from sales with COGS produces the ITR, which calculates how many times within a financial year a company recycled its inventory. This ratio is essential for evaluating inventory management practices and assessing a company's ability to convert inventory into sales for three important reasons. First, it measures how effectively a company is utilizing its inventory. A higher turnover ratio implies that inventory is sold quickly, reducing carrying costs and the risk of obsolescence. Second, efficient inventory turnover can lead to lower capital tied up in unsold goods, freeing up resources for other investments or operational needs. Third, this ratio helps companies gauge demand patterns and adjust their inventory levels to meet customer needs, reducing the likelihood of stock-outs or overstock situations.

While the technicalities of the ratio are straightforward, its insight and meaning are somewhat different from the rest of the ratios, especially for a company in the defense industry. The companies comprising the dataset provide all kinds of goods and services, so a direct comparison of their ratios doesn't help, since some of them have to maintain a large amount of inventory as a measure to respond to fluctuating demand and to secure their supply chains, and some of them do not need any inventory at all. This increased

variability lessens the usefulness of this metric as a tool to compare the whole of the industry, as is clearly demonstrated by the values of the dataset in Table 15. However, the ratio can provide some benefit if the analysis focuses on companies with similar products.

Table 15. Characteristics of the distribution of the ITR ratio for Greek and U.S. DIB firms. Source: Adapted from General Registry (2023) and Compustat (2023).

Country	Greece	USA
Observations	384 (57 observations with no inventory)	462
Minimum value	0.069	0.689
1st Quartile value	2.408	3.931
Median value	4.194	6.824
Mean value	74.700	25.270
3rd Quartile value	10.122	17.928
Maximum value	2,694.165	1,512.400

18. Gross Profit Margin and COGS/Sales Ratios

Returning to the profitability side of the ROA ratio, the major PMR drivers are the gross profit margin ratio (GMR) and the earnings before interest and tax (EBIT) ratio. The GMR is a financial metric that measures the profitability of a company's core business activities. It represents the percentage of revenue that remains after deducting the cost of goods sold (COGS). This ratio is a fundamental indicator of a company's ability to generate profit from its production or sale of goods and services. It reflects a company's ability to manage production costs and pricing strategies effectively and, in this way, can be an early indicator of overcharging and excessive profits (Wang & San Miguel, 2012). Alternatively, a unique product or a dominating position in the market can also be reflected in a high GMR, which for any country—the major customers of the defense industry—is also a worrisome sign, since companies with such a level of pricing power act as restrictive agents to country's security policy decisions.

In the dataset as a whole, GMR and PMR have a correlation of 0.638, which reiterates their close relationship. However, contrary to the distribution of PMR by country, here Greece and the United States have a much more similar distribution of values, as shown in Table 16. The bottom half of the companies in the two countries especially have almost identical GMRs, which is surprising given what the data has shown up until now and spurs research into other metrics.

Table 16. Characteristics of the distribution of the GMR ratio for Greek and U.S. DIB firms. Source: Adapted from General Registry (2023) and Compustat (2023).

Country	Greece	USA
Observations	441	462
Minimum value	-86.2%	-0.9%
1st Quartile value	18.7%	19.7%
Median value	25.4%	29.2%
Mean value	26.5%	36.0%
3rd Quartile value	33.2%	48.2%
Maximum value	94.6%	96.5%

While GMR is a very popular metric, especially within the accounting community, a straightforward linear transformation of it can emphasize its business perspective. In detail, the complementary part of the ratio, which can be easily calculated by subtracting GMR from the unit, is the percentage of the COGS in relation to the overall sales revenues for the period. This ratio focuses on the company's manufacturing or servicing efficiency, the value the particular firm can add to each of its sales, and the gravity it commands within the market as the ability to dictate higher prices due to some sustained competitive advantage or monopolistic access. The distribution of this ratio is obviously identical to the GMR, as shown in Table 17, and these two ratios can be used together to tell the same story from different angles, thus targeting the appropriate audience every time. For the needs of this analysis, I perform statistical significance tests on both metrics in the following chapter.

Table 17. Characteristics of the distribution of the COGS/Revenues from sales ratio for Greek and U.S. DIB firms. Source: Adapted from General Registry (2023) and Compustat (2023).

Country	Greece	USA
Observations	441	462
Minimum value	5.4%	3.5%
1st Quartile value	66.8%	51.8%
Median value	74.6%	70.8%
Mean value	73.5%	64.0%
3rd Quartile value	81.3%	80.3%
Maximum value	186.2%	100.9%

19. Earnings before Interest at Tax Ratio and SG&A/Sales Ratios

Another metric, the earnings before interest and tax (EBIT) ratio is the percentage of revenues that is left over after all operating expenses (COGS and SG&A) are deducted but before the effects of interest and tax payments take effect. As noted in the Selling, General and Administrative Costs and the Earnings before Tax subsections of this chapter, controlling for the cost of borrowing and particular tax policies is crucial in order to gauge the real competitiveness of a company. Moreover, this metric that acts as a proxy of the SG&A-to-revenue ratio can rationalize an increased PMR on the basis of greater operating efficiency.

The EBIT ratio, as expected, has a perfect correlation with the PMR, and this is reflected in its values for the companies of the two countries. Nevertheless, the significant difference in the variation of the values is extremely informative to potential investors (Table 18). A more conservative investor would probably prefer to invest in a U.S.-based defense company and be confident that they would get a hefty return. On the other hand, investors with a higher aptitude for risk and returns may have to do a deep, company-by-company analysis of the Greek defense sector to unearth some very lucrative investing opportunities.

Table 18. Characteristics of the distribution of the EBIT ratio for Greek and U.S. DIB firms. Source: Adapted from General Registry (2023) and Compustat (2023).

Country	Greece	USA
Observations	441	462
Minimum value	-981.7%	-18.5%
1st Quartile value	2.7%	5.9%
Median value	6.2%	11.1%
Mean value	1.8%	13.1%
3rd Quartile value	12.2%	18.4%
Maximum value	1,219.5%	64.3%

In the same vein as the alternative interpretation of the GMR, a slightly more complex set of arithmetic calculations on the EBIT ratio can reveal the proportion of SG&A expenses over the total revenues from sales. In order to reach this metric, I deduct from the EBIT ratio the previously calculated COGS/Revenue from sales ratio. This way, I can isolate the effect of the SG&A expenses on the profitability of the firm, highlighting those with more efficient management structures and overhead cost (marketing, personnel, etc.) synergies. Ignoring the extreme values for some Greek DIB firms (see Table 19), the similarity of values between the two countries leads me to believe that, in general, irrespective of their size, most of the firms have adopted the best organizing practices of the sector and operate in a comparable way.

Table 19. Characteristics of the distribution of the SG&A/Revenues from sales ratio for Greek and U.S. DIB firms. Source: Adapted from General Registry (2023) and Compustat (2023).

Country	Greece	USA
Observations	441	462
Minimum value	-1,248.3%	-7.6%
1st Quartile value	11.8%	11.4%
Median value	17.6%	17.6%
Mean value	24.7%	22.9%
3rd Quartile value	25.3%	34.8%
Maximum value	1,029.0%	72.1%

C. METHODOLOGY

In this section, I discuss the options regarding the methodology to infer statistical differences between the two samples for any of the constituents of the ROA ratio. After a brief introduction of the tests available for the comparison, I check the validity of their assumptions for the case in hand and present in a more detailed manner the test that fulfills these assumptions and is used in the following chapter for difference and effect size estimation.

Goulet-Pelletier and Cousineau (2018) produced a series of articles on the possible measures of effect sizes and their confidence intervals; the articles provided a comprehensive introduction to the subject and highlight the best practices of the domain. In his textbook, Keller (2005) dedicated a chapter to management-focused examples as well as a handy one-page table on methods to describe, compare, or relate populations. Gignac and Szodorai (2016) and Sawilowsky (2009) added interesting perspectives by arguing in favor of a more tailored approach to judging the effect size based on modelling and literature reviews.

In short, to choose between the different methods of statistical evaluation of the difference between two populations, four different criteria of their characteristics must be answered. These assumptions are:

- The independence of the observations: Are the data points of the two populations related in any way?
- The existence of significant outliers in the two groups: Are there extreme values that distort the means of the groups?
- The normality of distribution for the data of each group: Are the values of the variable in question normally distributed in each group?
- The homogeneity of variances between the groups: Could we assume that the population variance in the two groups is equal?

In the next chapter, for each variable under examination and at each level of analysis (1st level: ROA, 2nd level: PMR and TATR, 3rd level: GMR [COGS/Sales], EBIT ratio [SG&A/Sales], ART ratio, and ITR), these assumptions must be checked to decide on the most suitable statistical test to use.

If all of the previously questions can be answered positively, then the test statistic used to evaluate the difference between the means of the two groups is the two sample Student's t-test. Originally published in 1908, this groundbreaking approach has since be refined and gradually expanded in order to use its variations in less-than-ideal situations (*Student's t-Test | Definition, Formula, & Example | Britannica*, 2023). Moreover, the extended use of the t-test has proved that it remains robust to all but large deviations from the assumptions previously mentioned.

Given that the two groups are clearly independent, even though both are part of the global defense industry, the focus is shifted to answer the rest of the questions for each analysis level. For example, if by studying the sample, I cannot argue in favor of the equality of the variance between the two groups for each ratio, I use the Welch's t-test, which is designed for unequal population variances. Additionally, possible extreme outliers in the two samples may drive the analysis to use a two-sample, non-parametric Wilcoxon rank-sum test, also known as Mann-Whitney U test. This test emphasizes the median values of the distributions, thus eliminating the distortion an extreme value can cause to the respective mean values. Lastly, leveraging the large and almost equal sizes of the

observations between the two groups (Kim & Park, 2019), I will the Shapiro-Wilk test to check for the groups' normality of distribution.

In conclusion, in the first part of this chapter, I presented the data sources for both the Greek and the U.S.-based companies as well as an overview of the breadth and depth of the former in the defense industry. In the second part, I presented the variables used to construct the ratios that are analyzed and provide a short commentary on their main characteristics, while in the last part, I presented a general methodology on how to choose the proper statistical test to evaluate the differences of the two populations based on the samples collected.

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IV. ANALYSIS

A. INTRODUCTION

After explaining the dataset collected and the research methodology, in this Chapter I will implement the latter to the former and get the results which could support the difference in profitability levels for DIB companies across Greece and the USA. To do that, I follow the level-by-level analysis laid out before (Figure 7) and use the proper statistical tools, given the characteristics of each metric.

B. ANALYSIS

In this part, I present step-by-step the application of the methodological approach described in the previous chapter. Before presenting the tools I used and the relevant results, I should note that the comparisons were made with the U.S. DIB firms against two set-ups of the Greek ones. Specifically, in order to account for the dichotomy noted in the literature review between the state-owned Greek DIB firms (EAS and HAI) and the rest of the sector, characterized by smaller yet more efficient private firms, I used two set of companies. The first set includes all the Greek DIB firms, while the second only the non-state-owned ones. Given that the state-owned firms include only 16 out of 441 observations, it would be interesting to examine if their distinctly different profile alters that of the whole sector in a meaningful way. At the same time, this separation will provide a useful benchmark against the U.S. DIB firms, from which none of them is state-owned and are usually being considered the frontrunners of the industry globally.

The main tools used for this chapter were the rstatix and ggstatsplot packages of the programming language R. The first package has the necessary functions to run the test required to determine that kind of statistical test I should use. The answer to this question (parametric or non-parametric) depends on the normality of the distribution of each sample values and the equality of their variances. Those tests were performed for each one of the previously defined variables. As it was evident to the experienced eye for the key distribution values of chapter 3, most of the variables do not satisfy either of those requirements. In all cases, both Shapiro-Wilk test (for the normality of the distribution and

F-test (for the equality of the variances) gave definitive answers and for that reason I chose the Kruskal-Wallis test, as a non-parametric equivalent of the ANOVA test (*Getting Started with the Kruskal-Wallis Test | UVA Library*, n.d.) and the Dunn pairwise test with the Holm-Bonferroni adjustment on the p-value for any pairwise comparisons.

The ggstatsplot package on the other hand, is an extremely powerful tool for statistical analysis, as it performs both the necessary statistical tests (frequentist, bayesian or both) and plot their results at the same time, As the developers noted "…combine these two phases into one in the form of graphics with statistical details, which makes data exploration simpler and faster" (ggstatsplot, n.d.). This way, I got a simple yet informative figure for every level of analysis, which are presented below and help for a better understanding of the results.

1. 1st Level Analysis: ROA

Starting from the first level presented in the Figure 7 above, I compared the difference in median ROA values between the three groups. I chose median over mean comparisons, as noted earlier since the p-value for the Shapiro-Wilk test is much smaller than 0.05. The results confirm that the U.S. DIB firms are significantly better at generating returns from their assets than either group of Greek companies. Specifically, a typical American company seems more than 3 times larger than its Greek counterpart (10% and 3% respectively), even though it usually has more assets to manage.

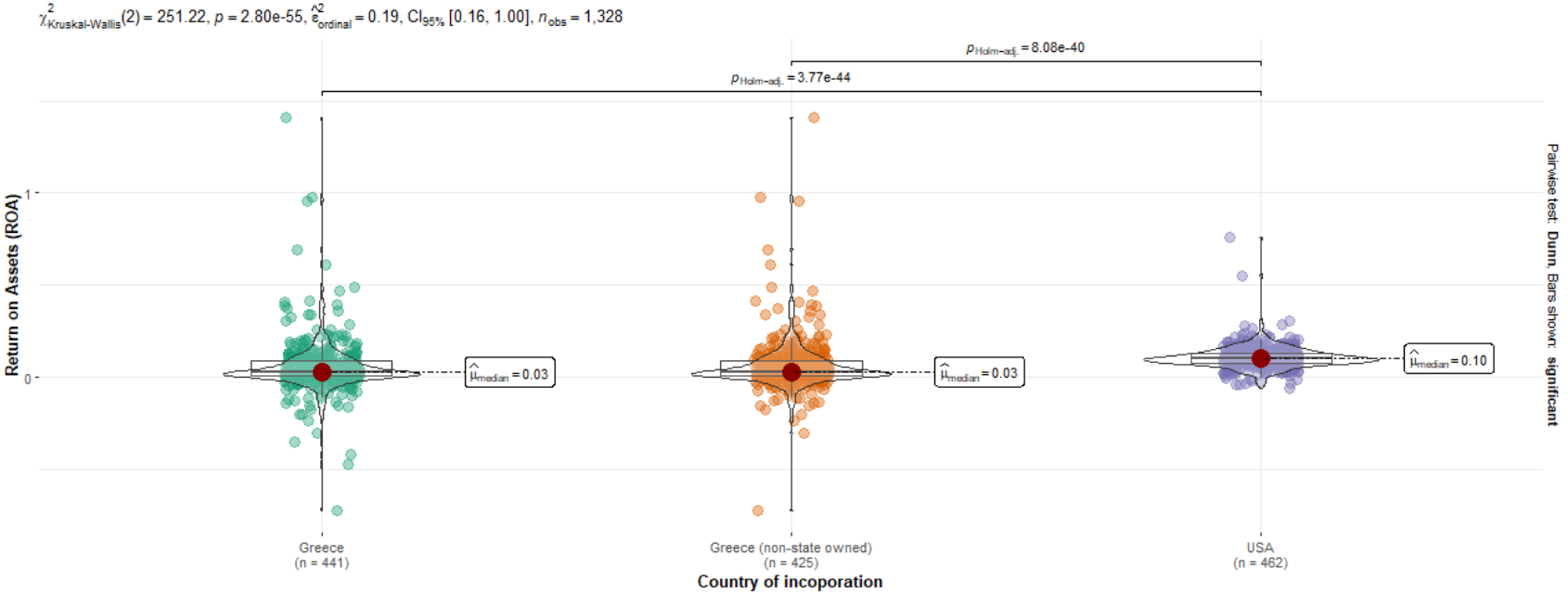


Figure 8. Results for significance testing on ROA variable

2. 2nd Level Analysis: PMR and TATR

Getting to the second level of analysis, that of the profit margin ratio and the total assets turnover ratio, will help the researcher to identify the drivers behind the great difference demonstrated at the ROA values. Following the same methodological steps will ensure robustness and the creation of a unifying analysis framework. At this level and at PMR metric, we can gain some valuable insight at the *modus operandi* of each group. As we can see at Figure 9, the statistically significant difference between U.S. and Greek firms remain, albeit in a smaller level than the overall ROA. Moreover, while the miniscule difference in the size of the two Greek groups hides any statistical power of their difference, the observations belonging to the state-owned companies are immediately apparent both on the positive and even more on the negative side of the metric. A separate analysis between the state-owned firms and a comparable number of observations from private companies of similar size revealed this statistical significance, with the state-owned firms having a sizeable negative difference in their performance. The lower PMR achieved could signify cost management challenges and the lack of a competitive advantage other than the price itself. Conversely, American companies seem to have created a "moat" against competition and thus command a price premium.

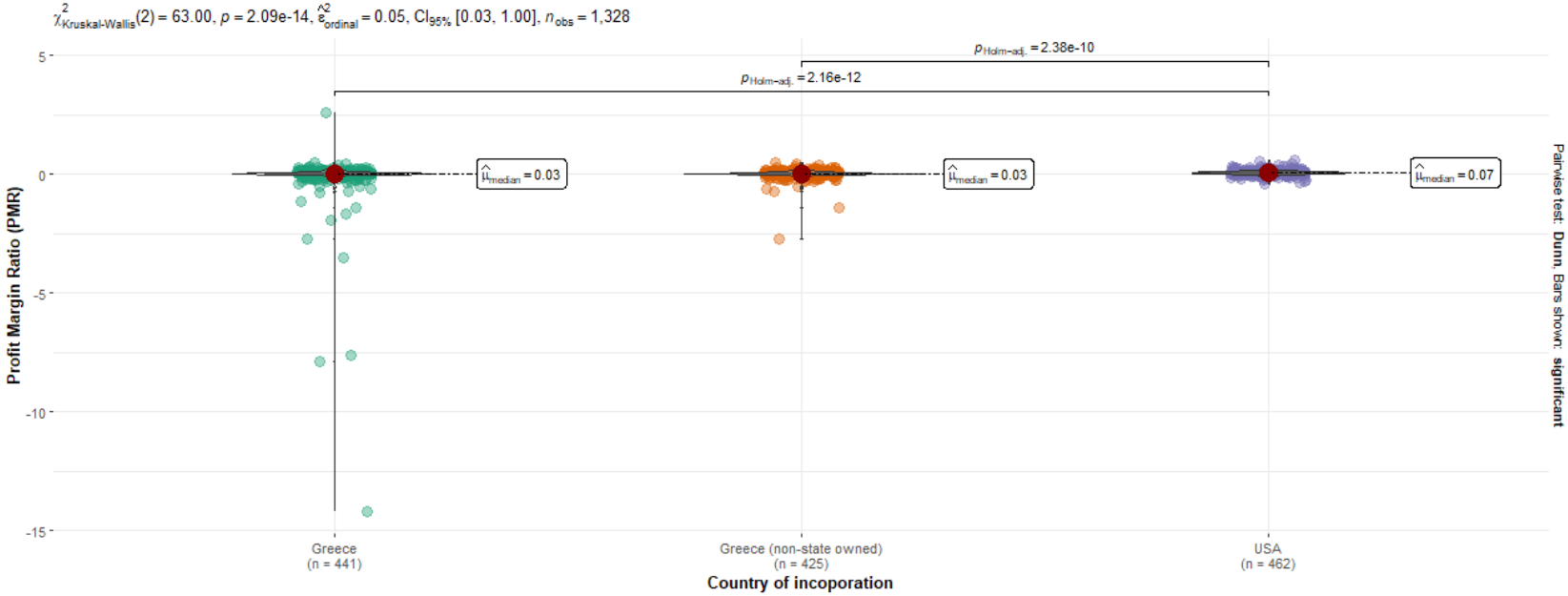


Figure 9. Results for significance testing on PMR variable

On the other hand, the analysis of TATR uncovers some unexpected results. In general, Greek DIB firms were about 50% better in turning their assets over (i.e., creating sales of a higher value) in relation with the assets they utilize. The extremely small values of Holm adjusted p values (range from 2.38e-10 to 0.08e-40 for the first two levels of analysis, imply higher asset utilization and ability to influence the selling price or control the direct costs. While being smaller in general helps by keeping the denominator relatively small, Greek DIB companies have developed a more agile approach to manage the – generally smaller size- asset pool, in response to the lack of a long-term competitive advantage. In broad strokes, they try to stay afloat and prosper assuming a proactive and aggressive resourcefulness, in lieu of massive investments on creating more favorable market profiles and strategic planning.

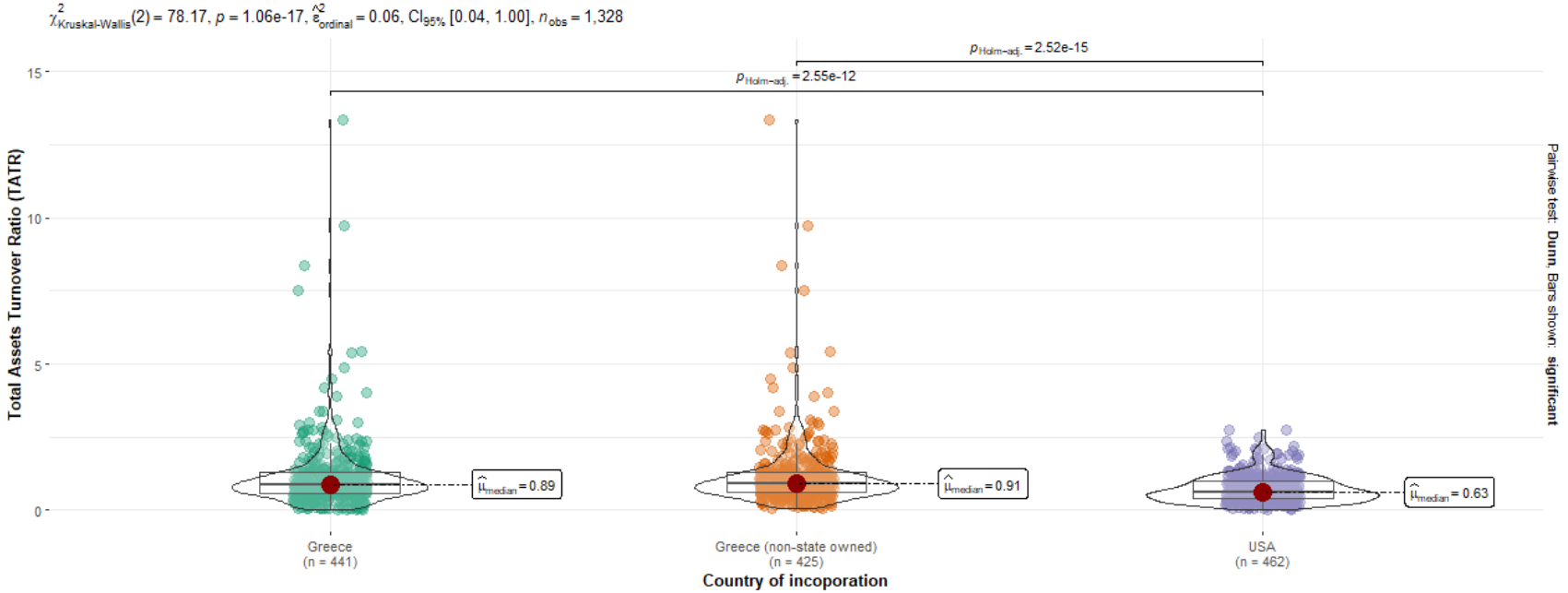


Figure 10. Results for significance testing on TATR variable

3. 3rd Level of Analysis: COGS/Revenue, SG&A/Revenue, ART and ITR

The third level of analysis splits PMR and TATR even further. This decision proves fundamental since it was at the level of PMR and TATR where statistically significant differences in both directions between the countries were found. To further analyze the PMR I disaggregated it to the two ratios that highlight the ability to control the market price or the direct production costs (COGS/Revenue) and to control operational costs (SG&A/ Revenue) respectively. Accordingly, to analyze the surprising results of TATR, I use two of its key components accounts receivables turnover ratio (ART) and inventory turnover ratio (ITR).

Through the analysis of the COGS/Revenues from sales ratio, we can see that the U.S. DIB firms are able to command a small yet consistent and significant price premium. The typical ratio for an American company is around 71%, which is 3 percentage points smaller than the one Greek companies face. This difference arguably incorporates the technological advantage, the quality assurance and the goodwill the American DIB firms have developed over the years. Moreover, the U.S. companies may have higher bargaining power vis-à-vis their customers, both due to the uniqueness of their products and the broader options the Federal Acquisition Regulations (FAR) give them in respect to contract types and funding innovative projects. An interesting future research could seek to compare the contracting procedures in both countries to evaluate if this gap is affected from those (i.e., if and which government manages to get a better price given the bargaining position of the industry).

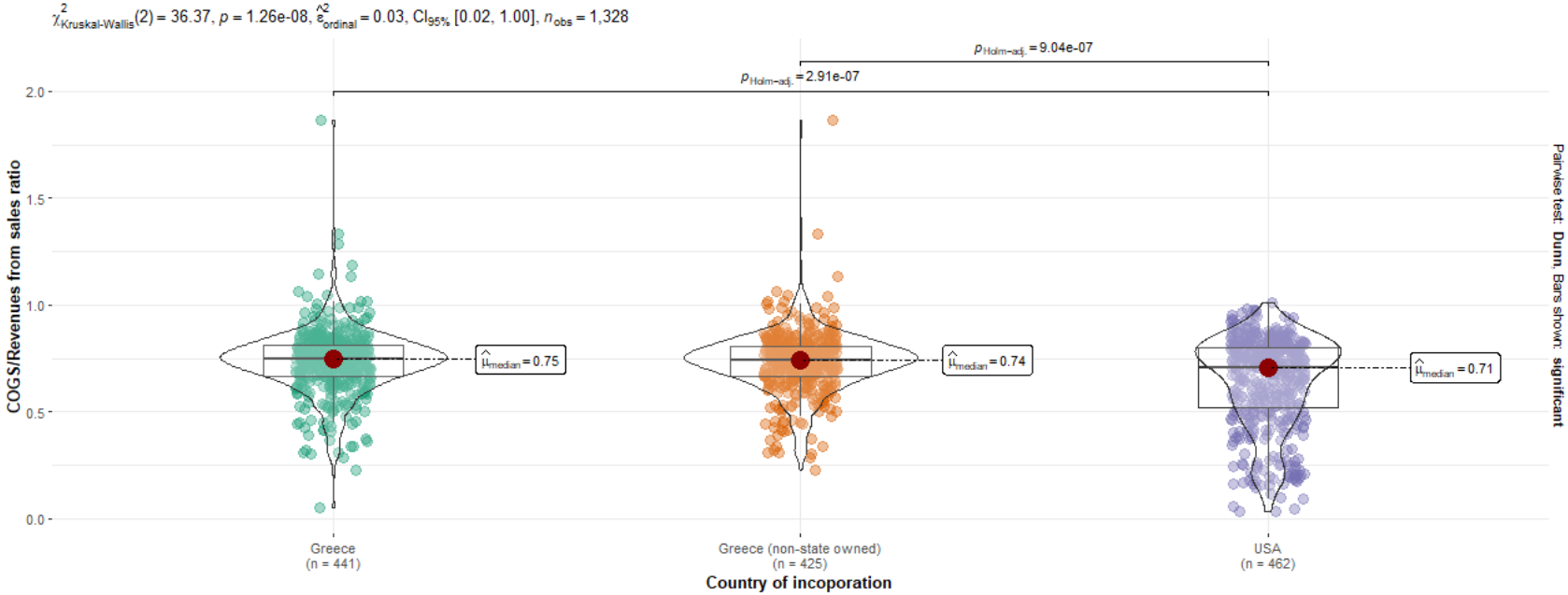


Figure 11. Results for significance testing on COGS/Revenue variable

The SG&A/Revenues ratio is the first metric that does not exhibit any statistically significance in pairwise comparison. The typical value of a defense industry company seems to be around 17–18% of its revenues with a rather sort band of variation. However, once again the state-owned Greek DIB firms have characteristically higher values, confirming the widespread belief that their management has a harder time controlling organizational costs. Some have argued that the inability to control SG&A costs happens due to political pressures and the better bargaining position of the employees of a state-owned company, but it could also be at least partially attributed to the relatively lower level of revenues they generate. For the rest of the sector, it seems like the best practices in production organization have spread throughout and all the companies are organized in a similar way.

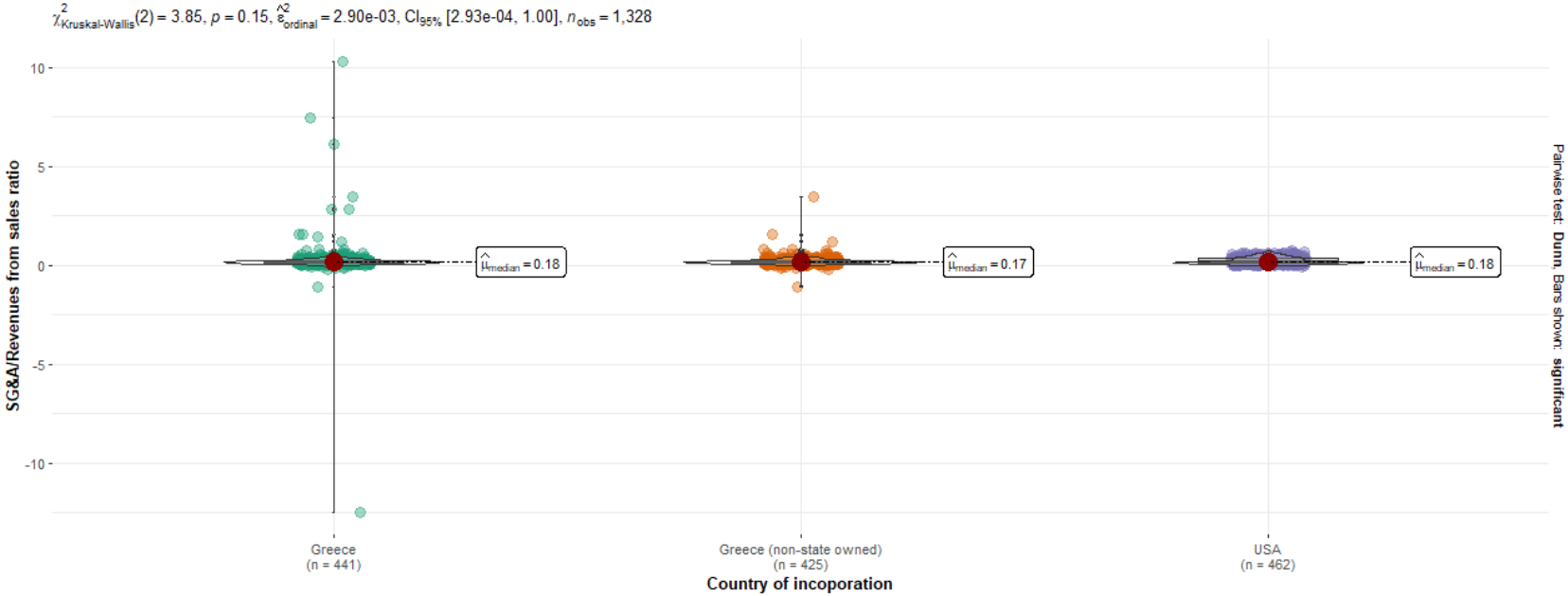


Figure 12. Results for significance testing on SG&A/Revenue variable

The other half of the analysis at this level is focused on the TATR by comparing two of its main components (ART, ITR) across the two countries. However, it should be noted that due to less stringent reporting requirements, some of the smaller Greek companies do not report account receivables and inventory as separate accounts. This practice reduces the total amount of observations for their side to 437 (422 of which non-state-owned) for the accounts receivable comparison and to 384 (368) for the inventory turnover respectively. This slight imbalance of observations between the groups makes the use of non-parametric statistical tests even more crucial, to ameliorate its effect.

In the particular instance under research, U.S. DIB firms have a significantly higher ART, which means that they are able to collect in a more timely fashion than the Greek companies. This evidence offers a possible explanation for why the Greek companies may have a lower ability or willingness to collect displayed by the latter is a way to stay more competitive, by offering better payment terms. Additionally, since many of the companies are part of the same production chains in business-to-business transactions, it seems that Greek firms offer an alternative way of short-term financing to their customers by delaying the reception of their payments. This perspective is clearer when the ART ratio is used as the denominator over 365, which is the number of days in a year. This metric is called Days of AR Outstanding and stands at 376.3 and 62 days for Greek and U.S. firms respectively. In other words, Greek DIB companies give an average credit to their customers of over one year, while the U.S. DIB firms are able to collect in about two months after the sale. This discrepancy facilitates the cash flows for the latter and allows them more options on how to manage the cash and other current assets in hand.

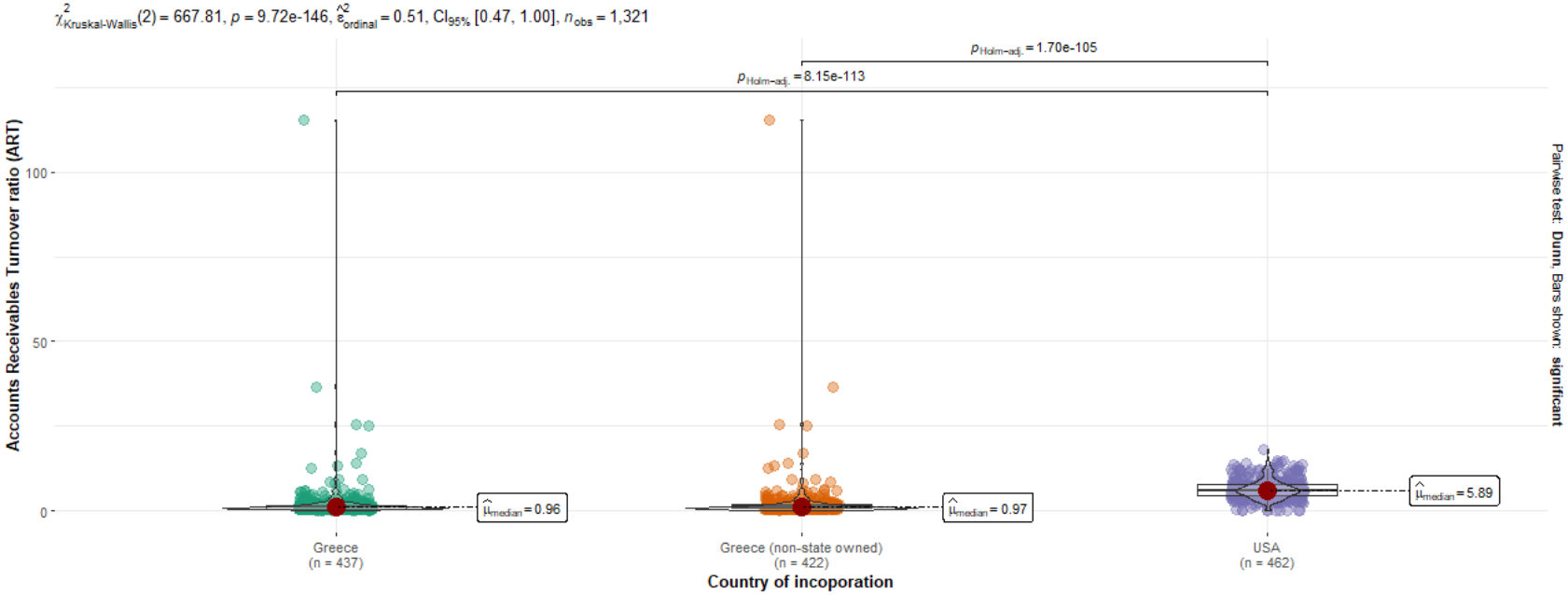


Figure 13. Results for significance testing on ART variable

Lastly, the inventory turnover ratio displays extreme variation both for Greek and (less so) for American companies. Still, the latter can in general sell their inventory faster, something that frees capital from things like storage, transportation and obsolesce costs, raising on the other hand the possibility of stock-outs and delays in the production. This last issue could have increased importance in the future with trade disputes and the re- or near-shoring of the supply chains, to counter the dependence on key imported ingredients. In the same vein with the Days of AR Outstanding, the calculation for Days of Inventory Outstanding yields the values of 87.1 days (80.8, if I exclude the state-owned companies) for the Greek firms and just 53.5 for the American ones. Having inventory sitting in the warehouse on average a month more than the competition, limits the liquidity of the Greek companies and incurs to them increased storing costs. Additionally, while Greek firms exhibited better TATR, they are significantly worse that the U.S. firms on both ART and ITR.

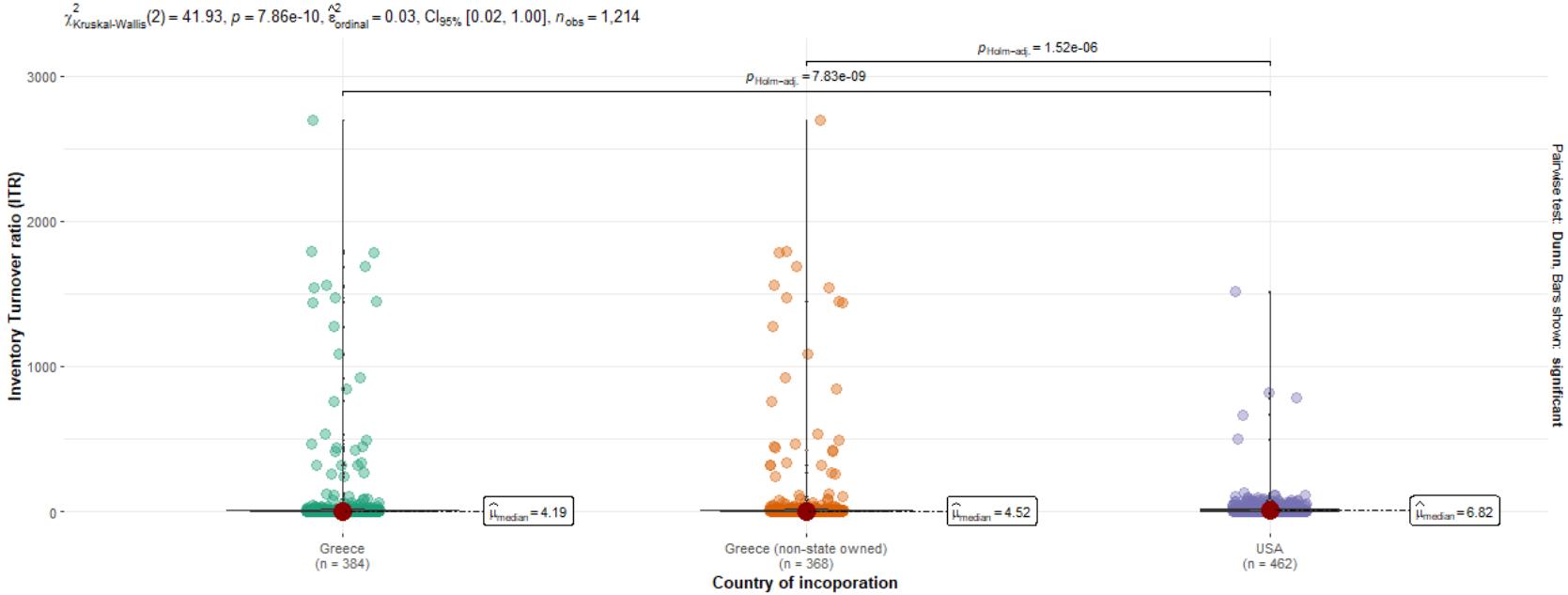


Figure 14. Results for significance testing on ITR variable

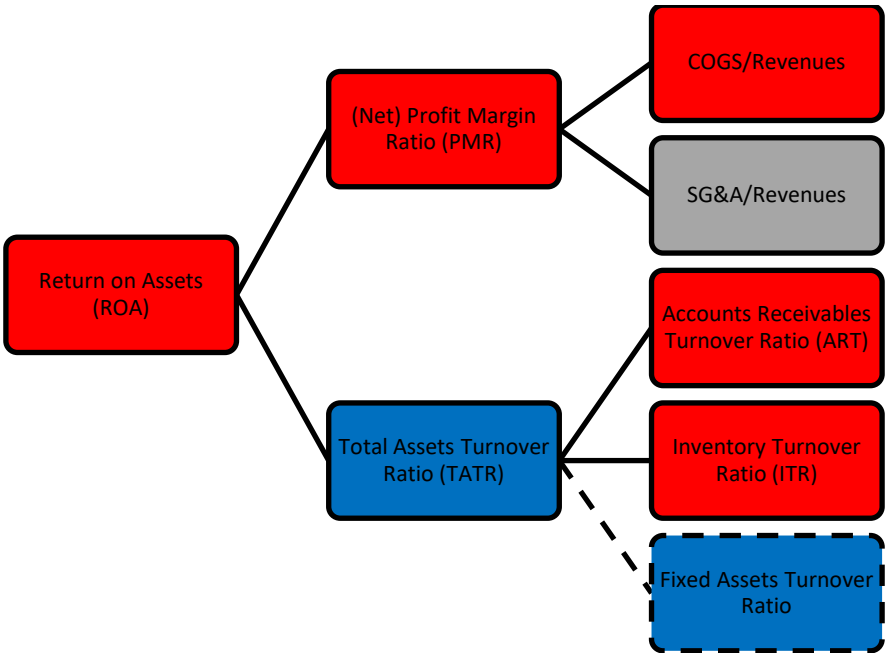
To recap, in this Chapter I implement the methodological approach to the dataset collected, while confronting the decisions about the proper statistical tools to use and identify differences in the way Greek and American DIB companies tried to achieve profitability between 2014 and 2022. At the final chapter, I will recap the findings, highlight the limitations of this thesis and provide ideas for future research.

V. DISCUSSION – LIMITATIONS – FUTURE RESEARCH

In this Chapter I present the results of the analysis in a concise way, and then based on those provide some thoughts about the causing mechanisms behind them. After that, I focus on the limitations of this thesis as well as the possible avenues for future research to dispute, confirm or further analyze my results.

A. DISCUSSION

In order to provide an easier way to understand the results of the analysis, it would be useful to overlay them to the framework developed at the methodology chapter. For that reason, I update Figure 7 as an easy visual aid. Specifically, I replicated the figure but used color (red for the USA DIB firms and blue for the Greeks) to indicate which group performs better at each metric. Moreover, I gray out the SG&A/Revenues metric, as it didn't show any statistical difference. Finally, in dashed lines, I added the inference of superior performance in the Fixed Assets Turnover ratio for the Greek companies, made at the end of the previous chapter. This "horserace" figure can visualize the findings in an aesthetic and straightforward way.



Legend

	US DIB firms perform better on average
	Greek DIB firms perform better on average

Figure 15. Updated ROA breakdown chart

Recapitulating the findings, I can argue that the sizable difference in ROA performance between the two groups seems to be primary driven by the PMR. Characteristically, the PMR effect is on its own smaller than the ROA and the TATR effect is on the opposite direction. This ability of the PMR to overcompensate for the worse performance in assets turnover allows them to eventually get statistically better ROA. Some of the reasons for the discrepancy in the effects of each component could be found in the big internal market-both military and civilian one-, the economies of scale their size can ensure, research and development advantages but also commitments and the easier access to financing pools and high-quality resources (mainly employees) from around the world.

Undoubtably, the most peculiar result of the thesis is the apparent contradiction between the performance as measured from the TATR and that of its constituents, ART and ITR. This apparent paradox leads me to believe that the Greek companies must have

performed much better in the rest aspects of asset turnover, mainly the turnover of the fixed assets. While this thesis did not collect the necessary data to conclusively prove this statement, it derives logically as an educated guess from the rest of the analysis. The researcher should keep in mind that the assets are composed by multiple classes, only two of them being Accounts Receivables and Inventory. As such, this result points to better utilization from the Greek DIB firms of the rest of the classes, like cash and cash equivalents, fixed assets, both tangible and intangible. As noted before, Greek companies are significantly smaller, in terms of fixed assets, from the typical American one. This way it seems that they can have a better oversight of the fixed assets utilization and managing to create more sales, maybe placing safer "bets." The reverse view of that is that the U.S. DIB firms could re-evaluate the use of their assets and in particular the research and development dedicated resources. While some basic research must always be done, even if it does not provide viable commercial applications, maybe it would be wiser for the companies to focus their competition on applied research and evolutionary developments and seek a more cooperative approach (either with private or governmental entities) in the more disruptive and revolutionary approaches. For example, given the character already displayed by the Greek companies analyzed, the complementarity of their management styles seems fertile ground for the creation of joint ventures and synergies between the companies in the two countries, especially in sectors, capabilities and levels there are gaps, as presented in Figure 4.

The conclusions based on the preliminary findings of the thesis can inform multiple agents in the global defense industry. Governments, both of the countries analyzed and beyond, can evaluate how the legal framework they set influences the profitability or the employment level of the sector. Moreover, they could reconsider their role not as rule-makers but as customers and benchmark if they are getting back good value for one of their greatest expenses. Benchmarking is also directly useful for the companies themselves, as they seek to improve operations, control costs and create a sustainable competitive advantage or form a strategic partnership. Of course, the companies my need a more selective and tailored approach, in order to compare to a similar group and not the industry as a whole. Lastly, the information collected for, and the conclusions drawn from this

research can help prospective and current investors to compare different investment opportunities. This complementarity could be especially beneficial for the Greek DIB, since after many years of restrain financing by the Greek Debt Crisis and its ramifications, are poised to ask for more funding displaying their efficiency to convert assets to sales. Already, trade exhibitions, such as DEFEA, have returned to Greece and some of the companies in my dataset have sign lucrative agreements to cover domestic and international customers.

B. LIMITATIONS AND FUTURE RESEARCH

As any research attempt, this thesis comes with its limitations, which should be always kept in mind. In order to assess the characteristics of an international market will always need the use of several assumptions. This is even truer for the defense industry, due to its peculiarities, connected with the need for information security and secrecy, as well as technology transfer, local employment and international sourcing of materials. This industry is connected with the most valuable of the communal goods, the security and freedom of its society and people and thus the importance of understanding its inner workings surpasses that of any other industry.

Profitability is the most important of those characteristics one can evaluate. It ensures not only current prosperity but also future growth while at the same time enhances the investing potential of the companies. However, there are numerous caveats in this attempt. First of all there are epistemological issues, from defining the boundaries of the defense industry to defining the proper profit metric to use. To define the industry, I used two different avenues. For the Greek companies the main criterion was their inclusion in HELDIC, which is voluntary and requires the firms to meet some specific criteria on industrial competence and security. However, the requirements do not include any actual acquisition relations with the Hellenic Armed Forces. On the other hand, current (FY 2023) total levels of awarded contracts in dollars was used the primary criterion to choose a representative sample of U.S. DOD contractors.

Additionally, most of the firms in both groups have civilian customers and offer dual-purpose goods and services. Organizationally they may facilitate this distinction with separate divisions being responsible to the respective customers, but financial reporting rules does not require them to break the corresponding transaction in separate forms. This managerial decision "masks" the real profitability of the sector, at least for an external researcher. Additionally, cost transferring between those divisions can further obscure the actual profitability on a government contract, for reasons varying from tax avoidance to compliance with state-mandated upper limits for profit. These issues open two different avenues for future research:

- seek and compile more granular data trying to isolate the defense-related part of the business for the companies or
- try to combat this restriction with an even larger sample, where the military-civilian split would become less important to the final results.

Methodologically, similar limitations arise when we contemplate the setup of the financial statements themselves. Firstly, Greece and the USA are using different accounting standards. In the USA, the Financial Accounting Standards Board (FASB) sets the generally accepted accounting principles (GAAP), under the auspices of the Securities and Exchange Commission (SEC). FASB intents to ensure an optimal trade-off amongst the key qualitative characteristics of relevance, reliability, comparability, consistency and materiality of the information provided by the economic entities (Stickney, 2010). On the other hand, Greece as a member-state of the European Union (EU) applies the International Financial Reporting Standards (IFRS), as they defined periodically by the International Accounting Standards Board (IASB). IFRS is considered more principles-based, focusing on providing general principles for reporting financial information. It allows for more judgment and interpretation by companies and auditors. GAAP, on the other hand, is often considered more rules-based, with specific guidelines and detailed rules for various accounting transactions. One of the differences that weights a lot in the thesis is that on reporting format, with GAAP being more prescriptive and IFRS allowing for more flexibility. Also, in addition to the full IFRS framework, the IASB has developed a

simplified version known as IFRS for Small and Medium-sized Entities (IFRS for SMEs). This is designed for smaller, non-publicly traded entities and aims to reduce the reporting burden while still providing high-quality financial reporting. Many of the smaller Greek companies chose to use this less demanding version, making the comparisons harder. Moreover, while there as several differences between the two set of standards that could nudge the managerial decisions one way or another (e.g., in revenue recognition, reporting of leases and insurance contracts, classification and impairment of financial instruments and inventory valuation), there is a different approach regarding R&D expenses. Specifically, GAAP allows for the capitalization of certain research and development costs under specific conditions while IFRS generally requires the immediate expensing of research and development costs. In an industry with profound needs in capital for R&D this treatment has substantial repercussions and could very well explain at least part of the gulf in overall country-level spending amongst developed nations (Jr, n.d.). Finally, I should note that this limitation may well be lessen in the future since the global applicability of the IFRS and the fundamental importance of the U.S. companies to the world economy have initiated a gradual convergence of the accounting standards (DeGennaro, 2017; Gillani & Harris, 2023; Kapsis & Brown, 2015).

Similar methodological issues arise once we consider the effect of the different currencies used. Even though U.S. dollar is the prime currency for global trade, Euro has its own allure and standing and accounts for the major part of the costs faced by the Greek firms. Between the start and the end of the period I examine (Jan 2014 to Dec 2022), the dollar has appreciated 28.05%, while the EURO/USD exchange rate swung from almost 1.40 to under 1 dollar before settling at 1.066 (ECB Reference Exchange Rate, U.S. Dollar/ Euro, 2:15 Pm (C.E.T.) – Quick View – ECB Statistical Data Warehouse, n.d.). The use of ratios has the advantage of compartmentalizing the general effects of the currency exchange rates, but the managerial decisions taken at that time did get those in consideration. This massive depreciation of Euro made EU products more competitive on the global markets, raising revenues, but at the same time increased the importing and production costs. Additionally, hedging against those movements and trying to secure the

value of future cash-flows could had made Greek companies to adopt a more conservative stance regarding cash management and the valuation of receivables and payables accounts.

Another limitation, albeit it functioned as a motive for this thesis is the fact that the period it is examining (2014-2022) had a very different outlook for the economic landscape of the two countries in general. In the USA, this was one of the most stable and prosperous periods, with the annual rate of GDP growth hovering around 2% for a time span the country hadn't seen since 1990s (U.S. Bureau of Economic Analysis, 1930). At the same time, Greece experienced a stagnation at the nadir of its Debt Crisis, with budget drawdowns and restricted public spending. The time span does include a couple of years with a more positive outlook, but those were impacted by the COVID-19 pandemic effects in both countries. While this cross-examination of a turbulent and a humming economic environment can lead to interesting narratives by itself, leaves open avenues for future researchers to try something similar, controlling for the greater economy ecosystem.

These future researchers can also focus their attention to the different sub-sectors of the defense industry. Sadly, while both countries are using alphanumeric codes to classify the specific activities of a company (CUSIP for the USA and Activity Codes for Greece), those are not based on a common template and could be compared directly. Notwithstanding the relative smaller significance, given the increasing interdependence of global commerce and the need of a common vocabulary and framework of operations of these companies –at least amongst OECD member states–, I envisioned a gradual realignment of those codes in the future, which will assist more direct en masse comparisons.

Finally, this thesis just compared an aspect of profitability for U.S. and Greek defense industry (ROA), as it is analyzed at the profit margin and assets turnover components, to search for excess profitability and its drivers. Future research can build on those conclusions and examine the key aspects that make U.S. defense industry a major source of exports for the country, in contrast to the anemic results of the Greek attempts to achieve, mutatis mutandis, something similar. Promising avenues are the comparison of spending figures and patterns in R&D, the size of the supporting financial instruments, the alignment with the needs of the national defense organizations and the international trends

in security and conflict and the opportunities for cross-country collaboration to minimize duplication of effort and address the customers' needs in a better way.

APPENDIX A. DETERMINATION OF ENTITY SIZE BY PUBLIC LAW 4308/14

Category	Criterion	Limits	Documentation requirements
Very small entities	Don't exceed at least 2 of the limits for the reporting period	• Total Assets ≤ 350,000 € • Revenues ≤ 700,000 € • Average number of employees ≤ 10	• Simplified balance sheet • Simplified income statement • Notes
Very small entities (§2γ, Art.1)	Must conform to both limits	• Legal form of partnership or proprietorship • Revenues ≤ 1.5 mil. €	• Simplified income statement • Notes
Small entities	Don't fall to the previous categories and don't exceed at least 2 of the limits for the reporting period	• Total Assets ≤ 4 mil. € • Revenues ≤ 8 mil. € • Average number of employees ≤ 50	• Balance sheet • Income statement • Notes (with managers' report)
Medium entities	Don't fall to the previous categories and don't exceed at	• Total Assets ≤ 20 mil. €	• Balance sheet

Category	Criterion	Limits	Documentation requirements
	least 2 of the limits for the reporting period	• Revenues ≤ 40 mil. € • Average number of employees ≤ 250	• Income statement • Statement of shareholders' equity • Notes (with managers' report) • Auditor's report
Large entities	Conform with at least 2 of the limits for the reporting period	• Total Assets ≥ 20 mil. € • Revenues ≥ 40 mil. € • Average number of employees ≥ 250	• Balance sheet • Income statement • Statement of shareholders' equity • Statement of cash flows • Notes (with managers' report) • Auditor's report

APPENDIX B. LIST OF GREEK COMPANIES USED IN THE DATASET

ID	Entity	Registry number	Year of establishment	Number of observations	First year	Last year	Sectors	Capabilities	Levels
1	ADAMANT COMPOSITES LTD	122427716000	2012	8	2014	2021	1/6/9/11/12	1/2/3/4/5/6	1/2
2	AERO APARTION PCC	143160801000	2017	5	2017	2021	1	6	1
3	AEROPHOTO CO LTD[1]	131372806000	1992	8	2015	2022	6/12	4/6	3
4	AEROSERVICES S.A.	1177101000	1993	8	2014	2021	1	2/4/5/6	1/2/3
5	Aether Aeronautics PC	154825858000	2020	2	2020	2021	5/6/9/10/12/13	1/2/3/4/5/6	1/2/3/4
6	AKMON S.A.	003749701000	1988	8	2014	2021	1/3/5/10	1/3/4/5/6	1/2/3
7	ALTUS LSA	115974258000	2011	8	2014	2021	5/6/12/13	1/3/4/5/6	1/2/3/4
8	AMS AERO PCC	149394001000	2019	1	2021	2021	1/3/5/8/9/10/12	1/2/3/4/6	1/2/3
9	ANORAK HELLAS Ltd	85656402000	1975	9	2014	2022	7	2/3/4/5/6	1/2
10	ARIEXPO ENGINEERING S.A.	124349701000	1982	8	2014	2021	2/3/9	4/6	1/2/3/4
11	ATCOR L.P.[2]	8195601000	2008				5/9/13	3/4/6	1/2
12	ATESE S.A.	2873401000	1998	8	2014	2021	1/3/5/12	2/4/5/6	1
13	Axon Engineering S.A.	013396817000	1985	8	2014	2021	1/2/3/4/9/12	1/2/3/4/5/6	1/2/3/4

ID	Entity	Registry number	Year of establishment	Number of observations	First year	Last year	Sectors	Capabilities	Levels
15	B&T Composites S.A.	017378055000	2006	8	2014	2021	1/2/3/6/9/11/15	3	2
14	BARRACUDA P.C.	159511506000	2021	1	2021	2021	3/6	2/3/4/5/6	1/4
16	CENSUS S.A.	43476106000	2014	8	2014	2021	5/12	1/5/6	1
17	COSMOS Business Systems S.A.	412401000	1988	8	2014	2021	3/5/10/12	1/2/4/5/6	1
18	DiodeBell S.A.	24536841000	2006	8	2014	2021	3/4/5/6/10	3/4	3/4
19	EAS	131982201000	2014	9	2014	2022	2/4	3/4/5	1/2/3/4
20	EFA VENTURES	003817301000	2000	9	2014	2022	2/4	3/4/5	1/2/3/4
22	EL.IN. S.A.	046813018000	1989	8	2014	2021	2/9	3/6	1/2
21	ELFON LTD	082999602000	1975	9	2014	2022	10	1/2/3/4/6	3
23	ELMON S.A.	008071201000	2005	9	2014	2022	7	2/3	2/3
24	ELVIK S.A.	112844508000	1982	8	2014	2021	3	3/6	1/2
25	ELVO S.A.	157231604000	2020	2	2020	2021	2/9	3/4/5/6	1/4
26	EMTECH SPACE P.C.	69819103000	2008	6	2016	2021	1/5/11/12/14	1/2/4/5/6	1/2/3/4
27	EODH S.A.[1]	58661504000	2003	8	2015	2022	2/9/12	1/2/3/4/5/6	1/2/3/4
28	ETME S.A.	121732403000	2000	5	2017	2021	3/6/12	1/2/6	1/2

ID	Entity	Registry number	Year of establishment	Number of observations	First year	Last year	Sectors	Capabilities	Levels
29	EUROtrade S.A.	2143601000	1978	8	2014	2021	13	3/6	3
30	FARAD S.A.	112657608000	1979	7	2015	2021	3/9/11	1/2/3/4/6	1/2/3
31	FEAC ENGINEERING P.C.	131398901000	2014	8	2014	2021	1/3/6/9/10/12	1/2/5/6	1
32	G.A. AVIATION SERVICES S.A.	086753002000	1977	7	2015	2021	1	4/5/6	1/2/3
33	GEOSYSTEMS HELLAS S.A.	9083501000	2009	8	2014	2021	6/8/12	2/5/6	1/4
34	GLASSART S.A.	084513002000	1980	8	2014	2021	9/13	3/6	1/3
35	GRANTEX S.A.	083313702000	1958	8	2014	2021	2/9	3/5	-
36	HAI S.A.	000297501000	1975	8	2014	2021	1/5/6/12	1/2/3/4/5/6	1/2/3/4
37	HARLAS	121592407000	1969	8	2014	2021	13	6	1
38	HDVS S.A.	051228844000	2001	8	2015	2022	2/9	3/4	1/2/3
39	HELLENIC INSTRUMENTS P.C.	140373101000	2016	6	2016	2021	3/4/5/8/10/12	1/2/4/5/6	1/3
40	HERADO	147766202000	2018	5	2018	2022	1/5/7/10/12	1/2/3/4/5/6	1/3/4
41	Heron Engineering LLC	125389701000	2013	8	2014	2021	12	1/2/5/6	1

ID	Entity	Registry number	Year of establishment	Number of observations	First year	Last year	Sectors	Capabilities	Levels
42	HYDRUS ENGINEERING S.A.	9125301000	2009	8	2014	2021	3/11/12	5/6	1
43	IDE	006657001000	2001	9	2014	2022	1/2/3/5/6/10/11/ 12/13/14	1/2/3/4/5/6	1/2/3/4
44	iKNOWHOW S.A.	005277801000	2002	8	2014	2021	5/6/8/10/12/15	1/2/4/6	1/2/3
45	INTRACOM TELECOM S.A.	006617101000	1994	8	2014	2021	5/10/12	1/2/3/4/5/6	1/2/3/4
46	ISD S.A.	002844301000	1998	8	2014	2021	1/2/3/6/8/10/11/12	1/2/3/4/5/6	1/2/3
47	KLEEMAN HELLAS S.A.	014486404001	1983	8	2014	2021	3/10	3/4/6	3
48	Labor S.A.	002328501000	1996	8	2014	2021	14	5	1
49	METKA/ MYTILINEOS S.A.[3]	000757001000	1962				2/3/9/11	2/3/4/5/6	1/2/3/4
50	MEVACO S.A.	089232902000	1993	8	2015	2022	3/9/11	-	-
51	MILTECH HELLAS S.A.	002516801000	1997	8	2014	2021	1/2/3/5/8/9/10	1/2/3/4/5/6	1/2/3/4
52	MKK TECHNIKI PC	137167503000	2015	2	2020	2021	5/12/13	2/4/5/6	1
53	NAX[2]	112846208000	1957				9	1/2/3/4/5/6	1/2

ID	Entity	Registry number	Year of establishment	Number of observations	First year	Last year	Sectors	Capabilities	Levels
54	NETCOMPANY-INTRASOFT S.A.	123949801001	1996	8	2014	2021	5/12	2	1
55	OCEANKING	044759007000	1989	8	2014	2021	3/12/13	4/6	1/2/3
56	OHB Hellas	146955901000	2018	4	2018	2021	1/12	1/2/4/6	1/2
57	ONEX TS&BS S.A.	006855801000	2004	8	2014	2021	1/2/3/5/9/12/13	1/2/3/5/6	1/2/3/4
58	PASS DEFENCE LTD	131523707000	1999	8	2014	2021	1/4/7/13/14	6	1
59	PRISMA ELECTRONICS S.A.	054418521000	1996	8	2014	2021	1/2/3/4/5/6/8/10/12	1/2/3/4/5/6	1/2/3
60	RAYCAP S.A.	396701000	1987	8	2014	2021	2/3/10/11/12	1/2/3/4/5/6	1/2/3
61	RAYMETRICS S.A.	5049601000	2002	8	2015	2022	7/8/13	2/3/4/6	1
62	Realiscape Typorama	36602316000	2004	8	2014	2021	5/12	1/2/3/4/5/6	1/4
63	SAS Technology	155531607000	2020	2	2020	2021	5/6/10/12	1/2/3/4/5/6	1/2/3/4
64	SATWAYS LTD	6815401000	2006	7	2015	2021	5/6/10	1/2/3/4/5/6	1/2/3/4
65	SCYTALYS S.A.	128440001000	1993	9	2014	2022	1/3/5/12	2/4/5/6	1/4
66	SGL ENGINEERING LTD	008545001000	2008	1	2021	2021	3/12	2/4	1
67	SHIPSAFE MARINE EQUIPMENT LTD	44513107000	1992	8	2014	2021	3/9/12/13	4/5/6	1/2/3

ID	Entity	Registry number	Year of establishment	Number of observations	First year	Last year	Sectors	Capabilities	Levels
68	SIELMAN S.A.	050680344000	1982	8	2014	2021	2/5/9/10	3/4/5/6	1/3/4
69	SOTIRIA TECHNOLOGY[4]	161759601000	2021				3/5/8/10/12	1/2/4/6	1/3/4
70	SPACE HELLAS S.A.	000375501000	1985	8	2015	2022	5/12/13	1/2/4/5/6	1/3/4
71	SSA S.A.	1103401000	1990	8	2014	2021	1/3/5/10/12/13	1/2/4/5/6	1/2/3/4
72	SSMART S.A.	121905407000	1994	9	2014	2022	3/5/12	2/4/6	1/3
73	STELMA T.S.A.	5094201000	1990	8	2014	2021	1/3/4	6	1
74	SYLCO HELLAS S.A.	057828704000	1992	8	2014	2021	2/9	2/3/4/5/6	-
75	TELETEL S.A.	002176101000	1995	9	2014	2022	1/5	1/2/4/5/6	1/3
76	TEMMA S.A.	083141802000	1961	8	2014	2021	9	2/3/4	2/3
77	TERRA SPATIUM S.A.	9340801000	2010	8	2014	2021	3/5/6/12	1/2	1/4
78	THALES HELLAS S.A.	004032601000	2000	8	2014	2021	1/2/3/4/5/8/10/12/13/15	1/3/4/5/6	1/3/4
79	THEON SENSORS S.A.	002502801000	1997	9	2014	2022	8/10	1/2/3/4/5/6	1/2/3
80	TotalView G.P.[2]	157910503000	2021				1/5/12	2/4/6	1/2/3
81	UCANDRONE S.A.	134708703000	2015	7	2015	2021	6/12	2/3/4/6	1/4
82	VALPAK S.A.	1345501000	1990	8	2014	2021	2/7	1/2/3/4/5/6	1/2/3/4

ID	Entity	Registry number	Year of establishment	Number of observations	First year	Last year	Sectors	Capabilities	Levels
83	Vector Technologies	6858401000	2006	8	2014	2021	1/5/8	-	1
84	VIKING NORSAFE S.A.	13377917000	1974	8	2014	2021	3/7/12	3/4/5/6	1/2/3/4
85	WHITESTEPS TECHNOLOGIES S.A.	8607101000	2012	9	2014	2022	5/7/13	1/2/4/6	1
86	ALUMAN S.A.[5]	000387901000	1986	9	2014	2022			
87	AVIATEC S.A.[5]	132632203000	2014	8	2015	2022			
88	DOUBLE ACTION[5]	134929601000	2015	7	2015	2021			
89	ILEKTROPNEUMATIKI.[5]	044494907000	1988	8	2014	2021			
90	KATRADIS A.V.E.E.[5]	044358307000	1989	8	2014	2021			
91	SIAMIDIS S.A.[5]	013375917000	1975	8	2014	2021			
92	SUNLIGHT TECHNOSYSTEMS[5]	014517835000	2001	8	2105	2022			

Notes:

1. Entity with financial year ending at June 30th.
2. Entity not included since due to its legal form does not publish annual financial statements.
3. Entity not included due to its unique characteristics and size.
4. Entity not included due to not publishing its first annual financial statements yet.
5. Entity included even if not at the HELDIC 2023–24
6. All designations of sectors, capabilities and levels are according the numbering in Table 1.

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APPENDIX C. LIST OF U.S. COMPANIES USED IN THE DATASET

ID	Entity	CUSIP	CIK number	Number of observations	First year	Last year
1	AAR CORP	000361105	0000001750	9	2014	2022
2	ABBOTT LABORATORIES	002824100	0000001800	9	2014	2022
3	AECOM	00766T100	0000868857	9	2014	2022
4	AEROVIRONMENT INC	008073108	0001368622	9	2014	2022
5	AMERESCO INC	02361E108	0001488139	9	2014	2022
6	AMERICAN STATES WATER CO	029899101	0001056903	9	2014	2022
7	AMERICAN WATER WORKS CO INC	030420103	0001410636	9	2014	2022
8	AT&T INC	00206R102	0000732717	9	2014	2022
9	BALL CORP	058498106	0000009389	1	2022	2022
10	BOEING CO	097023105	0000012927	9	2014	2022
11	BOOZ ALLEN HAMILTON HLDG CP	099502106	0001443646	9	2014	2022
12	CACI INTL INC -CL A	127190304	0000016058	9	2014	2022

ID	Entity	CUSIP	CIK number	Number of observations	First year	Last year
13	CALIFORNIA WATER SERVICE GP	130788102	0001035201	9	2014	2022
14	CENTERPOINT ENERGY INC	15189T107	0001130310	9	2014	2022
15	CENTENE CORP	15135B101	0001071739	9	2014	2022
16	COMTECH TELECOMMUN	205826209	0000023197	9	2014	2022
17	DELL TECHNOLOGIES INC	24703L202	0001571996	4	2019	2022
18	DOMINION ENERGY INC	25746U109	0000715957	9	2014	2022
19	DUKE ENERGY CORP	26441C204	0001326160	9	2014	2022
20	ENTERGY CORP	29364G103	0000065984	9	2014	2022
21	FLUOR CORP	343412102	0001124198	9	2014	2022
22	FEDEX CORP	31428X106	0001048911	9	2014	2022
23	GENERAL DYNAMICS CORP	369550108	0000040533	9	2014	2022
24	GENERAL ELECTRIC CO	369604301	0000040545	9	2014	2022
25	GREAT LAKES DREDGE & DOCK CP	390607109	0001372020	9	2014	2022
26	GRIFFON CORP	398433102	0000050725	9	2014	2022

ID	Entity	CUSIP	CIK number	Number of observations	First year	Last year
27	HAWAIIAN ELECTRIC INDS	419870100	0000354707	9	2014	2022
28	HEWLETT PACKARD ENTERPRISE	42824C109	0001645590	7	2016	2022
29	HONEYWELL INTERNATIONAL INC	438516106	0000773840	9	2014	2022
30	HUMANA INC	444859102	0000049071	9	2014	2022
31	HUNTINGTON INGALLS IND INC	446413106	0001501585	9	2014	2022
32	INTL BUSINESS MACHINES CORP	459200101	0000051143	9	2014	2022
33	IRIDIUM COMMUNICATIONS INC	46269C102	0001418819	9	2014	2022
34	JACOBS SOLUTIONS INC	46982L108	0000052988	3	2020	2022
35	JOHNSON CONTROLS INTL PLC	G51502105	0000833444	2	2014	2015
36	KBR INC	48242W106	0001357615	9	2014	2022
37	KRATOS DEFENSE & SECURITY	50077B207	0001069258	9	2014	2022
38	L3HARRIS TECHNOLOGIES INC	502431109	0000202058	3	2019	2022
39	LEIDOS HOLDINGS INC	525327102	0001336920	9	2014	2022
40	LILLY (ELI) & CO	532457108	0000059478	9	2014	2022

ID	Entity	CUSIP	CIK number	Number of observations	First year	Last year
41	LOCKHEED MARTIN CORP	539830109	0000936468	9	2014	2022
42	LUMEN TECHNOLOGIES INC	550241103	0000018926	3	2020	2022
43	MERCK & CO	58933Y105	0000310158	9	2014	2022
44	MERCURY SYSTEMS INC	589378108	0001049521	9	2014	2022
45	MICROSOFT CORP	594918104	0000789019	9	2014	2022
46	MODERNA INC	60770K107	0001682852	4	2019	2022
47	NORTHROP GRUMMAN CORP	666807102	0001133421	9	2014	2022
48	OCEANEERING INTERNATIONAL	675232102	0000073756	9	2014	2022
49	OLIN CORP	680665205	0000074303	9	2014	2022
50	OMNICOM GROUP INC	681919106	0000029989	9	2014	2022
51	ONE GAS INC	68235P108	0001587732	9	2014	2022
52	OSHKOSH CORP	688239201	0000775158	8	2014	2021
53	PALANTIR TECHNOLOG INC	69608A108	0001321655	3	2020	2022
54	PAR TECHNOLOGY CORP	698884103	0000708821	9	2014	2022

ID	Entity	CUSIP	CIK number	Number of observations	First year	Last year
55	PARSONS CORP	70202L102	0000275880	4	2019	2022
56	PFIZER INC	717081103	0000078003	9	2014	2022
57	PRIMORIS SERVICES CORP	74164F103	0001361538	9	2014	2022
58	RTX CORP	75513E101	0000101829	3	2020	2022
59	SCIENCE APPLICATIONS INTL CP	808625107	0001571123	9	2014	2022
60	TELEDYNE TECHNOLOGIES INC	879360105	0001094285	9	2014	2022
61	TETRA TECH INC	88162G103	0000831641	9	2014	2022
62	TEXTRON INC	883203101	0000217346	9	2014	2022
63	TUTOR PERINI CORP	901109108	0000077543	9	2014	2022
64	UMB FINANCIAL CORP	902788108	0000101382	9	2014	2022
65	VERIZON COMMUNICATIONS INC	92343V104	0000732712	9	2014	2022
66	VIASAT INC	92552V100	0000797721	9	2014	2022
67	VSE CORP	918284100	0000102752	9	2014	2022

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