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THE EFFECTS OF ESG ON THE FINANCIAL PERFORMANCE OF
AEROSPACE & DEFENSE COMPANIES

by

COOPER R. TRIMBLE

A thesis submitted in partial fulfillment of the requirements
for the Honors Undergraduate Thesis program in Finance
in the College of Business Administration
and in the Burnett Honors College
at the University of Central Florida
Orlando, Florida

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Thesis Chair: Dr. Ann Marie Whyte

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ABSTRACT

This study examines the relationship between Environmental, Social, and Corporate Governance (ESG) activity and financial performance in the context of firms operating in the Aerospace & Defense industry. As societal pressure increases for companies to adopt ESG and related corporate sustainability practices, it is crucial to understand the repercussions of such adoptions. As the Aerospace & Defense industry continues to grow and capitalize on post-COVID travel booms, military modernization efforts, and increased demand for advanced aerospace technology, it is essential to understand the consequences of ESG implementation. By examining data from 2012 – 2023, this study produced results regarding the relationship between ESG activity and financial performance. The results indicated a positive relationship between ESG activity and financial performance. The results also show that the relationship between ESG and financial performance has grown stronger over time consistent with the fact that proxies for ESG activity such as ESG Score and ESG Disclosure have increased in recent years.

This undergraduate thesis is dedicated to my family, thesis chair, and all those at the University of Central Florida who supported my academic endeavors.

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I. Introduction

In recent years, many governments, corporations, institutions, and individuals have begun to realize the long-lasting effects of previous years of mismanagement of the environment and society. As a result of the increased awareness of these long-lasting effects, including climate change, deforestation, unsafe working conditions, discriminatory practices, and corruption, companies have initiated course corrections and prescribed solutions for these issues. By maneuvering from a short-term profit-oriented strategy into a long-term, sustainable, and ethical strategy, companies posture themselves to outlast and outperform competitors and attract investors who demand a level of ethical behavior. To meet the goals of their long-term sustainability strategies, many companies adopt initiatives related to Environmental (E), Social (S), and Corporate Governance (G), ESG for short.

The first pillar of ESG contains practices and initiatives related to the firm's environmental interactions. This pillar, called Environmental, or "E" for short, considers issues such as energy management, ecological impact, waste management, and climate exposure. To obtain a high rating in the environmental pillar, a company might adopt initiatives to reduce wastefulness with resources such as water and energy. One of the most widely known issues within the environmental pillar is climate exposure. To obtain a high rating on this issue, companies might adopt initiatives to reduce their carbon emissions and take action to prevent global climate change.

The second pillar of ESG is based on the firm's interactions with its stakeholders, communities, and employees. This pillar, known as the Social or "S" pillar, considers issues of data security and customer privacy, community relations, and compliance with ethical policies,

to name a few. To obtain a high rating in this pillar, a firm might adopt initiatives to uphold ethical standards, such as policies preventing child and slave labor. A firm might also enact policies to protect the data and privacy of their customers to increase their S rating.

The third pillar of ESG contains themes relating to the firm's interactions with its shareholders and leadership. Unlike the previously mentioned E and S pillars, Corporate Governance, or G, is evaluated through an aggregate of four themes. The four themes in the G pillar are board composition, executive compensation, shareholder rights, and audit. To obtain a high rating in this pillar, a firm might adopt policies and initiatives to introduce performance-based compensation for executives, produce a diverse board of directors, and protect shareholder's rights to control the company.

Firms may also be rated based on their level of disclosure in each pillar. ESG disclosure is a rating between 0 and 100, identifying a company's compliance with public reporting guidelines. A company with a high ESG disclosure score will likely be more transparent in its risks, opportunities, and strategies. Likewise, a company with a low ESG disclosure score withholds information relating to its ESG activities, which may indicate poor performance.

Theoretically, with proper implementation of an ESG strategy, a firm's financial performance should increase due to the long-term perspective and increased awareness of the impact on stakeholders when making decisions. By disclosing corporate activity and sustainability performance, companies are rated based on the effectiveness of their strategies. When calculating the ESG score of a firm, each pillar is evaluated individually, then combined using a weighted average to produce an overall ESG score. The weighted average of each pillar depends on the firm's industry.

Much controversy has arisen recently due to the complexity of ESG and the mixed results post-implementation. Supporters of ESG argue that sustainable management strategies require extended periods before the impact of the results can be observed. However, opponents of ESG practices argue that sustainable management has no place in society, as it distracts management from the firm's purpose of delivering returns to shareholders. Nevertheless, implementing an ESG strategy requires a commitment to human and financial capital. Therefore, it is essential to understand whether the goals of ESG align with those of the firm and its owners.

Prior research examining the relationship between ESG and financial performance has produced mixed results. Studies have historically indicated there is a positive relationship, a negative relationship, and no relationship at all. Previous studies have produced these mixed results due to the various metrics in ESG and financial performance and the different variables used to measure them. For example, financial performance may be measured using accounting-based measures such as return on assets (Duque 2021) and return on equity (Rossi 2021) or using market-based measures such as price-to-book value ratios (Naimy 2021) or Tobin's Q (Truong 2024). The goal of this study is to examine the relationship between ESG and financial performance using combinations of pillar scores as well as the total ESG rating of publicly traded Aerospace & Defense companies. This study contributes to existing literature by being the first to examine the relationship between ESG and financial performance in the context of publicly traded Aerospace & Defense companies. Further, this study aims to examine this relationship using accounting-based measures such as return on assets (ROA) and return on equity (ROE). In examining this relationship, the statistical model utilized controls for variables such as firm size, financial leverage, and price-to-book value.

The study examines 314 publicly traded firms categorized as Aerospace & Defense by Bloomberg. The results of this research indicate a positive relationship between most elements of ESG activity and financial performance. This relationship is primarily driven by the overall ESG Score and the Governance Score, which suggests that the Aerospace & Defense industry has a unique relationship with issues of corporate governance when compared to environmental and social issues. This research also examines two subperiods in isolation to understand how the relationship between ESG activity and financial performance has changed. An examination of these results indicates that the relationship between ESG activity and financial performance has strengthened over time.

The remainder of this thesis is organized as follows. Section II discusses previous literature related to the relationship between ESG activity and financial performance. Section III discusses the development of hypotheses. Section IV identifies the data sources and discusses this study's variables and statistical model. Section V discusses the empirical results and Section VI summarizes the primary conclusions and limitations of the study.

II. Previous Literature

A. Organization

The literature examined in this study is organized based on the granularity of each study. This literature review begins with the least specific studies, which include analyses examining companies without regard to their industry. These studies are followed by those that examined companies across several countries without regard to each firm's industry. The following studies examined companies within specific countries but did not regard each firm's industry. The following two sections contain the literature reviews of previous research that examined companies on an international scale and nation-specific studies. These studies examine these firms according to their industry and do not comingle separate industries, and are most closely related to this study.

B. Large-Scale Studies

Previous literature examining the relationship between ESG practices and financial performance has yielded various conclusions. Friede (2015) and Whelan (2021) performed second-level analyses of existing studies on the relationship between ESG practices and financial performance. Each report aggregated 2,200 and 1,000 independent studies, respectively. The conclusions of these analyses indicated a positive relationship between a firm's ESG practices and its financial performance. Although these analyses are helpful, it is essential to acknowledge that they cover various geographic markets and industries, each with unique regulations and business types.

Studies conducted by Habib (2023) and Khoury (2022) set out to examine the effect of ESG on corporate financial performance during the COVID-19 pandemic. Both studies examined a large number of companies without regard to industry. Khoury's study examined the impact of ESG on the financial performance of companies in the Group of 20 (G20). The G20 is an inter-governmental forum comprising the finance ministries of 19 economically advanced sovereign nations, the European Union, and the African Union. The results of this study indicated that ESG provided benefits to a firm's financial performance during COVID-19. The results also indicated that the reward associated with this influence depended on various ESG-specific attributes, a firm's income level, and other variables related to a specific firm. Habib's study explored the same relationship in US firms during the COVID-19 pandemic. The results indicated that higher ESG practices resulted in better performance measures during COVID. Although these two studies provided results from unique and unusual circumstances, the COVID-19 pandemic was a scenario in which the practical applications of ESG practices sharply manifested.

C. International Studies

Darmansya (2019) analyzed the influence of ESG disclosure on the financial performance of firms within countries in the Group of Seven (G7). The G7 is an economic forum comprising the world's most economically advanced countries. This list contains the United States, the United Kingdom, Canada, France, Germany, Italy, and Japan. This study measured a firm's financial performance using ratios of ROA, ROE, return on capital, as well as market-based performance measures. The results of Darmansya's study produced a statistically positive relationship between a firm's ESG disclosure and ROA. When analyzed in isolation, no significant relationship existed between a firm's financial performance and its social or governance disclosures. It is essential to

acknowledge that this study does not focus on the ESG score of a firm but rather on its disclosures. However, the information provided by this study helps analyze the impact of ESG practices on financial performance as it provides an aggregated summary of ESG's impact on firms in advanced economies.

Further research into this topic exists with a focus on emerging markets. Duque (2021) conducted a study to analyze the relationship between ESG practices and the financial performance of 'multilatinas,' multinational companies in Latin America. The study consisted of 104 companies and concluded that there was a statistically significant relationship between ESG and financial performance and that the relationship was negative. Further research was conducted by Truong (2024) and Naimy (2021), focusing on Southeast and East Asian firms, respectively. Truong concluded that ESG had a statistically significant and negative relationship with a firm's value, profitability, and financing cash flows. Naimy's research focused on various East Asian industrials and found that the relationship depended on variables such as pillars, measures of corporate financial performance, and industry nature. The results of their research found that ESG had a negative relationship with the economic performance of transportation firms but had no impact on capital goods firms. A study by Tarmuji (2016) examined the relationship between ESG and the economic performance of companies in Malaysia and Singapore. The study indicated a positive relationship between a firm's financial performance and social and governance pillars. While inconclusive, these results provide insight when considering ESG in emerging markets. Overall, these results indicate that ESG harms companies in economically undeveloped countries.

Studies conducted in Europe have also yielded a variety of results. Aarak (2021) conducted a study to analyze the relationship between ESG performance and financial performance. Their study separated Europe into three regions: the Nordics, the UK, and Central Europe. The study concluded that a positive relationship existed between ESG and financial performance when measured by Tobin's Q, and the social pillar primarily drove such a relationship. Aarak also concluded that the governance pillar destroyed financial performance when measured against ROA. Another study by Kharbeet (2023) explored the relationship between ESG scores and firm performance in European private and public firms. The study concluded that there was a positive influence between a firm's performance and its social pillar. The conclusion also stated that a negative relationship existed between financial performance and the governance and environmental pillars. A third study by Rossi (2021) examined publicly listed companies in Europe. The results indicated a positive relationship between ESG and corporate financial performance. Koundouri (2022) examined the publicly traded firms on Europe's STOXX Europe ESG Leaders 50 Index. Their study concluded that there was a relationship between good ESG performance and sound financial performance. Although these studies produced various results, the information provided is still valid. The variance in these results demonstrates that assigning financial and ESG performance measures is crucial in determining relationships. It is also important to acknowledge the differences between each region in Europe, suggesting that geographical markets play a significant role in the relationship between ESG and financial performance.

Lisin (2022) conducted a similar study focusing on listed firms in North American countries. Their study examined the relationship between ESG and corporate financial performance. Additionally, Lisin utilized the Ohlson O-Score to measure a firm's likelihood of bankruptcy.

Their results found that larger firms tended to have higher ESG scores, suggesting that committing to ESG practices requires substantial investment. If true, this information would support the negative relationships frequently found in emerging markets. Lisin's study also found that a firm's governance pillar had the highest degree of positive impact on its financial success.

D. National Level Studies

Studies focusing on specific countries provide more refined evidence of the relationship between ESG and financial performance. Tantawy (2023) examined the relationship between ESG and a firm's future financial performance. Using a sample of 100 firms listed on Egypt's EGX, a positive relationship was identified between ESG performance and future financial performance. Dalal (2019) conducted a similar analysis in which they selected 65 listed Indian firms to determine the influence of ESG factors on their firm financial performance. The study concluded that good ESG performance enhanced accounting and market-based firm financial performance measures. Ruan (2021) examined the relationship between ESG and corporate financial performance in Chinese companies. They found a statistically substantial and negative relationship between ESG and financial performance. Firms that were non-state-owned and non-environmentally sensitive enterprises demonstrated this negative relationship the strongest. Taj (2023) investigated the impact of ESG on the corporate financial performance of 15 commercial banks in Pakistan. The results indicated that ESG positively impacts banks' financial performance, consistent with other literature. Ahmad (2023) studied the relationship between ESG disclosure and firm value in the top 100 companies in the Bursa Malaysia. This analysis found that ESG boosted existing firm performance, and the social pillar provided the most significant boost. Atan (2018) also examined Malaysian firms. Their study examined 54

Malaysian firms with complete ESG and financial data and found no significant relationship between these two datasets. Although these analyses examined emerging markets nationally, they utilized different ESG and corporate financial performance variables. It is also worth acknowledging differences in periods when attempting to identify trends in this relationship.

An examination of this relationship in Europe by Ahmad (2021) revisited the impact of ESG on the financial performance of firms listed on the UK's FTSE350. Their study found that ESG positively and significantly impacted a firm's financial performance. However, this relationship produced mixed results when ESG pillars were isolated. Overall, firms with higher ESG demonstrated higher financial performance than firms with lower ESG. Velte (2017) investigated the relationship between ESG performance and its impact on the financial performance of firms listed on the German Prime Standard. Their study found a positive relationship between ESG performance and ROA. However, no impact existed when analyzing the relationship between ESG performance and Tobin's Q, strengthening the argument that results depend on the measures selected. Velte concluded that governance had the most substantial impact on the financial performance of these firms.

Alareeni (2020) examined ESG disclosure's impact on the firm performance of companies listed on the American S&P 500. They concluded that by measuring firm performance through ROA, ROE, and Tobin's Q, there was a positive relationship between ESG disclosure and firm performance. Zebian (2021) measured ESG's impact on firm financial performance through accounting and mixed-measure methods. Zebian concluded that the environmental and governance pillars positively impact the financial performance of manufacturing firms. In contrast, the social pillar had a positive impact on service firms. These results strengthen the

argument for analyses to focus on the national and sector-specific level. Betzer (2023) measured the impact of sustainability as an aggregate of ESG scores against the financial performance of American companies. The results were deemed inconclusive after analyzing the relationship using accounting and market-based firm financial performance measures.

Balabat (2012) investigated the relationship between ESG and financial performance in firms listed on the Australian Securities Exchange. Balabat identified a weak positive relationship by utilizing a variety of financial ratios as measures of financial performance. This analysis also included one-year and two-year lags, where the results followed the same trend of a weak positive relationship.

E. International Sector-Specific Studies

Previous literature has examined the relationship between ESG and corporate financial performance at an industry level. Batae (2020) examined the relationship between ESG and banks' financial performance. The analysis concluded that different regions of Europe produced different relationships between ESG and financial performance. Although this analysis was limited to banks in the European region, the results still provide valuable conclusions. Kalia (2023) examined the impact of ESG scores on the financial performance of healthcare companies globally. The study found differing relationships depending on the context of each country. In the case of healthcare companies, there was a net positive in developed countries but a net negative relationship in emerging economies. This relationship is consistent with previous literature documenting negative relationships in developing economies. Shakil (2019) evaluated the effects of ESG on the financial performance of 93 banks in emerging economies. Their results indicated a positive association between an emerging market bank's environmental, social, and financial

performance. However, Shakil concluded that governance did not influence performance. While there is still a variance in results, the overall trends become much more evident when analyses are on a sector-specific level.

F. National Sector-Specific Studies

The most detailed level of analysis combines a national filter as well as a sector-specific filter. Agarwal (2023) measured the effect of ESG on a firm's financial performance using market-to-book ratios as a proxy of financial performance. Their analysis consisted of Indian pharmaceutical companies. They concluded that there was a strong negative association between ESG and financial performance. However, when competition is a moderator for this relationship, it was found that ESG had a significant and positive relationship with financial performance. Kumari (2022) examined the relationship between ESG score and firm value through a cross-lagged panel of Indian energy companies. Their results indicated a non-bidirectional relationship between ESG and firm value. A negative association exists in the first two lags and a positive relationship in the last lag. Zhao (2018) examined the impact of ESG on the corporate financial performance of listed Chinese power generation companies. The results indicated that good ESG performance can improve the financial performance of these companies.

In Poland, Baran (2022) investigated the relationship between ESG scores and the corporate financial performance of Polish energy firms. Using ROE, ROA, and ROS ratios to measure financial performance, Baran determined no repetitive dependency between ESG and corporate financial performance. Further, this relationship was likely a result of the chosen industry due to the strict regulatory nature of energy corporations and a combination of state ownership.

In North America, Xhafa (2023) examined the relationship between American Insurance companies' financial performance and ESG scores. By analyzing the impact of ESG score on net profit, Xhafa concluded that the governance pillar had a positive and statistically significant relationship with financial performance.

G. Contributions of this Study

No study to date has examined the impact of ESG on the financial performance of publicly traded companies in the Aerospace & Defense industry. According to Boston Consulting Group, the Aerospace & Defense industry is expected to account for approximately 20% of global greenhouse gas emissions by 2050.¹ Similarly, KPMG reports that the demand for air transport will increase by 300%, while firms must still adhere to the European Green Deal, which calls for carbon neutrality by 2050.² As such, the industry must innovate new solutions to reduce environmental impacts. By examining the effects of ESG activity on the financial performance of Aerospace & Defense during this crucial period, results can be extrapolated to other heavy manufacturing and transportation industries to ensure companies can survive the implementation of sustainability practices. Thus, this study fills an important gap in the existing literature.

¹ Losada, P., Aaronson, M., Brimmer, A., Hangai, Y., & Rein, J. (2022, September 15). The Sustainability Opportunity For Aerospace. BCG Global.

² Sustainability in the Aerospace and Defense Industry. (2023, June).

III. Hypotheses Development

Although there is a wide variety of results when examining all previous literature, studies that have specifically examined the relationship between a firms' ESG activity and their financial performance have generally found two conclusions; mixed relationships when examining large samples and positive relationships when examining specific samples. As such, this study's hypothesis development utilizes previous research results. However, it is essential to acknowledge that there has yet to be an analysis of the relationship between ESG activity and firm financial performance in the context of Aerospace & Defense companies. Therefore, it is not easy to accurately extrapolate the results of previous literature into this study's hypotheses.

Previous literature has found that there is a positive relationship between ESG activity and the financial performance of Indian pharmaceutical firms (Agarwal 2023), American insurance firms (Xhafa 2023), Chinese power generation firms (Zhao 2018), and Pakistani commercial banks (Taj 2023). Additionally, previous literature has indicated that firms that dedicate more resources to research and development efforts have higher ESG scores (Pinheiro 2024). Pinheiro's study also found that firms with higher ESG scores tended to have higher economic and financial performance levels. Additionally, research has found that ESG positively impacts the financial performance of companies in developed economies but harms companies in emerging markets (Kalia 2023). While this research focused on healthcare companies, it is worthwhile to consider their findings in the context of economic development. It is instrumental in supporting the development of hypotheses when considering that most Aerospace & Defense companies operate in developed economies. Therefore, this study posits its first hypothesis for

the relationship between ESG activity and the financial performance of Aerospace & Defense firms:

H1. Aerospace & Defense firms' ESG practices positively impact their financial performance.

Although the results of previous research are convincing in the likelihood of a positive relationship existing, it is crucial to acknowledge research that contradicts those findings.

Previously, negative relationships have been found between the ESG activity and financial performance of listed firms in Southeast Asia (Truong 2024) and Chinese companies (Ruan 2021). Ruan's research found that non-state-owned companies produce more robust conclusions supporting the existence of a negative relationship. It is worthwhile to consider these findings when examining Aerospace & Defense firms. Although this study examines listed firms that are not state-owned, it is essential to acknowledge that most of the business conducted by these firms is with government entities, which may indirectly influence the operations and strategy of these firms. Therefore, this study posits its alternate hypothesis for the relationship between ESG activity and the financial performance of Aerospace & Defense firms:

H2. Aerospace & Defense firms' ESG practices negatively impact their financial performance.

IV. Variables, Data Sources, and Model

A. Data Sources

This study sourced financial data from Bloomberg's database for 314 firms. The sample was selected according to the Bloomberg Industry Classification System (BICS) and includes only publicly traded companies in the Aerospace & Defense sector. The purpose of the BICS system is to provide precise information regarding industry classification for enhanced analysis or security screening. The BICS system is a catalog of securities and legal entities reviewed annually and after corporate actions that might change industry classification. The BICS system covers approximately 1.5 million securities and 2.6 million legal entities, separated into seven hierarchical levels for granularity and precision. The final sample utilized in this study consists of 314 firms from 2015-2023. This study utilized the previously mentioned period due to the completeness of the financial and ESG data. All data used in this study underwent a winsorization process before use. This process transforms the dataset by limiting the extreme values affecting results. Data below the 1st percentile was transformed to match the 1st percentile, while data above the 99th percentile was transformed to match the 99th percentile. Firms affected by this process were typically small firms facing financial distress or large firms experiencing periods of exceptional performance.

B. Statistical Model

This study utilizes a statistical model adapted from previous literature (Kalia, D., & Aggarwal, D., 2022). This model tests hypotheses 1 & 2, referred to as *H1* and *H2* respectively. The regression model utilized in this study is as follows:

$$FP_i = \beta_0 + \beta_1 * ESG\ Activity_i + \beta_2 * LN\ TA_i + \beta_3 * \frac{TD}{TE}_i + \beta_4 * PBV_i + \beta_5 * Current\ Ratio_i + e$$

C. Dependent Variable

The dependent variable utilized in this study's model is firm financial performance (FP_i), which is proxied by two accounting measures: Return on Assets (ROA) and Return on Equity (ROE). Using these two accounting measures as a proxy of firm financial performance is consistent with previous literature (Aggarwal 2022).

D. Key Independent Variable

The key independent variable utilized in this study is ESG activity. The measure of ESG activity is proxied by the ESG rating of each firm in the sample. Furthermore, the model utilized in this study may be adapted to consider a specific pillar of ESG, such as Environmental (E), Social (S), or Corporate Governance (G). The aggregate of these scores is equivalent to a firm's overall ESG rating, but analysis of each pillar in isolation may provide more granular evidence. ESG Disclosure is a rating that identifies the firm's level of disclosure in each category and the overall ESG score. A company with a higher ESG disclosure rating is more transparent, whereas a company with a low ESG disclosure rating is likely to withhold information.

E. Control Variables

The regression model utilized in this study controls for a firm's size and financial leverage. The study calculates firm size as the natural logarithm of a firm's total assets (LN TA). Further, this study calculates a firm's financial leverage as a firm's total debt divided by the firm's total equity (TD/TE). This study's model includes a control variable for a firm's price-to-book

value (PBV) ratio. The PBV ratio is a market-based measure of a firm's market value to book value. This ratio is used as a proxy for the market's perspective on a firm's growth opportunities. The inclusion of this ratio on the right-hand side of the statistical equation is consistent with previous literature (Naimy 2021). All variable definitions are provided in Appendix A.

F. Methodology

This study examines the sample data in several formats to understand the relationship between ESG activity and financial performance. The study first examines the model over the entire sample period from 2012-2023. Further examination separates the sample into two subperiods: 2012-2017 and 2018-2023. The goal of this exercise is to determine if the relationship between ESG and financial performance has changed over time.

V. Empirical Results

Table 1 presents the descriptive statistics for each variable, separated into three panels. Panel A presents the summary statistics for all firm data across the sample period. In this panel, ROA has a mean of 3.49% while the median is 3.64%. The ROA ranges from -62.43% at the minimum to 34.67% at the maximum, with a standard deviation of 6.39%. The ROE has a mean of 9.72% with a median of 9.92%. The ROE ranges from -192.75% to 85.47%, with a standard deviation of 23.45%. The ESG Score has a mean of 2.72, while E, S, and G have an average of 1.29, 1.88, and 5.29, respectively. The respective medians for these variables are 2.52, 0.78, 1.61, and 5.90. The ESG Score ranges between 0.77 and 6.42, likely due to the presence of companies from both emerging and developed economies in the sample. Panel B shows only firm data between the years 2012 and 2017. Concerning ROA, Panel B presents a higher minimum, mean, and median while maintaining the same maximum and a smaller standard deviation. When considering ROE, Panel B presents a higher minimum, mean, and median while retaining the same maximum and a smaller standard deviation. The mean for the ESG Score and ESG disclosure variables is lower, suggesting reduced ESG disclosure and activity during the first sample period. Panel C presents only firm data between the years 2018 and 2023. Concerning ROA, Panel C presents the same minimum with a lower mean, median, maximum, and a smaller standard deviation. ROE presents the same minimum with a lower mean, median, and maximum. The standard deviation for the ROE in Panel C is larger. The means for ESG Score and ESG Disclosure variables are higher, suggesting increased ESG disclosure and activity.

Table 2 presents the correlation matrix. ROA and ROE present a positive relationship with ESG Score, E Score, S Score, G Score, ESG Disclosure, E Disclosure, S Disclosure, and G

Disclosure. ROA presents a positive relationship with all control variables except TD/TE. ROE presents a positive relationship with all control variables except the current ratio.

Table 3 presents the regression results using ROA as a measure of firm financial performance. In models (1) and (2) the overall ESG Score as well as the Governance component of that score were both significant at the 10% level and indicated a positive relationship with ROA. ESG Disclosure also presents a positive relationship with ROA (model 3), significant at the 5% level. However, the individual components of ESG disclosure presents mixed results. Environmental disclosure presents a negative relationship with ROA, significant at the 10% level, while Social disclosure presents a positive relationship with ROA, significant at the 1% level. In examining the control variables presented in table 3, we see the size measure used, LN TA³, exhibits a positive relationship, statistically significant at the 1% level. This relationship suggests economies of scale may allow for greater ROA. TD/TE, the measure of firm leverage, exhibits a negative relationship significant at the 1% level, which indicates leverage may harm ROA. The measure of working capital, the current ratio, exhibits a positive relationship statistically significant at the 1% level, which indicates working capital benefits a firm's ROA. The price-to-book value variable presents a positive relationship statistically significant at the 1% level, which suggests a higher market valuation may aid a firm's ROA.

Table 4 presents the regression results using ROE as a measure of firm financial performance. In model (1), ESG score exhibits a positive relationship with ROE, significant at the 5% level. When examining the individual components of the overall ESG Score, the

³ The chosen measure of size, LN TA, is robust to the other two measures, Enterprise Value and Market Capitalization.

Governance Score presents a statistically significant relationship at the 5% level (model 2), which was positive. ESG Disclosure presents a positive relationship with ROE, significant at the 5% level (model 3). The individual components of ESG Disclosure continue to provide mixed results, with Environmental Disclosure being negative and statistically significant at the 10% level, while Social Disclosure was positive and statistically significant at the 1% level (model 4). In examining the control variables in table 4, we see the LN TA exhibits an identical relationship as in table 3. This relationship is positive and significant at the 1% level. Such results indicate economies of scale may also benefit a firm's ROE. TD/TE exhibits a negative relationship statistically significant at the 1% level, which indicates leverage is harmful to a firm's ROE. The current ratio exhibits a positive relationship with ROE, statistically significant at the 5% level. This relationship is indicative of working capital being beneficial to a firm's ROE. The price-to-book value variable presents a positive relationship statistically significant at the 1% level, which suggests a higher market valuation may be beneficial to a firm's ROE.

Tables 5 and 6 present the regression results using ROA as a measure of firm financial performance when the sample is partitioned into two subperiods. The results presented in these tables indicate that the relationship between ESG and financial performance has become more significant over time. In the first sample period (Table 5), only the ESG Disclosure and S Disclosure variables were statistically significant, at the 10% and 1% levels respectively. In the second sample period (Table 6), we see an increase in significant variables, with ESG Score, E Score, ESG Disclosure, and S Disclosure being statistically significant at the 5%, 10%, 5%, and 5% levels, respectively. Each of these variables present a positive relationship with ROA.

Tables 7 and 8 present the regression results using ROE as a measure of firm financial performance for the two subperiods. The results presented in these tables follow the trend identified in our examination of tables 5 and 6. In the first sample period (Table 7), only the ESG Disclosure variable is statistically significant, at the 10% level. In the second sample period (Table 8), ESG Score, G Score, ESG Disclosure, and S Disclosure each exhibit a positive, statistically significant relationship with ROE at the 1%, 5%, 5%, and 1% levels respectively. However, this sample period also presents a negative, statistically significant relationship between E Disclosure and ROE, significant at the 1% level.

In examination of these results, we can identify certain trends of interest. The overall ESG Score always exhibits a positive and statistically significant relationship with the chosen measure of firm financial performance, suggesting the overall ESG activity may result in enhanced corporate performance. The Governance Score component of ESG always produces statistically significant, positive results, suggesting that corporate governance has the most impact on the financial performance of an Aerospace & Defense company. Such could be true due to the nature of the industry, which relies on government interactions and manufacturing. Due to the industry's importance in the context of global security, many governments may choose to overlook certain environmental or social concerns and choose to conduct business with reputable and stable companies. As such, the environmental and social components of ESG would have their importance surpassed by the corporate governance component, which represents a company's commitment to balanced management, accountability, and transparency. The ESG disclosure element of ESG activity provides mixed results, with Environmental disclosure presenting statistically significant, negative relationships against measures of financial performance. However, Social disclosure exhibits a statistically significant, positive relationship

with measures of financial performance. Although Environmental scores have increased throughout the sample period, the associated disclosures may present troubling circumstances for a firm's financial performance. As these manufacturing-heavy companies shift to carbon neutrality, clean energy, and environmentally safe manufacturing processes, they are likely committing a large portion of their resources and potentially incurring additional expenses, which would explain the negative relationship between the disclosures and their financial performance. Social disclosure presents a positive relationship with firm financial performance, likely indicative of enhanced workforce productivity and efficiency. By increasing investments in its workforce, community, and stakeholders, an Aerospace & Defense firm might be able to increase workforce productivity, attract more experienced talent, and negotiate more favorable terms, each of which would benefit the firm's financial performance.

This study has provided evidence of a positive relationship exists between ESG activity and measures of financial performance. The results are consistent with the findings of previous studies (Agarwal 2023; Xhafa 2023; Zhao 2018; Taj 2023). These findings support *H1*, which hypothesizes that Aerospace & Defense firms' ESG practices positively impact their financial performance. However, this study has also identified some evidence of a negative relationship between ESG activity and financial performance. We must acknowledge those findings similar to previous research (Truong, 2024; Ruan, 2021), which supports *H2*, which hypothesizes that Aerospace & Defense firms' ESG practices negatively impact their financial performance.

VI. Discussion and Conclusion

As society pressures firms to implement more ESG activity, policymakers, regulators, business leaders, stakeholders, and investors must thoroughly understand the relationship between ESG activity and financial performance before acting. This study has examined the relationship between ESG activity and the financial performance of Aerospace & Defense companies through a multivariate regression model.

At the time of writing, this is the first study that has examined the relationship between ESG activity and financial performance in Aerospace & Defense companies. The results of this study provide evidence of statistically significant relationships between ESG activity and financial performance, and answer questions generated through previous research efforts. By focusing this study on the Aerospace & Defense industry, the results produced were more consistent than those of previous works. Thus, this research reinforces the argument for examinations of the relationship between ESG activity and financial performance to consider the differences between industries.

Although the results are robust, there are limitations to the analysis. It is crucial to acknowledge the unknown influence of causality in these results. This study does not attempt to quantify the potential influence of causality between a company's financial performance and its investment in ESG activities. As such, companies with increased financial performance may have more resources for ESG activities, thus raising their ESG scores. Such a relationship would undermine the assumption that this research relies on, that ESG activities increase financial performance.

The results of this research will be helpful for policymakers, regulators, business leaders, stakeholders, and investors who aim to increase their understanding of the relationship between ESG activity and financial performance. By understanding this relationship, policymakers and regulators can be more informed regarding the consequences of their decisions and may shape more effective policies to reach goals related to ESG. Business leaders, such as management teams, may use this information to make informed decisions regarding their adoption and commitment to ESG practices in the context of the firm's financial performance. Stakeholders and investors may use this research to understand better what practices they wish to advocate for and the potential repercussions of increased ESG adoption.

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Table 1. Summary Statistics

This table presents summary statistics. Panel A presents summary statistics for the full sample period. Panel B presents summary statistics for the years 2012-2017. Panel C presents summary statistics for the years 2018-2023. The definition of each variable is available in Appendix A.

Panel A. Summary Statistics (2012-2023)

Variables	N	Min	Mean	Median	SD	Max
<i>Financial Performance</i>						
ROA	462	-62.43%	3.49%	3.64%	6.39%	34.67%
ROE	462	192.75%	9.72%	9.92%	23.45%	85.47%
<i>ESG Activity</i>						
ESG Score	462	0.77	2.72	2.52	1.16	6.42
E Score	462	0.00	1.29	0.78	1.39	6.18
S Score	462	0.39	1.88	1.61	1.58	8.59
G Score	462	2.10	5.92	5.90	1.37	8.32
ESG Disclosure	462	8.48	42.41	41.70	11.81	67.64
E Disclosure	462	0.00	24.32	20.57	19.71	70.70
S Disclosure	462	2.57	23.17	21.67	12.20	53.32
G Disclosure	462	20.53	79.59	83.59	12.50	97.50
<i>Control Variables</i>						
LN TA	462	17.11	22.10	22.12	1.66	25.59
TD/TE	462	0.00	0.75	0.50	1.16	9.57
Current Ratio	462	0.36	1.99	1.48	1.49	12.70
PBV	462	0.33	3.76	2.69	4.52	48.81

Panel B. Summary Statistics (2012-2017)

Variables	N	Min	Mean	Median	SD	Max
<i>Financial Performance</i>						
ROA	159	-19.22%	4.54%	4.24%	5.31%	34.67%
ROE	159	117.28%	14.57%	12.75%	22.40%	85.47%
<i>ESG Activity</i>						
ESG Score	159	1.05	2.41	2.32	0.81	4.77
E Score	159	0.00	0.93	0.45	1.05	4.20
S Score	159	0.39	1.39	1.31	0.83	4.81
G Score	159	2.73	6.06	6.04	1.31	8.23
ESG Disclosure	159	22.13	40.45	39.75	10.16	62.19
E Disclosure	159	0.00	20.38	16.79	18.84	63.20
S Disclosure	159	2.57	21.31	20.62	11.71	48.22
G Disclosure	159	44.94	79.53	83.59	11.04	93.74
<i>Control Variables</i>						
LN TA	159	18.94	22.29	22.21	1.49	25.23
TD/TE	159	0.00	0.85	0.53	1.41	9.57
Current Ratio	159	0.48	1.93	1.50	1.49	12.70
PBV	159	0.84	4.40	3.18	5.23	32.34

Panel C. Summary Statistics (2018-2023)

Variables	N	Min	Mean	Median	SD	Max
<i>Financial Performance</i>						
ROA	303	-62.43%	2.94%	3.38%	6.83%	18.79%
ROE	303	192.75%	7.17%	8.48%	23.62%	82.90%
<i>ESG Activity</i>						
ESG Score	303	0.77	2.88	2.69	1.28	6.42
E Score	303	0.00	1.48	1.01	1.51	6.18
S Score	303	0.39	2.14	1.64	1.80	8.59
G Score	303	2.10	5.85	5.85	1.40	8.32
ESG Disclosure	303	8.48	43.44	43.10	12.49	67.64
E Disclosure	303	0.00	26.38	22.47	19.87	70.70
S Disclosure	303	2.57	24.14	23.88	12.35	53.32
G Disclosure	303	20.53	79.62	83.59	13.22	97.50
<i>Control Variables</i>						
LN TA	303	17.11	22.00	22.06	1.73	25.59
TD/TE	303	0.00	0.69	0.47	0.99	7.51
Current Ratio	303	0.36	2.02	1.47	1.50	12.04
PBV	303	0.33	3.42	2.51	4.06	48.81

Table 2. Correlation Table

This table presents the correlation matrix between all variables. The definition of each variable is available in Appendix A.

	<i>ROA</i>	<i>ROE</i>	<i>ESG Score</i>	<i>E Score</i>	<i>S Score</i>	<i>G Score</i>	<i>ESG Disclosure</i>	<i>E Disclosure</i>	<i>S Disclosure</i>	<i>G Disclosure</i>	<i>LN TA</i>	<i>TD/TE</i>	<i>Current Ratio</i>	<i>PBV</i>
ROA	1.0000													
ROE	0.8323	1.0000												
ESG Score	0.0958	0.2036	1.0000											
E Score	0.0824	0.1855	0.7570	1.0000										
S Score	0.0204	0.0692	0.8727	0.4798	1.0000									
G Score	0.1635	0.2634	0.5378	0.2248	0.2607	1.0000								
ESG Disclosure	0.1101	0.2365	0.8165	0.7605	0.6060	0.4925	1.0000							
E Disclosure	0.0264	0.1629	0.6964	0.8020	0.5163	0.2067	0.9053	1.0000						
S Disclosure	0.1034	0.1925	0.7119	0.6323	0.5882	0.3419	0.8517	0.7520	1.0000					
G Disclosure	0.1701	0.2289	0.5264	0.2761	0.3328	0.7430	0.5808	0.2585	0.2550	1.0000				
LN TA	0.1342	0.3520	0.5129	0.5273	0.2922	0.4120	0.6184	0.5903	0.4150	0.4193	1.0000			
TD/TE	-0.1424	0.0408	0.2285	0.1913	0.1584	0.2122	0.2264	0.2276	0.1343	0.1607	0.2975	1.0000		
Current Ratio	0.1884	-0.0279	-0.2071	-0.3002	-0.1279	-0.0589	-0.3186	-0.3933	-0.3155	0.0242	-0.4567	-0.2188	1.0000	
PBV	0.1586	0.3843	0.1049	0.1015	0.0063	0.2041	0.1121	0.0909	0.0197	0.1636	0.2573	0.6764	-0.0963	1.0000

Table 3. ESG Activity and Financial Performance (ROA)

Table 3 presents the regression results of estimating equation 1. Models 1 to 4 use ROA as the dependent variable and alternate measures of ESG activity as the key independent variable. T-values are presented in parentheses. Significance levels of 10%, 5%, and 1% are represented by *, **, and *** respectively. The definition of each variable is provided in Appendix A.

	(1)	(2)	(3)	(4)
	Return on Assets	Return on Assets	Return on Assets	Return on Assets
ESG Score	0.50* (1.87)			
E Score		0.34 (1.41)		
S Score		0.02 (0.11)		
G Score		0.42* (1.94)		
ESG Disclosure			0.07** (2.35)	
E Disclosure				-0.04* (-1.84)
S Disclosure				0.12*** (3.56)
G Disclosure				0.02 (0.86)
LN TA	0.89*** (4.24)	0.77*** (3.45)	0.79*** (3.54)	0.94*** (4.10)
TD/TE	-2.59*** (-8.02)	-2.58*** (-7.99)	-2.58*** (-8.07)	-2.52*** (-7.93)
Current Ratio	1.08*** (5.35)	1.05*** (5.15)	1.11*** (5.55)	1.11*** (5.30)
PBV	0.61*** (7.54)	0.59*** (7.31)	0.61*** (7.61)	0.61*** (7.58)
Constant	-20.04*** (-4.47)	-18.82*** (-4.08)	-19.32*** (-4.31)	-23.35*** (-5.03)
Observations	462	462	462	462
R ²	0.22	0.23	0.23	0.24

Table 4. ESG Activity and Financial Performance (ROE)

Table 4 presents the regression results of estimating equation 1. Models 1 to 4 use ROE as the dependent variable and alternate measures of ESG activity as the key independent variable. T-values are presented in parentheses. Significance levels of 10%, 5%, and 1% are represented by *, **, and *** respectively. The definition of each variable is provided in Appendix A.

	(1)	(2)	(3)	(4)
	Return on Equity	Return on Equity	Return on Equity	Return on Equity
ESG Score	2.02** (2.25)			
E Score		0.89 (1.08)		
S Score		0.16 (0.25)		
G Score		1.81** (2.47)		
ESG Disclosure			0.23** (2.42)	
E Disclosure				-0.14* (-1.87)
S Disclosure				0.41*** (3.75)
G Disclosure				0.05 (0.66)
LN TA	4.64*** (6.61)	4.29*** (5.77)	4.39*** (5.89)	4.97*** (6.44)
TD/TE	-9.74*** (-9.03)	-9.69*** (-8.96)	-9.68*** (-9.02)	-9.47*** (-8.88)
Current Ratio	1.53** (2.27)	1.38** (2.02)	1.67** (2.49)	1.73** (2.45)
PBV	3.24*** (11.97)	3.17*** (11.65)	3.24*** (12.00)	3.23*** (12.03)
Constant	-106.22*** (-7.07)	-104.56*** (-6.77)	-105.3*** (-7.01)	-118.96*** (-7.66)
Observations	462	462	462	462
R ²	0.35	0.36	0.35	0.37

Table 5. ESG Activity and Financial Performance (ROA) (2012-2017)

Table 5 presents the regression results of estimating equation 1. Models 1 to 4 use ROA as the dependent variable and alternate measures of ESG activity as the key independent variable. This model is limited to the first sample period. T-values are presented in parentheses. Significance levels of 10%, 5%, and 1% are represented by *, **, and *** respectively. The definition of each variable is provided in Appendix A.

	(1)	(2)	(3)	(4)
	Return on Assets	Return on Assets	Return on Assets	Return on Assets
ESG Score	0.60 (1.02)			
E Score		0.20 (0.42)		
S Score		0.31 (0.57)		
G Score		0.22 (0.68)		
ESG Disclosure			0.09* (1.74)	
E Disclosure				-0.04 (-1.27)
S Disclosure				0.13*** (2.95)
G Disclosure				0.02 (0.51)
LN TA	0.67 (1.85)	0.65* (1.71)	0.50 (1.35)	0.76* (1.98)
TD/TE	-2.65*** (-4.54)	-2.67*** (-4.53)	-2.74*** (-4.69)	-2.72*** (-4.72)
Current Ratio	1.53*** (5.55)	1.52*** (5.45)	1.56*** (5.75)	1.59*** (5.69)
PBV	0.73*** (4.82)	0.73*** (4.79)	0.75*** (4.98)	0.76*** (5.10)
Constant	-15.73** (-2.08)	-15.69* (-1.97)	-14.03* (-1.90)	-19.97** (-2.59)
Observations	159	159	159	159
R ²	0.27	0.27	0.28	0.31

Table 6. ESG Activity and Financial Performance (ROA) (2018-2023)

Table 6 presents the regression results of estimating equation 1. Models 1 to 4 use ROA as the dependent variable and alternate measures of ESG activity as the key independent variable. This model is limited to the second sample period. T-values are presented in parentheses. Significance levels of 10%, 5%, and 1% are represented by *, **, and *** respectively. The definition of each variable is provided in Appendix A.

	(1) Return on Equity	(2) Return on Equity	(3) Return on Equity	(4) Return on Equity
ESG Score	0.72** (2.22)			
E Score		0.51* (1.72)		
S Score		0.09 (0.41)		
G Score		0.44 (1.53)		
ESG Disclosure			0.08** (2.30)	
E Disclosure				-0.03 (-0.85)
S Disclosure				0.11** (2.38)
G Disclosure				0.02 (0.74)
LN TA	0.80*** (2.99)	0.65** (2.32)	0.72** (2.57)	0.85*** (2.92)
TD/TE	-2.82*** (-6.74)	-2.80*** (-6.68)	-2.75*** (-6.65)	-2.70*** (-6.54)
Current Ratio	0.81*** (2.98)	0.79*** (2.89)	0.87*** (3.21)	0.87*** (3.01)
PBV	0.55*** (5.52)	0.54*** (5.35)	0.55 (5.52)	0.55*** (5.47)
Constant	-18.21*** (-3.20)	-16.45** (-2.81)	-18.27*** (-3.22)	-21.39*** (-3.63)
Observations	303	303	303	303
R ²	0.22	0.23	0.22	0.23

Table 7. ESG Activity and Financial Performance (ROE) (2012-2017)

Table 7 presents the regression results of estimating equation 1. Models 1 to 4 use ROE as the dependent variable and alternate measures of ESG activity as the key independent variable. This model is limited to the first sample period. T-values are presented in parentheses. Significance levels of 10%, 5%, and 1% are represented by *, **, and *** respectively. The definition of each variable is provided in Appendix A.

	(1) Return on Equity	(2) Return on Equity	(3) Return on Equity	(4) Return on Equity
ESG Score	2.23 (0.97)			
E Score		1.04 (0.56)		
S Score		0.75 (0.36)		
G Score		0.47 (0.38)		
ESG Disclosure			0.33* (1.72)	
E Disclosure				0.00 (0.01)
S Disclosure				0.26 (1.48)
G Disclosure				0.12 (0.78)
LN TA	4.42*** (3.14)	4.42*** (2.99)	3.74** (2.60)	4.10** (2.69)
TD/TE	-6.39** (-2.81)	-6.38** (-2.78)	-6.72*** (-2.96)	-6.69*** (-2.94)
Current Ratio	2.91** (2.72)	2.97** (2.73)	3.05*** (2.88)	3.03** (2.75)
PBV	3.37*** (5.75)	3.36*** (5.69)	3.46*** (5.92)	3.47*** (5.89)
Constant	-104.42*** (-3.55)	-103.89*** (-3.35)	-97.45*** (-3.39)	-106.94*** (-3.50)
Observations	159	159	159	159
R ²	0.38	0.38	0.39	0.39

Table 8. ESG Activity and Financial Performance (ROE) (2018-2023)

Table 8 presents the regression results of estimating equation 1. Models 1 to 4 use ROE as the dependent variable and alternate measures of ESG activity as the key independent variable. This model is limited to the second sample period. T-values are presented in parentheses. Significance levels of 10%, 5%, and 1% are represented by *, **, and *** respectively. The definition of each variable is provided in Appendix A.

	(1)	(2)	(3)	(4)
	Return on Equity	Return on Equity	Return on Equity	Return on Equity
ESG Score	3.19*** (3.23)			
E Score		1.32 (1.47)		
S Score		0.65 (0.95)		
G Score		2.27** (2.60)		
ESG Disclosure			0.28** (2.52)	
E Disclosure				-0.18* (-1.88)
S Disclosure				0.52*** (3.78)
G Disclosure				0.04 (0.40)
LN TA	3.83*** (4.74)	3.39*** (3.96)	3.88*** (4.53)	4.62*** (5.22)
TD/TE	-13.24*** (-10.42)	-13.17*** (-10.34)	-12.84*** (-10.15)	-12.59*** (-10.08)
Current Ratio	0.47 (0.57)	0.30 (0.36)	0.71 (0.86)	0.84 (0.97)
PBV	2.82*** (9.29)	2.76*** (9.00)	2.79*** (9.13)	2.78*** (9.19)
Constant	-87.57*** (-5.06)	-84.87*** (-4.78)	-92.37*** (-5.33)	-107.82*** (-6.06)
Observations	303	303	303	303
R ²	0.40	0.41	0.39	0.41

Appendix A: Variable Definitions

Variable	Definition
<i>Financial Performance</i>	
ROA	Return on Assets defined as Net Income / Total Assets
ROE	Return on Equity defined as Net Income / Total Equity
<i>ESG Activity</i>	
ESG Score	The aggregated rating (0-10) of a firm's performance related to all ESG components.
E Score	The evaluated rating (0-10) of a firm's performance related to environmental (E) practices.
S Score	The evaluated rating (0-10) of a firm's performance related to social (S) practices.
G Score	The evaluated rating (0-10) of a firm's performance related to corporate governance (G) practices.
ESG Disclosure	The aggregated measure of a firm's level of public disclosure related to all ESG components.
E Disclosure	The measure of a firm's level of public disclosure related to environmental (E) practices.
S Disclosure	The measure of a firm's level of public disclosure related to social (S) practices.
G Disclosure	The measure of a firm's level of public disclosure related to corporate governance (G) practices.
<i>Control Variables</i>	
LN TA	The natural logarithm of a firm's total assets.
TD/TE	The ratio of a firm's total debt to total equity.
Current Ratio	The ratio of a firm's current assets to current liabilities.
PBV	The ratio of a firm's market valuation to its book value.