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ESG RISK AND PERFORMANCE: THE GREEK CASE

Gerasimos G. Rompotis

Department of Economics, National and Kapodistrian University of Athens

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Abstract: The relationship of ESG risk rating with financial performance, stock return and risk is the subject of this study. Panel data of 23 firms that are traded on the Athens Stock Exchange are used. The study period spans from 2019 to 2022. The ESG risk rating used is provided by Morningstar's Sustainalytics. Financial performance is calculated as Return on Assets (ROA) and Return on Equity (ROE), while stock return is calculated as the daily return, total return, Sharpe ratio, Modigliani and Modigliani ratio, and the alpha deriving from the market model. Size, as well as efficiency, leverage, solvency and liquidity ratios are used as control variables. The results reveal a strong negative relationship between financial performance and ESG risk. A negative, but insignificant, relationship exists between stock return and ESG risk too.

Keywords: Firm Performance, Stock Return, Risk, ESG Risk, Greek Stock Market

JEL Classification Codes: G11

1. INTRODUCTION

Responsible investing based on environmental, social and governance (ESG) criteria has been very popular over recent years with ESG becoming the most powerful driver of growth in asset and wealth management. As a consequence of this rapid increase in the demand for ESG products, investors frequently struggle to find attractive and adequate ESG investment opportunities. In addition, concerns are frequently expressed about a possible conflict between financial and ESG performance. However, many asset managers believe that

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assuming ESG factors in their strategies can improve the returns of their portfolios. If this is the case, investors are willing to pay the higher fees that are often required by ESG investment products.

Several theories have been developed to explain the correlation between ESG performance and stock returns.[1] In the model of the modern firm in the traditional principal-agent theory of Jensen and Meckling (1976), where ownership and management are separated, company executives are responsible for daily operations and are supposed to act to the benefit of shareholders. However, quite often, executives seek to fulfill their own interests against the interests of shareholders. For instance, the pursuance of costly ESG projects that will enhance the reputation of a firm's management team could be against the interests of shareholders. Such projects could trigger a decline in the stock price of a company. Therefore, the agency theory suggests that ESG practices and corporate value are negatively related to each other. This negative relationship can result in lower stock returns.

According to the stakeholder theory of Freeman and Phillips (2002), modern enterprises are no longer accountable just to their shareholders, but they have to take responsibility for a wide range of stakeholders. In this respect, savings in energy consumption and decrease is emissions can contribute to the reduction of enterprises' carbon footprint and the mitigation of climate change. Overall, by meeting their duties towards the various stakeholders, firms can gain their support and benefit in several ways. For instance, companies with a great ESG performance can ensure generous credit lines and favorable interest rates from their lenders. This can also be the case about their relationship with suppliers. Moreover, consumers are more likely to prefer a firm that has built a favorable corporate image and reputation in society. Such a reputation can help a company attract more skillful, motivated and loyal personnel. The lower debt cost, the efficient cooperation with suppliers, and the attraction of loyal customers and employees can contribute to the improvement of firm performance and also encourage investors to increase their position in companies with such characteristics. Ultimately, according to the stakeholder theory, ESG performance must be positively related to firm performance and stock return.

Finally, according to the corporate innovation theory of Porter and Kramer (2006), the social responsibility of a company can, among

other things, contribute to innovation and boost its advantage over the competition. The alignment of a firm's ESG practices with government's environmental and green development policies help secure funding from the government and technical support that can improve the ability of the company for innovation. Innovation capabilities are also enhanced via the spillover of knowledge between ESG reputable upstream and downstream firms in the chain. In addition, quality corporate governance contributes to attracting more talented people, who can boost a firm's innovation capability. Overall, high ESG performance will boost corporate innovation, affecting stock returns in a positive way.

In this study, the relation of ESG performance with financial performance and stock returns is examined with data from Greece. The relation of ESG performance with stock risk is assessed too. The study focuses on 23 firms which are traded on the Athens Stock Exchange (ASE) and are monitored by Morningstar's Sustainalytics for ESG risk assessment purposes. The study period spans from 2019 to 2022. Firm (or financial or corporate) performance is calculated as Return on Assets (ROA) and Return on Equity (ROE). Stock return is calculated in several ways as the daily raw and total (cumulative) raw return, the risk-adjusted return, expressed by the Sharpe and the Modigliani and Modigliani ratios, as well as the alpha deriving from the market model, where the daily return of each company in the sample is regressed on the return of the General Index of ASE. Risk is computed as the standard deviation of daily raw returns and beta (systematic risk) deriving from the market model. The size of firms along with their efficiency, leverage, solvency and liquidity ratios are used as control variables in the regression analysis on the relation of ESG risk with performance and stock risk.

According to our results, both financial performance and stock return are negatively related to ESG risk. In the case of firm performance, this negative relation is quite strong in statistical terms. However, the negative relation of stock return with the ESG risk is weak from a statistical perspective. Our analysis also show that the control variables used can add value in explaining the financial performance and stock return of the Greek listed companies. On the other hand, stock risk is not related to ESG risk.

The Greek stock market is quite interesting. Greece went through a severe ten-year economic crisis during the period 2010-2019. The crisis significantly

affected macroeconomic figures, such as public and private debt, growth rates, salaries and wages, consumption rates, total savings, and investments from the private and public sector. However, the crisis also resulted in major investors abandoning the Greek stock market along with the value deterioration of the Greek stock shares.

Moreover, the ESG concept is very "new" in Greece compared to other developed markets, as evidenced by the fact that the Athens Stock Exchange has only recently launched a relevant ESG Index.[2] In addition, many listed Greek companies are still quite unwilling to engage in efficient ESG practices and the relevant reporting. For these reasons, the results of our study could possibly reflect to other emerging stock markets with comparable characteristics to those of the Greek market.

Our study is one of the first to examine the correlation of ESG ratings with firm performance, stock return and risk with data from Greece. We are only aware of a study by Gavrilakis and Floros (2023), who examine the influence on stock returns by indicators of financial performance and ESG scores with data of companies with large capitalization in Portugal, Italy, Greece, Spain, France and Germany during 2010-2020. The financial factors considered are market capitalization, which is a proxy for a firm's size, price to book value and Sharpe ratio. The authors find that for the Greek and French firms, size affects returns negatively. Moreover, with the exception of Italy, investors in European countries avoid investing in firms with high ESG scores. Investors seem to prefer companies with a smaller size and a higher price to book value and Sharpe ratio, which are more likely to contribute to producing higher returns. In comparison to the paper of Gavrilakis and Floros (2023), our study is more focused on Greece. In addition, we also consider more accounting-based explanatory factors than those assessed by Gavrilakis and Floros (2023). We also employ different ESG scores, as these authors use Refinitiv's database for ESG scores.

The rest of the paper is structured as follows: Next section discusses the findings of main studies on the relationship of ESG performance with financial performance and stock return. Next, the methodology and the sample are described. The findings of our study are provided in Section 4. Summary and conclusions are offered in Section 5.

2. LITERATURE REVIEW

2.1. ESG Rating and Firm Performance

Many studies focus on the relation between ESG performance and firm performance in the case of non-financial corporations. Albertini (2013) performs a review of 52 studies conducted over a 35-year period and reveals a positive relation between environmental performance and financial performance. Eccles *et al*. (2014) assess the effect of corporate sustainability on performance using a sample of 180 firms from the United Sates showing that companies of high sustainability significantly outperform their counterparts in the long run. Harjoto and Laksmana (2018) use US data to examine the mechanism through which corporate social responsibility (CSR) can have an impact on firm value. They find that CSR performance is positively related to firm value because CSR reduces excessive risk taking and risk avoidance. Atan *et al*. (2018) also confirm a positive relation between ESG and financial performance for a sample of 54 Malaysian public-limited companies.

A plethora of studies on the relation between ESG performance and corporate performance focus on firms from the financial sector. Using data from the American banks, Simpson and Kohers (2002) reveal a positive link between social and financial performance. Peni and Vähämaa (2012) examine the impact of the corporate governance pillar of ESG performance on the financial performance of large publicly traded US banks during the crisis of 2008. The results are mixed. Banks with stronger corporate governance mechanisms showed higher profitability in 2008, experiencing at the same time negative effects on their stock market values. Ersoy *et al*. (2022) also examine the impact of the ESG scores on the market value of the US commercial banks over the period 2016-2020. Results show an inverted U-shaped relation between market value and the Social Pillar Score and a U-shaped relation between market value and the Environment Pillar Score.

Brogi and Lagasio (2019) compare financial and non-financial companies from the US to assess the relation between the ESG performance and financial performance. According to the results, efficient ESG policies are positively related to profitability for both financial and non-financial firms. However, for industrial companies, the positive effect on profitability gradually slows during the years. On the contrary, the positive effect on banks' profitability is robust through time.

Jo *et al*. (2015) examine whether corporate environmental responsibility (CER) can enhance financial performance for firms from the financial services sector of 29 countries around the world. According to the authors, by effectively investing in CER, executives can decrease the environmental costs of their organizations, thereby enhancing operating performance. However, the reduction in environmental costs takes at least one or two years before enhancing return on assets. In addition, delays can be observed in the reduction in environmental costs between developed and less developed financial markets. Shakil *et al*. (2019) explore the effect of ESG performance on performance for a sample of 93 banks from emerging markets during the period 2015-2018. The results reveal a positive association of banks' environmental and social performance with their financial performance. The corporate governance pillar does not seem to affect financial performance.

Wu and Shen (2013) assess the linkage between corporate social responsibility (CSR) for a sample of 162 banks in 22 countries over 2003-2009. The results show that CSR is positively associated with financial performance. In a similar international set, Esteban-Sanchez *et al*. (2017) employ data for a sample of 154 financial institutions in 22 countries during the period 2005-2010 to examine the relationship between corporate performance and corporate responsibility. Based on the empirical findings, banks with better employee relationships and enhanced corporate governance have better financial performance.

Miralles-Quirós *et al*. (2019) assess the role of socially responsible activities for shareholder value creation for 166 banks from 31 countries over 2010-2015. The results reveal the lack of homogeneity for the value relevance of the ESG practices adopted by the examined banks. The environmental and corporate governance pillars are positively related to Tobin's Q and, thus, to the creation of value to the benefit of shareholders. On the other hand, social performance is negatively related to shareholder value creation. Simsek and Cankaya (2021) assess the relationship between ESG scores and firm performance focusing on banking institutions operating in the G-8 countries, namely, Italy, France, Germany, Japan, Canada, Russia, the UK and the US. The results show that the environmental score exerts a significantly negative impact on performance, while the social score has a positive and significant relation with performance.

Dragomir *et al.* (2022) examine the influence of ESG efficiency on the financial performance of 333 banks from 53 countries in Europe, America, and Asia, before and during the Covid-19 pandemic of 2019-2021. The results show that the environmental performance of banks in 2019 had a negative influence on their Return on Equity during 2020. No other ESG factors were significant.

Finally, in the case of Africa, Siueia *et al.* (2019) examine the impact of voluntary CSR disclosure on financial performance in the Sub-Saharan banking sector by comparing the top-ranked banks in Mozambique and the Republic of South Africa during the period 2012-2016. The authors find a significantly positive relation between the disclosed ESG factors and performance.

2.2. ESG Rating and Stock Return

The interaction between ESG performance and stock returns has been of great interest in financial literature. Several studies have accentuated a direct relationship between corporate ESG rating and stock returns. Contrary to the conventional wisdom in finance which says that lower risk leads to less return, Kumar *et al.* (2016) reveal that the stock returns of companies that incorporate ESG factors are less volatile but achieve higher returns than the non-ESG firms. Nagy *et al.* (2016) examine whether investors sacrifice risk-adjusted returns by considering ESG factors in their investment decisions. By assessing two global strategies, a "tilt" strategy, which overweights stocks with higher ESG ratings, and a "momentum" strategy, which overweights stocks with improved ESG ratings, they find that both strategies outperformed the MSCI World Index over an eight-year period. Khan (2019) states that ESG metrics can be leading indicators of firm performance and can predict stock returns, suggesting that there is value for investors in the signals conveyed by ESG metrics. In fact, Khan (2019) shows that portfolios including stocks with the highest ESG scores outperform other portfolios by 17 basis points (bps).

Lins *et al.* (2017) show that during the crisis of 2008-2009, the stock return of socially responsible firms was 4 to 7 points higher than that of firms with low socially responsibility rates. Akgun *et al.* (2021) support the idea that high ESG scores can enhance the return of small cap stocks in the Unites States. Yin *et al.* (2023) assess the impact of ESG performance on stock returns for a sample of Chinese publicly traded firms during 2011-2020. The results

reveal that ESG responsibility affects stock returns in a positive way. Similar results are provided by Shanaev and Ghimire (2022).

Albuquerque *et al*. (2020) show that listed companies with higher ESG ratings had significantly higher returns, lower volatility, and larger profit margins during the first quarter of 2020, i.e., during the first phase of the COVID-19 crisis. Engelhardt *et al*. (2021) also investigate the correlation between ESG ratings and stock returns during the COVID-19 crisis and find that European enterprises with high ESG ratings have higher abnormal stock returns and lower risk. Broadstock *et al*. (2021) examine the role of ESG responsibility during the financial crisis resulted from the COVID-19 pandemic. The authors use data from China's CSI300 Index and reveal an outperformance of portfolios including highly rated stocks over portfolios with shares of low-ESG scores. It is also shown that high ESG metrics can mitigate risk during periods of financial crisis. Liu *et al*. (2023) also focus on the interaction between ESG performance and stock share returns during the COVID-19 era with a sample of more than 300 listed Japanese firms. The results show that during the examined period ESG performance and stock returns are positively related to each other.

On the other hand, there are studies which have reached opposite conclusions, that is, ESG performance is associated with financial performance in a negative way. Fisher-Vanden and Thorburn (2011) show that abnormal returns of firms that announce their membership in the Environmental Protection Agency (EPA) Climate Leaders, a program that aims at reducing greenhouse gas emissions, are significantly negative. These negative returns are larger in firms with poor corporate governance structures and firms with high growth. Overall, corporate commitment to reducing greenhouse gas emissions is in conflict with the goal of maximizing firm value for shareholders.

El Ghoul and Karoui (2017) use a corporate social responsibility score weighted by assets to study the effects of such responsibility on fund return and flows. The results show that, in comparison to funds with low CSR scores, funds with high scores display poorer but persistent performance. The relationship between performance and flows is weaker for these funds too. The main conclusion reached by the authors is that investors in highly CSR rated funds derive utility from non-performance attributes.

Sahut and Pasquini-Descomps (2015) assess how news-based ESG scores have affected monthly stock market returns in Switzerland, the US and the

UK during 2007-2011. The authors find that the variation of the overall ESG score is immaterial in the US and Switzerland, but for the UK, changes in ESG scores can have a significant and slightly negative impact on stock returns. Landi and Sciarelli (2019) provide similar evidence for Italy.

Frambo and Kok (2022) correlate stock valuation and performance during the crash in stock markets in 2020 triggered by the COVID-19 health crisis with ESG score and its environmental, social and governance pillars for a sample of 606 companies traded on the New York Stock Exchange or NASDAQ. Based on the empirical results, the correlation of stock valuation with the overall ESG score is negative, as it is with the social and governance components in particular.

Finally, there are studies which report that there is no significant relationship between ESG performance and stock returns. Revelli and Viviani (2015) analyze 85 relevant studies and show that incorporating ESG factors in equity portfolios cannot enhance stock performance, but it does not subtract from returns either. Halbritter and Dorfleitner (2015) investigate the link between corporate social responsibility and performance. The findings indicate that there is no difference in returns between firms with high and low ESG ratings. Therefore, investors should not expect receiving material abnormal returns by discriminating stocks based on their ESG scores.

La Torre *et al.* (2020) assess the way ESG components affect the returns of the companies included in the Eurostoxx50 Index during 2010-2018. The results indicate that the performance of these stocks is not affected by their commitment to ESG practices. Finally, Milonas *et al.* (2022) examine the returns of 80 European and 64 US funds trying to identify whether the performance of funds that invest in companies following ESG principles differ from the performance of their conventional peers. The empirical findings do not reveal any significant difference in performance between ESG and non-ESG funds although the former have slightly higher returns than the latter. Similar results on the Australian stock are provided by Limkriangkrai et al. (2017).

3. RESEARCH METHODOLOGY

3.1. Performance and Risk Measures

The financial performance of the Greek listed companies is measured in two ways. The first one concerns the Return on Assets (ROA), computed with the following formula:

$$ROA_i = \frac{FBT_i}{Assets_i}$$

where EBT_i is the Earnings Before Tax of the company i for a year and $Assets_i$ are the assets of the company at year end.

The second method to calculate financial performance regards Return on Equity (ROE), shown in the following formula:

$$ROE_i = \frac{EBT_i}{Equity_i}$$

where EBT_i is define as above and Equity is the equity of each company at year end.

Several measures of stock return are used. First, we calculate daily stock returns in percentage terms with the following formula:

$$R_i = \frac{CP_{ti} - CP_{t-1,i}}{CP_{t-1,i}}$$

where, R_i is the daily return of the stock i and $CP_{t,i}$ is the closing trade price of the stock i on day t. We also compute total annual returns with formula (3) using the close prices of each stock on the last and the first trading day of the year, respectively. Risk is calculated as the standard deviation in returns.

Along with raw daily and total returns, we compute two types of risk-adjusted returns. The first one is the Sharpe ratio shown in formula (2).

$$ShR_i = \frac{AR_i - R_f}{\sigma_i}$$

where, ShR_i is the Sharpe ratio of stock i, AR_i is the average daily return of stock i, Rf is the daily risk-free rate for Europe, found on the website of Kenneth French, and σ_i is the standard deviation of the stock's i excess returns. The Sharpe ratio is estimated as the fraction of excess return to risk, used to define how well a stock compensates investors for the risk they assume. A high Sharpe ratio indicates high stock return and vice versa.

The second measure of risk-adjusted return used is the ratio of Modigliani and Modigliani. This ratio is an extended Sharpe ratio which gives the risk-adjusted return of a stock by multiplying the Sharpe ratio with the standard

deviation of a benchmark index and adding the risk-free return thereafter to it. The M&M ratio is shown in the following formula (3):

$$MM_i = ShR_i * \sigma_m + R_f \quad (5)$$

where, MM_i is the Modigliani-Modigliani ratio of stock i, ShR_i is defined as above, σ_m is the standard deviation (risk) in market return expressed by the General Index of ASE, and R_f is defined as above. Similar to the Sharpe ratio, the higher the MM ratio, the better the performance of a stock.

In the last step, stock performance is estimated via the market regression model, via which the excess daily stock return on each company, i.e., return minus the risk-free rate, is regressed on the corresponding return of the market index. The applied model is as follows:

$$R_i - R_f = \alpha_i + \beta_i (R_m - R_f) + \varepsilon_i \quad (6)$$

All the variables are defined as above. Alpha represents the above market return that can be achieved by a stock. Beta measures the systematic risk of each company. The model is applied for each single stock with the method of the Least Squares and, when it is necessary, adjustments are made for autocorrelation and heteroskedasticity.

3.2. Regression Analysis

We run the following multi-factor regression model trying to define the relation of ESG risk with i) financial performance, ii), stock return, and iii) stock risk:

$$DV = \beta_0 + \beta_1 ESG + \beta_2 Size + \beta_3 Eff + \beta_4 Lev + \beta_5 Solv + \beta_6 Liq + u \quad (7)$$

where, DV is the dependent variable of the model used each time, i.e., financial performance, stock return, and stock risk. ESG is the ESG risk score published by Morningstar's Sustainalytics. Size is the natural logarithm of each company's assets. The efficiency ratio is computed as the fraction of total revenue to total assets. The leverage ratio is the fraction of total liabilities (debt) to total assets. The solvency ratio is computed by dividing total debt to equity, and the liquidity ratio is the fraction of the net cash flow to assets.

The basic assumption examined in our analysis is that performance, either the financial one or the stock return, is positively related to the ESG performance of firms. In our case, we use an ESG risk score measure, which entails that the highest the score, the poorest the performance of a company from an ESG perspective and possibly from an economic perspective. Based on

this rationale, we expect the sign of the ESG factor in model (7) to be negative. The opposite is expected for risk.

With respect to size, literature has developed the small-cap theory according to which firms with a small market capitalization tend to outperform larger companies. If this theory applies to the size of firms expressed by assets instead of capitalization, the sign of size in model (7) will be negative. In regard to risk, large companies are often considered to be safer than small companies, especially during periods of crisis in stock markets. Based on that, we expect the relationship of risk with size to be negative.

As noted by Khan *et al.* (2021), efficiency is positively associated to firm performance. If this applies to stock returns too, the estimate of efficiency ratio will be positive, either when financial performance or stock return is the dependent variable of the model. The relation of efficiency with risk is expected to be negative, that is, the higher the efficiency of a company, the lower its stock risk. Moreover, Saati Ghare Musa *et al.* (2017) show that there is a positive relationship between leverage and stock returns. If this also the case about financial performance, the coefficient of leverage in model (7) is expected to be positive when performance is examined. On the other hand, an increased efficiency ratio should bear a negative impact on stock risk.

Furthermore, a decreasing solvency of a company expressed by an increasing debt to equity ratio could be bad news for financial performance and stock return. This means that as long as the debt to equity ratio increases, the company's net assets (i.e., equity) may not be adequate to cover its liabilities to third parties in the case the company needs to do so. In other words, an increasing dent to equity ratio increases the default risk of a company. In a scenario when the solvency of a company deteriorates, its financial and stock performance should decline, while its stock risk would rise. Thus, the sing of the solvency ratio in model (7) is expected to be negative for performance and positive for stock risk.

Finally, as reported by Zygmunt (2013), liquidity might determine profitability and, consequently, stock returns. Therefore, the estimate of liquidity should be positive in the case of performance. On the other hand, increased liquidity should be reflected in the stock risk of a company in a negative way, given that more liquidity entails less financial hardships and, thus, less risk. Thus, the estimate of liquidity must be negative. Following the

standard practice in the literature (e.g., Elewa and El-Haddad (2019), model (7) is performed with panel data over the period 2019-2022.

3.3. Sample

Our sample includes 23 companies (both financial and non-financial) that are traded on the Athens Stock Exchange. These companies are monitored by Morningstar for ESG risk purposes. As show in Table 1, several industries are covered by our sample, namely, banking sector and diversified financials, constructions, consumer services and household products, real estate, refining, retailing, software, telecommunications, transportation and utilities.

When it comes to the trading activity of the sample's firms on ASE, an average volume amounting to 1.2 million traded shares over the period 2019-2022 is reported in Table 1 with a maximum of 9.5 million shares. The corresponding turnover amounts to 2.6 million euros, with a maximum of 8.2 million euros. The most tradable companies over the period under study were two banks, namely Eurobank Ergasias Services & Holdings SA, when the average volume is considered, and Alpha Services & Holdings SA in turnover terms.

In regard to ESG performance, the average ESG risk score is 24.12, which means that average company in the sample is of medium risk from an ESG perspective. The lowest ESG risk is equal to 10.6, shown by Eurobank Ergasias Services & Holdings SA, and the highest ESG risk score is 41.9, attached to the Public Power Corp. SA. In sum, 9 companies in the sample are of low ESG risk, 7 firms are of medium ESG risk, 5 companies have a high ESG risk profile, and just 1 company maintains a severe ESG risk profile.

Table 2 reports key accounting data and financial ratios of the sample. More specifically, the table presents the assets, equity, revenue, earnings before tax, efficiency ratio, leverage ratio, solvency ratio, and liquidity ratio of the examined firms. The data presented concern the average terms of the annual estimates over 2019-2022.

With respect to size, average assets of the sample over the study period amount to 13.6 billion euros. The lowest and highest assets figures are equal to 107 million and 72 billion euros, respectively. Piraeus Financial Holdings SA is the biggest company in the sample. The average revenue of the examined companies amounts to 1.8 billion euros. Alpha Services & Holdings SA presents

the highest average amount of revenue at 7 billion euros. Finally, regarding profitability, the sample's average EBT amounts to 132 million euros. Only 5 companies present average losses before tax over the study period with an average loss of 162 million euros. The rest 17 companies make average profits before tax of 223 million euros.

When it comes to efficiency, the relevant average ratio is equal to 42.8%. The corresponding average terms for leverage, solvency and liquidity are equal to 60.1%, 420.9% and 2.4%. These average terms indicate that the sample's companies produce revenue less than one time their assets and that they are quite leveraged. In addition, in the case of default, the equity of the examined companies will not suffice to cover their obligations. Finally, the ability of the Greek firms to use their assets to make net cash flows seems to be weak.

4. EMPIRICAL RESULTS

4.1. Performance and Risk Measures

Table 3 presents performance and risk measures over the period 2019-2022. Similar to Table 2, the data presented concern the average terms of the annual estimates over the period under study. The average ROA of the sample is equal to 5%, while the respective average ROE is negative at -2.2%. The negative sign of the average ROE has been driven by a couple of extremely negative ROE estimates in 2020, resulted from the severe impact of the Covid-19 pandemic on certain industries such as aviation.

The average daily return has been slightly positive at 9 bps, while the average annual total return is equal to 195 bps, with the highest total return amounting to 738 bps (achieved by the Public Power Corp. SA). At the risk-adjusted return level, the sample's average Sharpe and MM ratios are equal to 3 and 3.8 bps, respectively, with only 1 Sharpe ratio and 2 MM ratios being negative. When it comes to the above-market return, an average alpha of 3.3 bps is reported in Table 3, whereas 12 single alphas are positive. However, it should be noted that with just a couple of exceptions, all the estimated alphas are not significant in statistical terms (not shown in the table).

On the question of risk, an average return standard deviation of 310 bps is provided in Table 3, with extreme stock risk scores ranging from 166 bps to 843 bps at a minimum and a maximum, respectively. On the other hand,

the average beta of the sample is equal to 1.049, indicating that the selected companies are quite aligned to the market index. Moreover, the beta of 16 companies is lower than unity, i.e., these firms are more conservative than the market, and 7 betas are higher than unity, showing that the corresponding companies are more aggressive than the market index.

4.2. Regression Results

Table 4 reports the outcomes of model (7) on the relationship of ESG risk scores with financial performance and stock return. The results verify our assumption about the negative impact of ESG risk on performance, as all the ESG risk estimates are negative. However, these coefficients are statistically significant only in the case of financial performance, ranging from -2.015 to -0.261 for ROE and ROA, respectively. Based on these results, a strong negative relation can be established only between the ESG risk and financial performance of the Greek firms.

Regarding the rest variables used trying to explain performance, the estimates of the size factor are negative but insignificant for all the types of performance, with the exception of ROE, for which the coefficient is significantly positive. The negative estimates are in line with our expectations about a small-size effect of performance, also agreeing with the findings of Gavrilakis and Floros (2023), which show that size is negatively related to daily stock return. However, the lack of statistical significance indicates that a solid inference about the negative impact on performance by the size of the examined companies cannot be reached. On the contrary, the statistically significant evidence on the positive relation between size and ROE is the only result that can be valid with respect to the impact of size on performance.

Furthermore, the efficiency ratio presents a significantly positive estimate only for ROW, while the rest coefficients are not significant. Thus, the expected positive relation between performance and efficiency is only partially verified. The results about leverage are mixed. In particular, the leverage's coefficient is significantly negative in the case of ROA and significantly positive for ROE, average daily return, total return and alpha. Based on these results, we may conclude that leverage matters when trying to explain the performance of the Greek listed companies. However, the impact of leverage is not of one sign, depending on the type of performance considered each time.

The coefficients of solvency are, as expected, negative and significant at 10% or better. In absolute terms, the most significant negative impact of solvency is that of ROE, with the corresponding coefficient being equal to -0.154. Based on these negative estimates, we can conclude that as far as the debt of a company increases in comparison to its equity, the default risk increases too, entailing a significant cost for the company in terms of lost financial performance and descending stock prices.

Finally, when it comes liquidity, the relevant estimates from model (7) indicate that this factor adds no value when trying to explain the performance of the Greek listed firms. It should be noted here that Rompotis and Balios (2023), by using a more traditional definition of liquidity, i.e., current assets to current liabilities, and a larger sample of Greek companies, accentuate a significantly positive relationship of liquidity with firm performance. Based on this fact, our insignificant results on liquidity might have been resulted from the version of liquidity used in our analysis.

The results of model (7) with stock risk considered as the dependent variable of the model are provided in Table 4 too. In regard to ESG risk, no significant effect on stock risk is found. This is also the case about leverage, solvency and liquidity. The only statistically significant estimates are that of the size factor, which is equal to 0.141, that of efficiency, which is equal to -0.002, and that of solvency, which is equal to 0.001. All these coefficients are obtained when beta is used as the risk measure. The estimate of size contradicts our expectation about a negative impact of size on stock risk. However, the negative estimate of efficiency and the positive sign of the debt to equity ratio are in line with our assumptions saying that as long as the ability of accompany to exploit its assets to make revenue increases, the risk of this company descends, while the opposite is the case when the debt of company rises in comparison to its equity.

Overall, the applied regression analysis showed that the ESG risk score is a significant factor to consider when trying to identify the elements that can affect the performance of the Greek listed companies. In fact, based on our results, as long as this risk increases, performance worsens. On the contrary, ESG risk is not a material factor to take into consideration when trying to explain the stock risk of the Greek firms. Finally, other factors, including size, as well as efficiency, leverage and solvency ratios, can add value in the effort to explain the performance and risk of the Greek firms.

5. CONCLUSION

In this study, we focus on the relation of ESG risk with financial performance, stock return and stock risk using a sample of 23 companies which are traded on the Athens Stock Exchange. The study covers the four-year period 2019-2022. Two types of financial performance are calculated, namely ROA and ROE, and five types of stock return, i.e., daily stock return, total annual stock return, Sharpe ratio, Modigliani and Modigliani ratio, and alpha. Stock risk is estimated in two ways, that is, the standard deviation of daily returns and systematic risk (beta). Multi-factor panel data regression analysis is applied using ESG risk scores as the main explanatory variable of performance and risk, as well as control factors including size, and efficiency, leverage, solvency and liquidity ratios.

The empirical findings indicate that financial performance is negatively related to ESG risk. Consequently, the higher the ESG risk, the lower the firm performance. Such a negative, but insignificant, relation of ESG risk with stock return is revealed too. On the other hand, ESG risk is not a factor that seems to affect stock risk.

Furthermore, the size of the company is related to ROE in a significantly positive way and to the rest of the performance measures in a negative but insignificant fashion. In the case of risk, size is found to be positively related to beta. The efficiency factor is positively related to ROA and negatively related to beta risk. The rest of the efficiency estimates are not significant. The results on leverage are mixed, as both significantly positive (in the case of ROA) and significantly negative estimates (in the case of the average daily return, total annual return and alpha) are obtained, while no significant estimates of leverage are observed in the case of stock risk. On the other hand, the impact of the debt to equity ratio on performance is clearly negative and significant, while the impact of this ratio on beta is positive. Finally, liquidity is not significant, both for performance and risk.

From a practical point of view, our results can serve as an efficient selection tool for investors. Those seeking to maximize their financial utility from their investments should embark on Greek companies with low ESG risk scores. Loss averse investors should avoid firms with high ESG risk profiles. Such a choice entails a potential financial gain in addition to gaining utility from serving more noble causes by investing in firms with a significant environmental and social

footprint. In addition, our study offers some additional practical selection tools relating to the control variables used in our analysis. These tools could help investors pick among the available investment choices on the Athens Stock Exchange.

Further research could be conducted on the topic. As we use only four years of data for 23 companies, our research could be expanded by examining more companies, more years of data and alternative ESG performance ratings. Should such an expanded period and data set be used, one can identify possible differences in the relationship of ESG ratings with financial performance, stock return and stock risk before and after the severe economic crisis in Greece.

Notes

1. The discussion of theories that follows that has been found in Yin *et al.* (2023).
2. ASE launched the ATHEX ESG Index in 2021 to monitor the stock returns of listed companies, which are concerned from an ESG perspective.

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Table 1: Sample. This table presents the sample of the study, namely, the symbol and name of each company, along with its industry, average daily volume (i.e., traded shares) and daily turnover (in euros) over the period 2019-2022, and the recent ESG Risk and the Risk Class based on Morningstar's Sustainalytics. Error! Not a valid link.

Table 2: Accounting Data and Financial Ratios

This table presents key accounting figures and financial ratios of the examined companies, that is, assets, equity, revenue, Earnings Before Tax (EBT), efficiency ratio (i.e., total revenue per assets), leverage ratio (i.e., total debt to assets), solvency ratio (i.e., total debt to equity), and liquidity ratio (i.e., net cash flow to assets). The data presented concern the average terms of the annual estimates over the period 2019-2022.

SYMBOL	*Assets*	*Equity*	*Revenue*	*EBT*	*Efficiency*	*Leverage*	*Solvency*	*Liquidity*
ALPHA	65,636,401,250	7,037,776,500	1,776,551,500	270,836,250	2.737	89.114	861.519	3.248
EUROBANK	59,152,500,000	5,012,750,000	1,793,500,000	664,000,000	2.997	91.491	1,103.388	4.310
ETE	71,426,750,000	5,167,000,000	1,945,000,000	558,500,000	2.725	92.713	1,287.991	3.716
TPEIR	72,064,250,000	6,827,500,000	2,293,000,000	-448,750,000	3.192	90.335	978.258	2.022
GEKTERNA	1,119,783,750	366,405,000	42,328,750	37,816,500	3.155	65.874	201.173	12.510
OPAP	1,930,409,500	732,542,750	784,724,500	299,841,750	40.850	62.076	164.317	0.910
INLOT	395,315,750	60,582,500	46,070,500	-10,916,750	11.888	85.781	1,602.588	-1.703
EXAE	348,201,250	105,848,250	34,519,500	8,568,250	9.935	69.431	229.424	-0.997
SAR	317,918,789	223,013,513	166,103,783	49,037,855	52.367	30.130	43.582	0.733
LAMDA	1,216,862,750	810,362,750	18,641,250	-15,923,000	1.456	32.338	50.647	6.150
ELPE	7,565,362,250	2,257,966,500	9,592,250,000	363,250,000	124.354	70.217	238.270	-1.189
MOH	3,110,686,000	1,108,983,000	7,560,432,250	419,308,250	237.906	63.990	182.109	1.273
BELA	1,189,669,951	778,461,809	588,533,941	131,300,048	49.499	34.554	52.825	2.359
FOYRK	107,417,000	99,039,500	4,470,250	12,268,500	4.235	7.558	8.351	-0.290
QUEST	551,399,500	195,893,250	825,356,750	64,119,000	148.922	64.805	191.254	4.798
HTO	5,888,550,000	3,210,175,000	1,618,300,000	633,025,000	27.573	45.301	83.532	-0.472
OTOEL	740,384,960	226,709,171	217,699,197	46,718,226	29.370	69.249	226.265	0.688
AEGN	1,433,684,283	187,798,320	780,160,953	-3,410,130	54.650	87.062	1,511.243	5.924

SYMBOL	*Assets*	*Equity*	*Revenue*	*EBT*	*Efficiency*	*Leverage*	*Solvency*	*Liquidity*
PPA	512,772,366	268,388,272	157,720,398	52,113,995	30.641	47.797	91.822	4.322
PPC	13,450,214,750	3,826,189,250	6,344,675,000	-329,738,500	46.472	71.787	281.112	4.834
EYDAP	1,585,472,500	858,151,250	339,573,000	18,417,250	21.459	45.677	85.632	-1.072
MYTIL	3,411,466,500	1,107,144,500	2,684,347,000	175,422,750	72.311	65.621	205.009	3.111
ADMIE	746,233,750	746,127,000	40,564,750	40,244,750	5.455	0.014	0.014	-0.002
Average	13,647,900,298	1,791,948,178	1,724,109,707	132,002,174	42.789	60.127	420.884	2.399
Min	107,417,000	60,582,500	4,470,250	-448,750,000	1.456	0.014	0.014	-1.703
Max	72,064,250,000	7,037,776,500	9,592,250,000	664,000,000	237.906	92.713	1,602.588	12.510

Table 3: Performance and Risk Measures

This table presents the financial performance of the examined companies, that is, Return on Assets (ROA) and Return on Equity (ROE), the average daily and total stock return, Sharpe and Modigliani-Modigliani ratios, the alpha deriving from the market model, stock risk (as the standard deviation of daily returns), and beta (systematic risk) deriving from the market model. The data presented concern the average terms of the annual estimates over the period 2019-2022.**Error! Not a valid link.**

Table 4: Regression Results on Performance and Risk

This table presents the results of multi-factor panel regression analysis on performance and risk stock daily return. The explanatory variables considered are the ESG Risk of the examined companies, their size, and their efficiency, leverage, solvency and liquidity ratios. Performance concerns financial performance, either expressed as the Return on Assets (ROA), or as the Return on Equity (ROE), and stock return calculated as the average daily return, annual total return, Sharpe and Modigliani-Modigliani ratios, and alpha. Risk is the standard deviation of daily stock returns and beta (systematic risk).

	D.V.: ROA		*D.V.: ROE*		*D.V.: Av. Return*		*D.V.: TotRet*		*D.V.: Sharpe Ratio*		*D.V.: MM Ratio*		*D.V.: Alpha*	
Variable	*Coef*	*t-Stat*	*Coef*	*t-Stat*	*Coef*	*t-Stat*	*Coef*	*t-Stat*	*Coef*	*t-Stat*	*Coef*	*t-Stat*	*Coef*	*t-Stat*
Constant	[c]**16.398**	**1.814**	[a]**-24.462**	**-2.760**	0.387	1.160	-2.464	-0.028	-0.006	-0.074	-0.017	-0.160	[c]**0.534**	**1.879**
ESG Risk	[a]**-0.261**	**-3.112**	[a]**-2.015**	**-3.711**	-0.003	-1.082	-0.413	-0.513	-0.001	-0.509	-0.001	-0.146	-0.003	-1.147
Size	-0.088	-0.192	[a]**12.313**	**2.966**	-0.017	-1.008	-1.050	-0.238	-0.001	-0.197	-0.001	-0.219	[c]**-0.027**	**-1.846**
Efficiency	[a]0.055	**4.436**	-0.021	-0.256	0.000	0.844	-0.078	-0.658	0.000	0.360	0.000	0.226	0.001	1.331
Leverage	[c]-0.069	-1.770	[a]1.006	3.064	[b]0.003	2.022	[b]**0.785**	**2.097**	0.001	1.589	0.001	1.543	[b]**0.003**	**2.062**
Solvency	[a]-0.003	-2.862	[a]-0.154	-4.904	[c]-0.001	-1.966	[b]-0.023	-2.054	[c]-0.001	-1.851	[b]-0.001	-2.211	[c]-0.001	-1.725
Liquidity	0.006	0.113	-0.007	-0.031	0.001	0.384	0.191	0.352	0.001	1.359	0.001	1.351	0.000	0.274
R-squared	0.419		0.832		0.190		0.174		0.186		0.192		0.114	
F-Stat	[a]**10.214**		[a]**70.056**		1.401		1.130		1.332		1.429		[c]**1.817**	

	D.V.: Risk		D.V.: Beta	
Variable	Coef	t-Stat	Coef	t-Stat
Constant	[c]6.267	1.616	[a]-2.095	-4.863
ESG Risk	-0.046	-1.266	-0.001	-0.287
Size	-0.187	-0.945	[a]**0.141**	**6.454**
Efficiency	0.006	1.106	[a]**-0.002**	**-2.885**
Leverage	0.025	1.506	0.002	1.272
Solvency	0.000	0.913	[c]**0.001**	**1.922**
Liquidity	0.005	0.212	0.001	0.243
R-squared	0.100		0.612	
F-Stat	1.580		[a]**22.314**	

[a] Statistically Significant at 1%; [b] Statistically Significant at 5%; [c] Statistically Significant at 10%.