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THE EFFECT OF ESG RATINGS ON THE FINANCIAL PERFORMANCE OF FIRMS LISTED ON THE JSE

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ABSTRACT

This study provides new evidence in the SRI stream of literature. Empirically, it investigates the effect of ESG ratings on the financial performance of firms listed on the JSE. While literature has documented differences in the performance of high-rated ESG portfolios over low-rated and conventional portfolios, no studies have been conducted on the effect of ESG ratings on the financial performance of firms in South Africa. This paper attempts to bridge this gap in the literature. Using portfolio analysis as well as regression analysis, the overall picture is that SRI does not lead to any significant financial advantage or disadvantage at a portfolio level. However, the results of the regression analysis indicate that firms with higher corporate governance ratings earn a greater return on investment in total assets than conventional firms. However, this better performance cannot be explained by either the financial slack theory or the good management theory.

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Definition of key terms.

Abbreviation	Meaning
ESG	Environmental, social, and corporate governance
SRI	Socially responsible investment
CSR	Corporate social responsibility

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VDI	Value driven investors
RPS	Responsible profit seekers
IPS	Irresponsible profit seekers
JSE	Johannesburg Stock Exchange

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

This chapter provides a brief introduction of the background and motivation for conducting the study. Section 1.2 outlays the background of the literature available on the topic. Further, the problem statement is discussed in section 1.3 and highlights the core research topic and the reason for its relevance and identifies a research gap. Section 1.4 specifies the objectives of the research. Next, section 1.5 details the research hypotheses and section 1.6 discusses the delimitations. Post ceded by this is a discussion of the importance and proposed benefits of the study in section 1.7 and an outline of the structure of the study in section 1.8. Lastly, section 1.9 concludes the chapter.

1.2 BACKGROUND AND OVERVIEW

The concept of socially responsible investment (SRI) has been around since early biblical times and has attracted a burgeoning amount of attention ever since (Schueth, 2003). The public has become increasingly aware that reckless environmental, social and corporate governance behaviour by companies may jeopardise future social welfare (Solomon, Solomon & Norton, 2002). As such, investors may become more inclined to influence corporate actions through their investment decisions. SRI, which is an investment process that incorporates ethical values, environmental protection, improved social conditions and strong corporate governance, has become increasingly popular globally (Revelli & Viviani, 2015). SRI is based on the corporate social responsibility (CSR) profiles of firms, with the level of CSR being evaluated based on environmental, social and corporate governance (ESG) criteria (Auer & Schuhmacher, 2016).

Forthwith, ESG investing is important as it may have financial benefits that differ at firm, portfolio, fund and index levels. The concept of ESG investing has been researched internationally, yet empirical research remains distorted as some studies find that there is a positive relationship between CSR and financial performance whereas others find a negative relationship or no relationship. Among these studies is Statman (2006) who finds that the returns of SRI indices are largely similar to those of conventional indices. Further, at a portfolio level, Kempf and Osthoff (2007) find that going long in portfolios with high CSR and selling those with low CSR can lead to abnormal returns of up to 8.7% per annum. Further, these excess returns persist even after accounting for transaction costs. However, other studies such as Auer and Schuhmacher (2016) that examine the United States, Europe and the Asia-Pacific region at a portfolio level find that ESG investing in certain European regions may lead to negative excess returns. Thus, results at a portfolio level remain mixed. Lastly, Brooks

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and Oikonomou (2018), taking a broad view of the vast literature, find an overall small positive relationship between SRI and financial performance at the firm level. However, at a fund level, the paper notes that the relationship is insignificant. Apart from financial gain, other important motives for SRI include risk management and a desire to contribute to sustainable (socially responsible) development (Camilleri, 2020).

Onward, Friede, Busch and Bassen (2015) aggregate evidence from over 2000 empirical studies. The paper finds that the sample of studies from emerging markets shows a considerably higher share of positive outcomes, regarding the link between CSR and financial performance compared, in comparison to the sample of studies from developed markets. Thus, it can be argued that SRI may be more beneficial in emerging markets as opposed to developed markets. Arguably, there is not much literature regarding the impact of SRI in emerging markets. Looking towards continental Africa, majority of the Southern African SRI capital is concentrated in South Africa (Mudaliar, Moynihans, Bass, Roberts & DeMarsh, 2016), thus making it the most ideal emerging African market in which to examine the impact of SRI on financial performance. Although there exists a small amount of SRI research in South Africa, much of it relates to broad aspects of SRI and the obstacles inhibiting the growth of SRI. Further, the empirical studies in South Africa are largely focused on BBBEE (broad-based black economic empowerment), the Johannesburg Stock Exchange (JSE) SRI index and SRI mutual funds. Overall, there is no comprehensive research paper in South Africa that encompasses and examines the impact of E, S, G and composite ESG ratings at a portfolio level. Thus, this study attempts to bridge this gap in the literature by analysing the effect of E, S, G and composite ESG ratings on the financial performance of firms listed on the JSE.

1.3 PROBLEM STATEMENT

Research on the impact of SRI on financial performance has primarily focused on developed markets. For example, Kempf and Osthoff (2007) find that going long in portfolios with high CSR and selling those with low CSR can lead to positive excess returns for U.S. listed stocks. Further, Auer and Schuhmacher (2016) investigate the performance of high-rated ESG portfolios in comparison to low-rated and conventional portfolios. They find that in the U.S. and the Asia- Pacific region, ESG investing has no significant effect on financial performance, whereas, in Europe, certain ESG screens in certain industries may lead to negative excess returns. Overall, Friede et al. (2015) aggregate evidence from over 2000 empirical studies (majority of which analyse developed markets), and note that, on average, portfolio studies exhibit a neutral/mixed relationship between ESG ratings and financial performance. In emerging market, particularly Africa, there is a lack of similar research to that in developed markets. Nonetheless, several researchers, such as Ward and Muller (2010), Viviers,

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Bosch, Smit and Buijs (2008), Chipeta and Gladysek (2012), Chetty, Naidoo and Seetharam (2015) and Sampong, Song, Boahene and Wadie (2018), have attempted to address the issue of SRI investing. Accordingly, Ward and Muller (2010) analyse the wealth effects of BBBEE transactions on the JSE in the long- and short-run and find that smaller firms experience positive cumulative abnormal returns in the year following an announcement of a black empowerment deal. Further, Viviers, Bosch, Smit and Buijs (2008) analyse the risk adjusted returns of several South African SRI funds and find that these funds do not consistently yield performance greater than their respective benchmark indices. Moreover, Chipeta and Gladysek (2012) study the impact that announcements of firms joining the JSE SRI index have on the value of firms listing on the JSE SRI index. In addition, Chetty, Naidoo and Seetharam (2015) examine the impact of CSR on the financial performance of firms included and excluded from the JSE SRI index. Sampong, Song, Boahene and Wadie (2018) analyse the relationship between CSR disclosure performance and firm value. Notwithstanding the above contributions, there is a gap in the South African literature on the effect of ESG ratings on the financial performance of firms listed on the JSE. Thus, this study attempts to bridge this gap in the literature by empirically investigating the impact of E, S, G and composite ESG ratings on the financial performance of firms listed on the JSE as a whole and at an industry level.

1.4 RESEARCH OBJECTIVES

The main objective of this research is to investigate the effect of ESG ratings on the financial performance of firms listed on the JSE. This research also seeks to examine if:

- Firms with higher ESG ratings offer superior long-run performance to firms with lower ESG ratings as well as conventional firms.
- ESG ratings are related to the amount of financial slack available to firms.
- ESG ratings are related to the good management of firms.

1.5 HYPOTHESES

Based on the research objectives stated above, the hypotheses of this study are formulated as follows.

$H0^a$: There is no statistically significant relationship between ESG ratings and the financial performance of firms on the JSE.

$H1^a$: There is a positive and statistically significant relationship between ESG ratings and the financial performance of firms on the JSE.

$H0^b$: There is no statistically significant relationship between lagged financial performance and ESG ratings of firms on the JSE.

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$H1^b$: There is a positive and statistically significant relationship between the lagged financial performance and ESG ratings of firms on the JSE (Financial slack theory).

$H0^c$: There is no statistically significant relationship between lagged ESG ratings and the financial performance of firms on the JSE.

$H1^c$: There is a positive and statistically significant relationship between lagged ESG ratings and the financial performance of firms on the JSE (Good management theory).

1.6 DELIMITATIONS

The main constraint and delimitation of this study is time as this study is required to be completed within 12 months. Further, the COVID-19 pandemic has caused difficulties relating to access to data collection sources and the availability of lecturers and supervisors required for consultation.

1.7 POTENTIAL BENEFITS OF THE STUDY

This study contributes industry practitioners and to academia. This study makes contributions to academia in that it is the first to empirically investigate the impact of E, S, G and composite ESG ratings on the financial performance of firms listed on the JSE and to extend the analysis to an industry level. The contributions of this study to practitioners are that it will outline the financial impact of E, S, G and composite ESG screening on the JSE as well as investigate the impact that financial slack has on ESG ratings. Regarding the financial impact, this study provides information on whether firms with high ESG ratings and firms with low ESG ratings outperform a passive benchmark or each other. This may give practitioners an indication of whether investing in an ESG strategy will lead to higher risk adjusted returns on the JSE as a whole and in each industry. Further, the study provides information regarding which industries may provide the greatest benefits or losses in terms of ESG investing. Moreover, the study indicates whether the possession of greater financial slack leads to higher ESG ratings in the future. This provides practitioners with information on whether firms that increase their ESG activity realise an increase in value or whether it is simply that firms which are already more profitable use their financial slack to increase ESG activity, therefore, increasing ESG ratings.

1.8 STRUCTURE OF THE STUDY

This study is structured as follows. Chapter two reviews the extensive literature on SRI as well as the theoretical and empirically evidenced links between SRI and financial performance. Next, Chapter three details the data collection process as well as the methods employed to determine the relationship between ESG ratings and financial performance. Forthwith, Chapter four presents the descriptive

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statistics and results followed by Chapter five that provides recommendations for future studies and conclusion.

1.9 CONCLUSION

This chapter has briefly introduced the background and motive for conducting a study on the effect of ESG ratings on the financial performance of firms listed on the JSE. The next chapter comprises a review of the vast literature on SRI.

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CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter reviews the extensive literature on SRI. Section 2.2 explains SRI, CSR and ESG investing and also discusses the theories about the link between ESG investing and financial performance. Next, section 2.3 discusses the empirical evidence relating to the relationship between SRI and financial performance at the firm, portfolio, fund and index levels followed by section 2.4 that outlines the drawbacks of the existing literature. Lastly, section 2.5 discusses the SRI literature and empirical evidence specific to South Africa and section 2.6 is the conclusion.

2.2 SRI, CSR, ESG AND THE LINK TO FINANCIAL PERFORMANCE

Socially responsible investing (SRI), which is an investment process that incorporates ethical values, environmental protection, improved social conditions and strong corporate governance, has become increasingly popular globally (Revelli & Viviani, 2015). Investors attain non-financial utility when investing in a socially responsible manner. According to Auer and Schuhmacher (2016), SRI can broadly be defined as an investment process based on the corporate social responsibility (CSR) profiles of firms with the level of CSR being evaluated based on environmental, social and corporate governance (ESG) criteria. Further, CSR is a multidimensional concept but can broadly be defined as the responsible and ethical treatment of all stakeholders of the firm (Hopkins, 2003). Moreover, according to Gillan, Koch and Starks (2021), ESG refers to how investors and firms incorporate E, S and G concerns into their business strategies. In addition, the paper notes that one difference between ESG and CSR is that ESG explicitly includes governance issues whereas CSR includes governance issues indirectly as they relate to social and environmental issues. Nevertheless, both terms cover largely the same aspects and the paper uses the terms almost synonymously. Notably, as alluded to above, ESG metrics can be used to measure the firms' level of CSR (Auer & Schuhmacher, 2016; Cini & Ricci, 2018). Onward, ESG investing has had significant growth in the past and continues to grow presently. This is evidenced by the fact that global ESG assets comprised a total of $22.8 trillion in 2016, $30.6 trillion in 2018 and are expected to reach $53 trillion by year end (Diab & Adams, 2021). Thus, it is evident that there is an increasing interest in and demand for SRI.

Forthwith, investors may be inclined towards ESG investing (investing in firms with high ESG ratings or avoiding firms with low ratings) for the following reasons. Schueth (2003) notes that some investors may invest following their values simply to feel good about themselves whereas other investors desire to use their investment capital in a way that may genuinely cause positive change in

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society. Further, Camilleri (2020) postulates that investors may be motivated towards ESG investing to attain higher returns, to lower their risk or to genuinely contribute to sustainable (socially responsible) development.

Although there is consensus about the existence of the non-financial utility derived from SRI, there is little consensus about the relationship between CSR and financial performance. According to Waddock and Graves (1997), it can be argued that there is a positive relationship, a negative relationship or no relationship between CSR and financial performance.

Delving in, Waddock and Graves (1997) note that a positive relationship can be observed between CSR and financial performance when either the slack resources or the good management theories hold. According to the slack resources theory, financially successful firms have excess resources and can use them to achieve a higher level of CSR. Thus, higher levels of CSR are not causing greater financial performance but are a consequence thereof. Onwards, the good management theory posits that better CSR leads to better financial performance possibly as it results in firms meeting the requirements, for example, product enhancement of their major stakeholders who consequently become loyal to the firm. Waddock and Graves (1997) find a relationship between CSR and financial performance which is positive and evidence of both the slack resources and good management theories.

Further, Friedman, a renowned economist, advocates for a negative relationship between CSR and financial performance. According to Friedman (1970), CSR imposes costs on a firm that exceed any potential benefits and thus leads to lower profits and shareholder wealth. Moreover, disinvestment (a form of negative screening) as a means of SRI leads to negative financial performance. For instance, during the apartheid regime in South Africa, many investors chose to disinvest in South Africa to dismantle the regime (Schueth, 2003). However, Wright and Ferris (1997) examine the effect of this disinvestment in South Africa and found that it led to negative excess returns. In addition, several studies note that a negative link may also occur, in a portfolio context, due to the diversification costs of SRI screening. One such paper is by Rudd (1981), which postulates that SRI screening reduces portfolio diversification by introducing a size bias, bias towards small firms, which increases the portfolio beta and adversely affects long-run performance. However, Bello (2005) tests this prediction for U.S. mutual funds and found that there is no significant difference in the degree of diversification between SRI compliant mutual funds and conventional mutual funds. In addition, as mentioned in Auer and Schuhmacher (2016), the managerial opportunism hypothesis argues that managers

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appropriate more wealth during prosperous times and subsequently increase shareholder welfare through improving social performance to appease weak financial performance.

The last link is that CSR does not affect financial performance. In support of this, Hamilton, Jo and Statman (1993) find evidence in line with the hypothesis that CSR does not affect financial performance because CSR is not priced. This argument is close to the customary structure of finance wherein only factors that proxy for risk impact expected returns. Alternatively, Brooks and Oikonomou (2018) note that no discernible link may result if the positive and negative effects of CSR net off or if CSR simply has a trivial effect on the costs and revenues of firms.

2.3 ASSESSING THE PERFORMANCE OF FIRM LEVEL SRI, SRI PORTFOLIOS, SRI FUNDS, AND SRI INDICES.

Many studies in this field argue that a consensus has not been reached regarding the link between SRI and stock market performance at the firm level (Brooks and Oikonomou, 2018). However, Brooks and Oikonomou (2018), in taking a broad view of the literature, note that the evidence points to an overall positive although economically modest relationship between SRI and financial performance at the firm level. However, this finding cannot be extended to SRI portfolios, funds and indices that incorporate the ESG criteria.

Forthwith, concerning indices, Statman (2006) finds that SRI indices do not perform significantly different compared to conventional indices. Onward, regarding SRI portfolios, the empirical results are mixed as some studies find a positive relationship between SRI and financial performance whereas others find a negative or neutral relationship. Kempf and Osthoff (2007) observe that going long in portfolios with high CSR and selling those with low CSR can lead to abnormal returns of up to 8.7% per annum. Further, the paper indicates that SRI stocks can outperform the market even once accounting for reasonable transaction costs. Moreover, the paper notes that the best-in-class approach (ensures that the portfolio is balanced across industries), which focuses on positive rather than negative (excluding firms in controversial business areas) CSR screening criteria, produces the best financial performance. Contrastingly, Auer and Schuhmacher (2016) find that in the U.S. and the Asia-Pacific region, SRI portfolios have no significant advantage or disadvantage over conventional portfolios. However, they also find that in Europe, portfolios using certain ESG screens in certain industries may lead to poorer financial performance. Overall, Brooks and Oikonomou (2018) note that most of the literature on both SRI portfolios and SRI indices indicate that SRI does not appear to lead to risk adjusted returns that are greater than those of conventional portfolios and indices. Further, regarding SRI funds, Renneboog, Ter Horst and Zhang (2008) provide a critical review of SRI

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literature relating to funds and note that generally, SRI funds do not appear to yield statistically significantly higher risk adjusted returns compared to conventional funds. The findings of Brooks and Oikonomou (2018) support this observation.

2.4 DRAWBACKS RELATING TO THE LITERATURE.

Much of the literature on SRI has focused on the performance of SRI compliant mutual funds in comparison to conventional funds (Auer & Schuhmacher, 2016). This is problematic for the following reasons. Firstly, the performance of a fund does not purely depict the returns of its underlying securities due to varying levels of management skills, fees and other variables, thus making it difficult to measure the impact of SRI investing (Kempf & Osthoff, 2007). Secondly, according to Auer and Schuhmacher (2016), SRI funds have varying compliancy with SRI standards and become more like conventional funds over time. Thirdly, many fund studies make use of alphas, which are based on systematic risk, to calculate risk-adjusted performance. This is problematic because SRI screening may lead to lower diversification in which case, a measure based on total risk such as the Sharpe ratio, is a more appropriate measure (Auer & Schuhmacher, 2016).

Further, Auer and Schuhmacher (2016) note that the prominent papers in which SRI portfolios rather than mutual funds are constructed have mixed results and face limitations. These papers use alternative alphas to measure performance, focus on single areas of social responsibility or single geographic regions and often have a limited sample size, and are thus incomparable. Auer and Schuhmacher (2016) overcome these issues and analyse the effect of socially responsible screening, based on ESG ratings on the performance of investments in the U.S., Europe and the Asia Pacific region. However, the study, unfortunately, does not include any African regions. Further, while the study finds some differential performance between conventional and ESG-adherent portfolios, particularly in certain European regions, it does not put forth any reasoning for why it occurs.

2.5 SRI IN SOUTHERN AFRICA

According to Mudaliar et al. (2016), South Africa is the single largest market for SRI capital in the entire Southern African region with about 74% of the total SRI capital in the region being concentrated in South Africa. In addition, the paper notes that over time, the growth trend in responsible investment transaction volume indicates a robust expansion in SRI investor activity in the region. Moreover, the paper postulates that there is a considerable need for SRI capital in South Africa due to economic disparities in the country. Given these observations, it may be useful to analyse the impact of SRI, or in other words, ESG investing on the financial performance of firms in

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South Africa. Doing so may provide evidence whether or not investors will achieve positive, zero or negative excess returns through ESG investing in South Africa.

Currently, a large portion of the literature regarding SRI in South Africa focuses on the broad aspects of SRI and the obstacles inhibiting the growth of SRI. Accordingly, Heese (2005) notes that a key inhibitor of SRI in South Africa is a lack of consensus on the issues that should define SRI and how SRI is related to the promotion of BBBEE (broad-based Black Economic Empowerment). Moreover, Herringer, Firer and Viviers (2009) indicate that the obstacles to SRI in South Africa include the limited SRI universe, the bleak attitude towards receiving returns that are below-average, a lack of accessible SRI information, the quantity of human capital needed for the screening of investments and a lack of pension fund interest in SRI. In addition, Viviers, Eccles, De Jongh, Bosch, Smit and Buijs (2008) find that the key drivers of SRI in South Africa are increased responsible investment legislation/regulation and evidence for increased risk-adjusted returns from responsible investment.

Forthwith, the empirical literature on SRI in South Africa focuses on BBBEE, the JSE SRI index and SRI mutual funds. Indicative of this is Ward and Muller (2010) who analyse the short and long-run wealth effects of BBBEE transactions on the JSE. Further, Viviers et al. (2008) analyse the risk adjusted returns of several responsible investment funds in South Africa during 1992- 2006. The paper finds that the responsible investment funds do not consistently outperform their relative benchmark indices. However, the responsible investment funds' performance improved relative to their benchmark indices over time. Moreover, Chipeta and Gladysek (2012) study the impact that announcements of firms joining the JSE SRI index have on the value of firms listing on the JSE SRI index. Notably, as mentioned in section 2.4, SRI fund analysis may be problematic and as such, the existing SRI literature in South Africa may be inadequate.

Further, there is also literature relating to the link between CSR and financial performance in South Africa. One such paper is by Chetty et al. (2015) and they examine the impact of CSR on the financial performance of firms included and excluded from the JSE SRI index. The paper finds that CSR activities do not lead to any significant differences in performance. Further, Sampong et al. (2018) analyse the relationship between CSR disclosure performance (measured by Global Reporting Initiative guidelines) and firm value. The findings of the paper imply that CSR disclosures may not necessarily affect firm value.

Onward, there does not appear to be any comprehensive non fund/index study in South Africa that measures CSR using ESG criteria at a portfolio level. Thus, this study attempts to bridge this gap in the literature. As such, this study aims to analyse the effect of ESG ratings on the financial

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performance of firms listed on the JSE. Further, the study considers ESG ratings not only in aggregate but in its separate dimensions as well (E, S and G separately). Moreover, the study considers the effects at an industry level to determine whether patterns of SRI performance differ across industries. In addition, the study looks at whether value driven investors (VDI), responsible profit seekers (RPS) and irresponsible profit seekers (IPS) may achieve their goals through ESG investing in South Africa. According to Auer and Schuhmacher (2016), VDI are investors that are only interested in the non-monetary related utility derived from responsible investing and are willing to accept a loss in financial performance to achieve it. RPS are investors that desire to hold companies with high ratings but also desire financial proceeds from doing so. IPS are investors that are only concerned with financial performance and would hold controversial stocks to achieve it.

2.6 CONCLUSION

This chapter has reviewed the extensive literature on SRI and its link to financial performance. There are theories advocating for a positive, negative and no link between SRI and financial performance. Further, the empirical evidence indicates that there is a small positive link at the firm level, no link at the index and fund level and a mixed, bordering on non-existent, link at the portfolio level. However, much of the existing literature has drawbacks such as the use of alternative alphas to measure performance among others. Moreover, there is a notable lack of studies that examine the impact of ESG ratings on the financial performance of firms in South Africa. Further, Friede et al. (2015) find that studies on SRI in emerging markets show a considerably higher share of positive outcomes regarding the link between CSR and financial performance compared to studies from developed markets. Moreover, it is noted that much of the SRI capital in the Southern African region is concentrated in South Africa. Thus, it can be hypothesised that the impact of SRI may be more pronounced in South Africa. The next chapter discusses the data and methodology.

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CHAPTER 3

DATA AND METHODOLOGY

3.1 INTRODUCTION

This chapter details how the data is collected and details the methodology that is used to determine the relationship between ESG ratings and financial performance. Further, this chapter also presents various tests which are performed on the data to make sure that the methodologies employed are appropriate given the characteristics of the data. Forthwith, section 3.2 describes the data and the data collection process followed by ethical considerations in section 3.2.1. Next, the research design is described in section 3.3. Specifically, sections 3.3.1 and 3.3.2 describe how the portfolio analysis is conducted followed by section 3.3.3, which describes how the regression analysis is conducted and section 3.3.4 which describes additional regressions which are used to test hypotheses b and c. Lastly, section 3.4 examines the specification tests followed by the conclusion in section 3.5.

3.2 SAMPLING AND DATA COLLECTIONS

The sample consists of 88 firms listed on the JSE for which ESG ratings can be extracted from Bloomberg from 01/01/2013 to 31/12/2019. The sample dates are chosen for the reason that this period has the largest number of firms for which consistent E, S and G ratings data exists. The 2019 cut-off date is used due to a lack of consistent ESG ratings data in existence thereafter. Regarding ESG scores, the scores are retrieved from Bloomberg and comprise data and scores on several CSR issues that are condensed into single composite annual E, S, G and ESG scores for each company. Thus, there is a time series of annual ESG scores, ranging from 0-100. As in Auer and Schuhmacher (2016), E scores show environmental awareness such as active recycling; S scores include social issues like labour relations and G scores include good practices in board independence among other issues.

Monthly share price data is retrieved from Bloomberg to calculate stock returns**.** Firms for which share price performance data cannot be found are removed from the sample. In addition, each firm's market capitalisation, book-to-market ratio, return on assets (ROA), returns on equity (ROE), return on sales (ROS), long-run debt, free-cash-flow and total assets for each year are extracted from Bloomberg. Where data is lacking on Bloomberg, it is supplemented with data from the financial statements of each firm retrieved from IRESS. To group stocks into industries, the 17 industry classifications of Arabesque are used. However, many of these industries only have a small number

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of firms and as such, the 17 industries are condensed into four industry sectors using the classifications of Hyde and Sherif (2005). These industry groupings are, capital goods (such as machinery, construction and automobiles), consumption (such as entertainment, food producers and health), financial (such as insurance, banking and real estate) and miscellaneous (such as mining, pharmaceuticals and transport). Firms that have delisted during the sample period are not removed to avoid the introduction of a survivorship bias. In the regression analyses, delisted firms are included up until the year in which they delisted. Further, in the portfolio analysis, delisted firms are included up until the portfolio rebalancing following the year in which they delisted and are assigned a return of zero for the months after they delisted but before the portfolio is rebalanced. This is done as an investor would not know a firm delisting in between portfolio rebalances.

In addition, it can be noted that from the total sample of 93 firms listed on the JSE retrieved from Bloomberg over the period 2013 – 2019, one firm is removed due to a lack of share price data and four firms are removed because of financial ratios. This results in a final sample of 88 firms used in the analysis.

3.3 DESCRIPTION OF OVERALL RESEARCH DESIGN

3.3.1 PORTFOLIO CONSTRUCTION METHODOLOGY

The methodology largely follows that of Auer and Schuhmacher (2016). Accordingly, portfolios are constructed based on ESG scores to determine whether portfolios with high ratings and portfolios with low ratings outperform a passive benchmark or one and another. All stocks in the applicable universe (total stocks and each specific industry) are ranked based on their ESG and separate E, S and G scores. The high-rated (low-rated) portfolios comprise an equal weighting of the top (bottom) 5% of stocks. This construction procedure is repeated using 10%, 15%, 20% and 25% cut-off rates when analysing the full sample of firms as cut-off rates could affect the results. However, when analysing each of the four industries, only a 25% cut-off rate is applied seeing that each industry only has a few firms and using lower cut-off rates could lead to extreme portfolio concentration (for example, a high rated portfolio comprising only one firm). The portfolios are rebalanced annually as only annual ESG ratings are available for the sample of firms. Thus, there are 36 high-rated portfolios and 36 low-rated portfolios with time series of monthly excess returns from 01/01/2013 to 31/12/2019. Such portfolios simply present the returns of their underlying ESG screened stocks. Next, as per Auer and Schuhmacher (2016), the benchmark portfolios are each comprised an equal weighting of all the stocks in the relevant universe, thus embodying a passive investment strategy in

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the stock market or industry indices. Further, the benchmarks are constructed in this way as, according to Auer and Schuhmacher (2016), SRI funds compare performance to such benchmarks in practice.

3.3.2 TESTING OF THE PERFORMANCE HYPOTHESIS USING THE SHARPE RATIO

Buy-and-hold Returns (BHRs) are used to calculate the monthly returns of each firm. For each firm, the return for a given month is measured as the closing price of the month less the opening price of the month, divided by the opening price of the month as follows:

$$bhr_{i,t} = (\mu_{close,i,t} - \mu_{open,i,t})/\mu_{open,i,t}$$

$bhr_{i,t}$ is the monthly buy-and-hold return for share *i* at time *t*. $\mu_{close,i,t}$ is the closing price for share *i* at time *t* and $\mu_{open,i,t}$ is the opening price for share *i* at time *t*. Further, as per Tan (2015), South African 91-day treasury bill rates are used to proxy for the risk-free rate and are annualised using geometric averages. Further, ESG portfolios are formed and analysed using a look-back period of one year and a holding period of one year, in which portfolio returns are calculated followed by portfolio rebalancing. This process is applied for the full sample period after which each of the annual returns calculated are combined to create a full period portfolio return. Thereafter, the standard deviations of these returns are calculated for use in the portfolio Sharpe ratio calculation.

Forthwith, following Auer and Schuhmacher (2016), the Sharpe ratio, based on total risk, is used to measure the risk-adjusted performance of the portfolios. Excess return is calculated as the annual return of a portfolio less the risk free rate. In a portfolio comprising *T* excess returns $r_1, \dots, r_t$, the Sharpe ratio is calculated as the mean excess return, $\hat{\mu}$, divided by the standard deviation of excess returns, $\hat{\sigma}$, as follows:

$$Sharpe\ ratio = \hat{\mu}/\hat{\sigma}$$

Where:

$$\hat{\mu} = (r_1 + \cdots + r_t)/T$$

$$\hat{\sigma} = \{[(r_1 - \hat{\mu})^2 + \cdots + (r_t - \hat{\mu})^2]\}^{0.5}$$

However, seeing that Sharpe ratios merely provide estimates of the true portfolio Sharpe ratios; statistical hypothesis testing is employed to fairly compare the Sharpe ratios of two portfolios. Following Auer and Schuhmacher (2016), to conduct reliable statistical inference, the studentised bootstrap test of Ledoit and Wolf (2008), hereafter LW, is employed. This is done as studentised bootstrap tests are empirically documented to be more accurate than standard inference. They are

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robust to non-normality and serial correlation, which are common features of financial time series. The null hypothesis being tested by this statistical procedure is that of equal risk-adjusted performance:

$$H0: \Delta = \eta_i - \eta_j = 0$$

Where η_i and η_j represent the true Sharpe ratios for portfolios *i* and *j*.

3.3.3 REGRESSION ANALYSIS

According to Gujarati (2004), panel data is a combination of both time series and cross section data. Further, Gujarati (2004) notes the following advantages of panel data. Firstly, panel data techniques can explicitly account for heterogeneity by allowing for individual, specific variables. Secondly, panel data combines the time series of cross section observations, thus providing data, which is very informative and provides less collinearity among variables, more variability, greater degrees of freedom and more efficiency. Thirdly, panel data is advantageous for analysing the dynamics of change. Fourthly, panel data can detect and measure effects that pure time series data and pure cross section data cannot. Fifthly, unlike pure time series data and pure cross section data, panel data allows for the use of more complex behavioural models. Lastly, panel data makes data available for thousands of units, thus eliminating the need for aggregating data and the bias that arises therefrom. Further, this study uses panel data as this study requires the analysis of many variables over time and panel data facilitates this while allowing for rich empirical analysis.

Forthwith, despite the use of alternative cut-off rates, the portfolios could be concentrated. Thus, to supplement the results of the portfolio analysis, regressions are run to examine the effects of ESG ratings on the financial performance of firms. Thus, the following regression is run:

$$\begin{aligned} BHR_{i,t} = {} & ESG_{i,t} + S_{i,t} + E_{i,t} + G_{i,t} + ESGhigh25_{i,t} + ESGhigh5_{i,t} + ESGlow25_{i,t} + \\ & ESG\ Misc\ high_{i,t} + ESG\ Cons\ high_{i,t} + ESG\ Fin\ high_{i,t} + Size_{i,t} + Leverage_{i,t} + \\ & Growth_{i,t} + Slack_{i,t} + e_{i,t} \end{aligned} \quad (1)$$

$BHR_{i,t}$ is the annualised return for share *i* in year *t* and proxies for financial performance. Further, return on assets, $ROA_{i,t}$, Return on equity, $ROE_{i,t}$, and return on sales, $ROS_{i,t}$, are used as alternatives to $BHR_{i,t}$. Moreover, $ESG_{i,t}$ is the composite ESG score (out of 100) and $E_{i,t}$, $S_{i,t}$ and $G_{i,t}$ are the separate environmental, social and governance scores. Further, $ESGhigh5_{i,t}$ and $ESGhigh25_{i,t}$ are dummy variables that facilitate comparison in the cross-sectional relationship between firms with high-rated and non-high-rated ESG scores with long-run performance. If a firm is high-rated (in the

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top 5% or 25% of ESG ranked firms) it is assigned a value of 1 and 0 otherwise. Similarly, $ESGlow25_{i,t}$ is a dummy variable that allows for a comparison in the cross-sectional relationship between firms with low-rated and non-low-rated ESG scores with long-run performance. If a firm is low-rated (in the bottom 25% of ESG ranked firms), it is assigned a value of 1 and 0 otherwise. Moreover, $ESG\ Misc\ high_{i,t}$, $ESG\ Cons\ high_{i,t}$, and $ESG\ Fin\ high_{i,t}$ are variables that represent an interaction between the respective industry dummy variables (miscellaneous, consumption and financial) and the$ESGhigh25_{i,t}$ dummy. The capital industry is excluded seeing that it only consists of five firms and only has one firm in one year which is high-rated.

Further, size and growth variables are included as, according to Chipeta and Jardine (2014), they could have an impact on returns.

Accordingly, $lnTA_{i,list}$ is the natural logarithm of the total assets for the firm and proxies for size. This measures how the long-run performance of a firm is affected by size. Moreover, $Growth_{i,t}$ is a measure of the growth prospects of a firm using the book-to-market ratio of the firm calculated as market value per share divided by the book value per share. Further, $Leverage_{i,t}$ which measures the riskiness of each firm is an important control variable and is calculated as the book value of long-term debt divided by total assets (Waddock & Graves, 1997). In addition, Renneboog et al. (2008) note that when analysing CSR, controlling for cash flows may be fruitful. Thus, $Slack_{i,t}$ proxies for financial slack and is calculated as free-cash-flow divided by total assets. Lastly, $e_{i,t}$ is the standard error term.

Table 1: Summary of the variables used in the regressions.

Variable	Calculation	Source
$BHR_{i,t}$	Annualised buy-and-hold return	(Auer & Schuhmacher, 2016)
$ROA_{i,t}$	Net income divided by total assets	(Waddock & Graves, 1997)
$ROE_{i,t}$	Net income divided by shareholders' equity	(Waddock & Graves, 1997)
$ROS_{i,t}$	Operating profit divided by net sales	(Waddock & Graves, 1997)
$ESG_{i,t}$	Composite ESG score out of 100	Bloomberg
$E_{i,t}$	E score out of 100	Bloomberg
$S_{i,t}$	S score out of 100	Bloomberg
$G_{i,t}$	G score out of 100	Bloomberg

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$ESGhigh25_{i,t}$	Dummy variable, which equals to one for firms in the top 25% of ESG score ranked firms and which equals to zero otherwise.	Authors calculation
$ESGhigh5_{i,t}$	Dummy variable, which equals to one for firms in the top 5% of ESG score ranked firms and which equals to zero otherwise.	Authors calculation
$ESGlow25_{i,t}$	Dummy variable, which equals to one for firms in the bottom 25% of ESG score ranked firms and which equals to zero otherwise.	Authors calculation
$ESG\ Misc\ high_{i,t}$	Dummy variable, which interacts an industry dummy (which takes a value of 1 for firms in the miscellaneous industry and zero otherwise) with the $ESGhigh25_{i,t}$ dummy	Authors calculation
$ESG\ Cons\ high_{i,t}$	Dummy variable, which interacts an industry dummy (which takes a value of 1 for firms in the consumption industry and zero otherwise) with the $ESGhigh25_{i,t}$ dummy	Authors calculation
$ESG\ Fin\ high_{i,t}$	Dummy variable, which interacts an industry dummy (which takes a value of 1 for firms in the financial industry and zero otherwise) with the $ESGhigh25_{i,t}$ dummy	Authors calculation
$Size_{i,t}$	The natural logarithm of total assets	(Chipeta & Jardine, 2014)

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$Leverage_{i,t}$	the book value of long-term debt divided by total assets	(Waddock & Graves, 1997)
$Growth_{i,t}$	market value per share divided by the book value per share	(Chipeta & Jardine, 2014)
$Slack_{i,t}$	free-cash-flow divided by total assets	(Renneboog et al., 2008)
$e_{i,t}$	Standard error term	(Chipeta & Jardine, 2014)

3.3.4 ADDITIONAL ANALYSIS

Moreover, regressions are conducted to test hypotheses b and c. Regressions are conducted in a similar manner to Waddock and Graves (1997) to determine whether better financial performance results in improved CSR (financial slack theory) or whether it is that improved CSR that leads to better financial performance (good management theory). When testing the financial slack theory, the dependent variable in the regression is the ESG scores, ESG scores of year *t* are used and the financial performance of *t-1* is used. This is done to determine whether lagged financial performance predicts ESG ratings. Further, when testing the good management theory, the dependent variable in the regression is financial performance (buy-and-hold-returns, return on assets, return on equity or returns on sales), financial performance from year *t* is used and ESG scores from *t-1* are used. This is done to determine whether lagged ESG ratings predict financial performance.

Moreover, two control variables (size and risk) are included as they have been suggested to affect both firm performance and CSR (Chipeta & Jardine, 2014; Waddock & Graves, 1997). Accordingly, as mentioned above, the natural log of total assets is used to proxy for firm size and the long-run debt to assets ratio (leverage) proxies for riskiness (Waddock & Graves, 1997). Unfortunately, industry is not controlled for due to a singularity issue with the dummy variables. Moreover, Basiewicz and Auret (2009) find that size and the book-to-market ratio are important explanatory variables for firms on the JSE. Thus, the book-to market ratio (growth) is also included as an explanatory variable in the following regressions:

$$ESG_{i,t} = ROA_{i,t-1} + Size_{i,t} + Leverage_{i,t} + Growth_{i,t} + Slack_{i,t} + e_{i,t} \quad (2)$$

$$ROA_{i,t} = ESG_{i,t-1} + Size_{i,t} + Leverage_{i,t} + Growth_{i,t} + Slack_{i,t} + e_{i,t} \quad (3)$$

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All variables are as defined in Table 1. Further, $ROA_{i,t}$ proxies for financial performance and $ROE_{i,t}$, $BHR_{i,t}$, and $ROS_{i,t}$, are used as alternatives to $ROA_{i,t}$. Moreover, $ESG_{i,t-1}$and $ROA_{i,t-1}$ are the one-year lagged $ESG_{i,t}$ and $ROA_{i,t}$. Lastly, $e_{i,t}$ is the error term.

3.4 SPECIFICATION TESTS

Further, given the characteristics of the panel data, various tests are performed on the data to determine the suitable type of regression to employ. Thus, the data is tested for endogeneity, multicollinearity, autocorrelation, and heteroscedasticity. Tables A1 to A28 and Figures A1 to A2J in Appendix A present the results of these tests.

Forthwith, a pooled ordinary least square (OLS) regression may lead to inconsistent results in the presence of endogeneity. Further, using a fixed effects regression controls for heterogeneity but does not allow for the use of lagged values of the dependent variable. Nevertheless, if endogeneity is not a concern, a random effects OLS model may be appropriate. However, if endogeneity is a concern, a generalised method of moments (GMM) regression is more appropriate as it can control for endogeneity (Ullaha, Akhtar & Zaefarian, 2015).

According to Gujarati and Porter (2009), multicollinearity can be defined as the existence of an exact linear relationship between the predictor variables in a regression. To test for multicollinearity, pairwise correlations between the variables are employed where a pairwise correlation close to one, a cut-off of 0.7 is applied, indicates a relationship which is linear. Figure A1 presents the results of the test for multicollinearity. The results indicate that E scores are highly correlated with the ESG scores (0.92) as well as with the ESG Misc high dummy (0.72). Further, the ESG High 25 dummy is also highly correlated with the ESG scores (0.72) and with the ESG Misc high dummy (0.72). These highly correlated variables cannot be used in the same regression. Thus, E scores and the ESG High 25 dummy are excluded in regression 1A in which ESG scores, the ESG Misc high dummy and the ESG High 5 dummy, included to substitute for the ESG High 25 dummy, are present. Moreover, ESG scores, the ESG Misc high dummy and the ESG High 5 dummy are excluded from regression 1B in which E scores and the ESG High 25 dummy are present.

In addition, according to Gujarati and Porter (2009), heteroscedasticity refers to non-constant error variance. The Breusch-Pagan test is employed to test for heteroscedasticity. However, this test is sensitive to the assumption of normality (Gujarati & Porter, 2009). Therefore, in order to ensure that results are robust, Whites test and the studentised Breusch-Pagan test for heteroscedasticity are utilised. If the p-value of these tests is greater than 0.05, then there is no significant heteroscedasticity. Heteroscedasticity is present if two or more of the tests find heteroscedasticity. Results from Tables

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A5-A20 indicate that in regressions 1,2 and 3, BHRs, ROA, ROE and ROS display significant heteroscedasticity. Moreover, in regression 1B, BHRs, ROE and ROS display significant heteroscedasticity but ROA does not. Overall, there appears to be significant heteroscedasticity in almost all the regressions. Thus, to control for heteroscedasticity, heteroscedastic consistent estimators are used in the regressions.

Next, Gujarati and Porter (2009) note that endogeneity is when there is correlation between a regressor and the unique errors. The Hausman test for endogeneity is conducted to test for endogeneity. A test yielding a p-value larger than 0.05 indicates that endogeneity is not present and a random effects regression model is appropriate. The results of the test, presented in Tables A1 and A2, indicate that, in regression 1A and 1B, there is significant endogeneity for BHRs, ROA, ROE and ROS. Further, the results of the test, presented in Table A3, indicate that, in regression 2, there is only significant endogeneity for the regression in which ROA is used as an explanatory variable. Moreover, the results of the test, presented in Table A4, indicate that, in regression 3, there is significant endogeneity for BHRs, ROA and ROE but not for ROS. Thus, given that many of the regressions suffer endogeneity concerns, an OLS regression is inappropriate and a GMM regression is considered. Forthwith, to determine whether a GMM regression is appropriate, the Arellano-Bond test for autocorrelation and the Sargan test for instrument validity are run.

Firstly, tests for autocorrelation are performed. Gujarati and Porter (2009) define autocorrelation as the correlation of a series of observations ordered by time. Forthwith, correlograms are used as visuals tests for autocorrelation in the y-variables used in the regressions and the Arellano-Bond test for autocorrelation is used to test for the first order and second order autocorrelation. A p-value larger than 0.05 indicates that there is no significant autocorrelation. From a visual inspection of the correlograms, shown in figures A2-A2J, it appears that all y-variable depict some autocorrelation. However, the results of the Arellano-Bond test, depicted in Tables A21-A24, indicate that although some of the variables depict first order autocorrelation in certain regressions, none of the variables depict second order autocorrelation. Thus, a GMM regression is appropriate.

Further, it can also be noted that ROS is dropped as an alternative y-variable in regressions 1, 1B and 3 due to the Wald test for coefficients being insignificant for these variables when using ROS as the y-variable. The Wald test for coefficients assess whether or not the explanatory variables in a regression are significant in that they are valuable to the model. A p-value of greater than 0.1 indicates that the explanatory variables are insignificant. The results of this test are reported along with the regression results in the next section in Tables 3, 4 and 5. Further, as can be seen in these tables, all

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p-values for the Wald test are less than 0.1 and thus the explanatory variables used in each regression are significant. Further, blank grey blocks indicate variables that are removed due to insignificance. Next, the Sargan test for instrument validity is conducted to determine whether the instruments used in the regressions are appropriate. A p-value greater than 0.1 indicates that the instruments used are valid. The results of this test, presented in Tables A25-A28, indicate that the instruments used in all regressions are valid. Thus, overall, it is appropriate to use a GMM regression and the instruments used in the GMM regressions are valid.

In addition, seeing that certain variables cannot be run in the same regression as mentioned above, the following versions of regression 1 are run:

$$BHR_{i,t} = ESG_{i,t} + S_{i,t} + G_{i,t} + ESGhigh_{i,t} + ESGhigh5_{i,t} + ESGlow_{i,t} + ESG\ Misc\ high_{i,t} + ESG\ Cons\ high_{i,t} + ESG\ Fin\ high_{i,t} + Size_{i,t} + Leverage_{i,t} + Growth_{i,t} + Slack_{i,t} + e_{i,t} \quad (1A)$$

$$BHR_{i,t} = E_{i,t} + S_{i,t} + G_{i,t} + ESGhigh_{i,t} + ESGhigh25_{i,t} + ESGlow_{i,t} + ESG\ Cons\ high_{i,t} + ESG\ Fin\ high_{i,t} + Size_{i,t} + Leverage_{i,t} + Growth_{i,t} + Slack_{i,t} + e_{i,t} \quad (1B)$$

3.5 CONCLUSION

This chapter has described the process of data collection and the methodologies that are utilised to carry out the analysis of the relationship between ESG ratings and financial performance. It is noted that a portfolio analysis as well as regression analyses are used in the determination of this relationship. BHRs, ROE, ROA, ROS and ESG are used in various GMM regression models that are controlled for issues relating to endogeneity, multicollinearity, autocorrelation and heteroscedasticity. The results of these analyses are discussed in the next chapter.

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CHAPTER 4

RESULTS AND DISCUSSION

4.1 INTRODUCTION

This chapter presents and discusses the results of the portfolio analysis and regression analyses aimed at determining the relationship between ESG ratings and financial performance for firms listed on the JSE. Section 4.2 consists of descriptive statistics of the data and allows for a preliminary look into the results. Next, section 4.3 discusses the results of the portfolio analysis. Lastly, section 4.4 discusses the results of the formal GMM panel regressions and section 4.5 is the conclusion.

4.2 DESCRIPTIVE STATISTICS

Figure 1 depicts the Buy-and-hold returns of the high-rated, low-rated and benchmark portfolio in each industry over time and this allows for a preliminary look into the results. It appears that in the full sample (at 5% and 25% cut-off rates) and the miscellaneous industry (Misc), the high-rated ESG portfolio underperforms both the low-rated portfolio and the respective benchmark portfolios during the first part of the period but subsequently outperforms both as time passes. Further, in the consumption industry (Cons), the high-rated portfolio consistently underperforms both the low-rated portfolio and the benchmark with the benchmark and low-rated portfolio outperforming and underperforming each other at different intervals. Moreover, in the financial industry (Fin) and the capital industry (Cap), the benchmark appears to outperform both the high-rated and low-rated portfolios for most of the period. Thus, overall, there appears to be a potentially positive relationship between ESG ratings and financial performance in the full sample and the miscellaneous industry but a potentially negative relationship in the consumption, financial and capital industries.

Further, Table 2 presents the means, standard deviations and Sharpe ratios for the high-rated and low-rated portfolios, using a 25% cut-off rate, as well as for the benchmark portfolio in each universe of firms. This allows for a further preliminary look at SRI performance and how SRI portfolios differ to the benchmark. Forthwith, when comparing the screened portfolios to their respective benchmarks, in terms of the Sharpe ratio, it is found that high-rated portfolios outperform their respective benchmarks in 11 of 20 cases. This outperformance can be observed for E, S, G and composite ESG screening in the total sample and in the miscellaneous industry, for S screening in the consumption and financial industries and for E screening in the capital industry. On the other hand, low-rated portfolios only outperform their respective benchmarks in 4 of 20 cases. This outperformance occurs for G screening in the capital, consumption and financial industries and for S screening in the capital industry. Further, high-rated portfolios outperform low-rated portfolios in 12 of 20 cases. This

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outperformance occurs for E, S, G and composite ESG screening in the total sample and the miscellaneous industry, for S screening in the consumption and financial industry and for E and composite ESG screening in the capital industry. However, these results differ from Auer and Schuhmacher (2016) who find that low rated portfolios outperform their respective benchmarks more frequently than high-rated portfolios and also find less frequent occurrence of high-rated portfolios outperforming low-rated portfolios in terms of the Sharpe ratio.

Figure 1: Buy-and-hold returns of high-rated portfolios, low-rated portfolios and the benchmark portfolio in each industry over time.

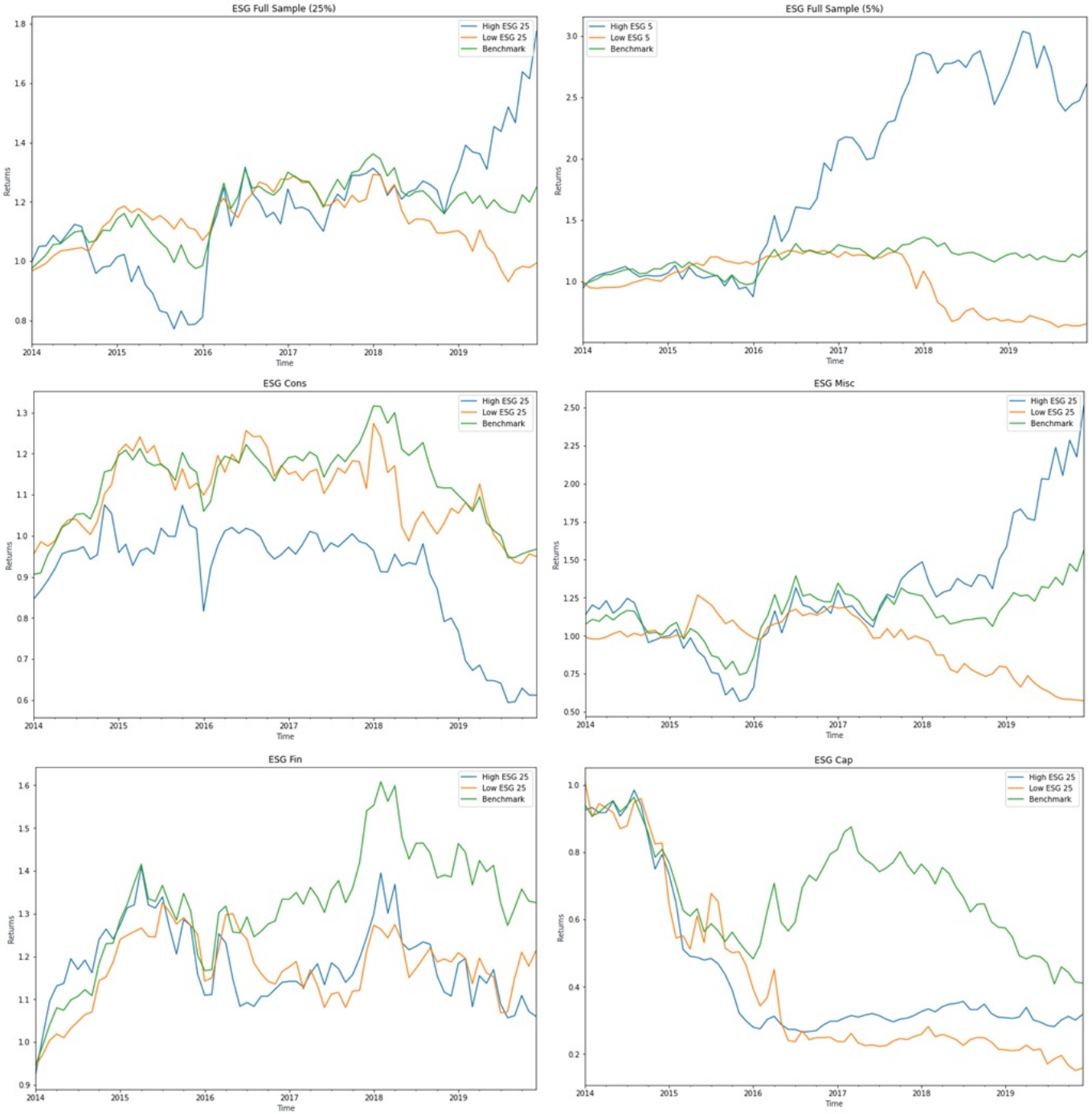

Table 2: Performance of ESG-based selection at a cut-off rate of 25% for different samples.

	Total	Cap	Cons	Fin	Misc
Benchmark					
Mean	-0.0214	-0.1631	-0.0679	-0.0130	0.0439
Standard deviation	0.1469	0.3412	0.1139	0.1294	0.3132
Sharpe ratio	-0.1459	-0.4781	-0.5957	-0.1005	0.1403
High Portfolios					
Environmental					
Mean	0.0561	0.0931	-0.1416	-0.0286	0.1122
Standard deviation	0.2411	1.2219	0.1028	0.1151	0.3596
Sharpe ratio	**0.2326**	**0.0762**	-1.3764	-0.2488	**0.3120**
Social					
Mean	0.0161	-0.1956	-0.0614	-0.0178	0.1768
Standard deviation	0.2278	0.2601	0.2415	0.1984	0.6143
Sharpe ratio	**0.0708**	-0.7521	**-0.2542**	**-0.0899**	**0.2878**
Governance					
Mean	0.0028	-0.1727	-0.1792	-0.0546	0.1196
Standard deviation	0.2101	0.3232	0.0766	0.1129	0.3404
Sharpe ratio	**0.0132**	-0.5344	-2.3379	-0.4834	**0.3514**
Total ESG					
Mean	0.0570	-0.1956	-0.1402	-0.0514	0.1837
Standard deviation	0.2564	0.2601	0.1153	0.1294	0.4933
Sharpe ratio	**0.2223**	-0.7521	-1.2159	-0.3977	**0.3724**
Low Portfolios					
Environmental					
Mean	-0.0547	-0.3143	-0.0907	-0.0153	-0.0988
Standard deviation	0.0652	0.1805	0.0961	0.0679	0.1848
Sharpe ratio	-0.8401	-1.7417	-0.9436	-0.2250	-0.5345
Social					
Mean	-0.0608	0.1209	-0.0963	-0.0278	-0.1261
Standard deviation	0.1198	1.1821	0.1524	0.1384	0.1880
Sharpe ratio	-0.5080	**0.1023**	-0.6319	-0.2008	-0.6712
Governance					
Mean	-0.0518	-0.0003	-0.0569	0.0257	-0.0251
Standard deviation	0.1721	1.2268	0.1282	0.1861	0.2871
Sharpe ratio	-0.3008	**-0.0002**	**-0.4443**	**0.1382**	-0.0875
Total ESG					
Mean	-0.0637	-0.3136	-0.0735	-0.0321	-0.1433
Standard deviation	0.1121	0.1809	0.0814	0.0868	0.1709
Sharpe ratio	-0.5679	-1.7336	-0.9028	-0.3701	-0.8383

This table shows the percentage time-series means, standard deviations and Sharpe ratios of excess returns for a selection of benchmark and socially screened portfolios. Each benchmark portfolio comprises all stocks of the relevant stock universe. High (low) rated portfolios contain the 25% best (worst) stocks based on certain ESG criterion. Each portfolio comprises stocks which are weighted equally. Portfolio rebalancing is conducted annually. Bold print figures indicate the Sharpe ratios of portfolios which are higher than their respective benchmarks.

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Further, Figure A1 in Appendix A presents a correlation matrix, which provides preliminary insight into the relationship between ESG scores and financial performance. Figure A1 indicates that there is a very small positive correlation between buy-and hold returns and ESG scores. Moreover, this positive correlation may be caused by either the slack resources theory or the good management theory. The slack resources theory posits that firms which are financially successful have excess resources to use in achieving a higher level of CSR. The good management theory posits that better CSR leads to better financial performance possibly as it results in firms meeting the requirements of their major stakeholders who consequently become loyal to the firm. However, there are small negative correlations between certain ESG scores and ROE, ROA and ROS. These negative correlations may indicate that CSR imposes costs on firms that exceed any potential benefits, thus leading to lower profits and shareholder wealth. Moreover, the negative correlation may also be due to the diversification costs of SRI screening (Rudd, 1981). Thus, it is still unclear whether this study rejects or fails to reject null hypothesis a, $H0^a$, due to mixed correlation results. In any event, the analysis of correlations is insufficient to assess the link between SRI and financial performance. Therefore, the relationship is tested using portfolio analysis and regression analysis, which controls for firm specific factors.

4.3 PORTFOLIO ANALYSIS RESULTS

The initial results reported above do not account for the statistical significance of the differences in Sharpe ratios between the portfolios. Thus, as in Auer and Schuhmacher (2016), Table 3 compares the high-rated and low-rated portfolios with each other and with their respective benchmarks and reports the signs (+ and −) and significances (a, b and c for levels of 1%, 5% and 10%) of the differences in Sharpe ratios.

Table 3: Performance of ESG-based selection for different cut-off rates and samples.

	Total (5%)	Total (10%)	Total (15%)	Total (20%)	Total (25%)	Cap	Cons	Fin	Misc
High-to-BM									
E	+	+	+	+	+	+b	-c	-	+c
S	+	+	+	+	+	-	+	+	+
G	+	+	+c	+	+	-	-c	-	+
ESG	+c	+c	+	+	+	-	-b	-c	+c
Low-to-BM									
E	-	-	-	-	-	-	-	-	-
S	-	-	-	-	-	+	-	-	-c
G	+	-	-	-	-	+c	+c	+	-

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ESG	-	-	-	-	-	-	-	-	-b
High-to-Low									
E	+c	+	+	+	+	+	-	-	+
S	+	+	+	+	+	-	+	+	+
G	+	+	+	+	+	-	-b	-b	+c
ESG	+	+	+c	+	+	+b	-	-	+b

This table reports significances (a, b and c for levels of 1%, 5% and 10%, respectively) and the signs (+ and −) for the differences of portfolio Sharpe ratios, where the significances are given by results from the LW test. High- and low-rated portfolios are compared to their benchmarks (BM). Additionally, High-rated portfolios are compared to their Low-rated counterparts. The percentages are indicative of the cut-off rates used in the ESG-screened portfolios.

The results from Table 3 indicate that many of the initially detected Sharpe ratio differences are not statistically significant. Looking at the total sample, the high-rated portfolio appears to yield a significantly higher Sharpe ratio than the benchmark portfolio when applying composite ESG screening at 5% or 10% cut-off rates and when applying G screening at a 15% cut-off rate. Further, the high-rated portfolio only significantly outperforms the low-rated portfolio when applying E screening at a 5% cut-off rate and ESG screening at a 15% cut-off rate. Overall, E, G and ESG screening in the total sample can lead to higher risk adjusted returns than the benchmark and low-rated portfolios but this better performance is very sensitive to specific cut-off rates and screens. Thus, overall, SRI in the total sample does not appear to lead to significant financial advantage or disadvantage. Therefore, the region is suitable for VDI as they can incorporate personal values into their portfolios without financial disadvantage. However, is not of interest to RPS and IPS. This result is in line with Auer and Schuhmacher (2016) who find that there is no significant financial advantage or disadvantage from SRI in the Asia-Pacific region and in the U.S. Further, a lack of a significant relationship between SRI and financial performance is in line with Hamilton et al. (1993) who find evidence in line with the hypothesis that CSR does not affect financial performance because CSR is not priced. Such an insignificant link may also result if the positive and negative effects of CSR net off or if CSR simply has a trivial effect on the costs and revenues of firms (Brooks & Oikonomou, 2018).

Further, the cut-off rate used in each of the industries is 25%. From Table 3, it is evident that SRI may lead to financial advantages in the capital industry. Specifically, the high-rated portfolio significantly outperforms the benchmark when E screening is applied; both VDI and RPS can benefit from this and significantly outperforms the low-rated portfolio when ESG screening is applied.

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Further, the G low-rated portfolio outperforms the benchmark and this would interest IPS. However, results in the capital industry may be inaccurate due to concentration as the industry only consists of five firms. Contrastingly, in the consumption industry, E, G and ESG high-rated portfolios significantly underperform the benchmark, thus this industry is of no interest to RPS but may still be of interest to VDI as they are willing to accept reduced financial performance to accommodate their values. This result is similar to that of Auer and Schuhmacher (2016) who find that, in Europe, E and S screening lead to significant financial disadvantage in the consumption industry. This financial disadvantage may be caused by the diversification costs of SRI screening (Rudd, 1981) or by other costs of SRI exceeding the benefits. Moreover, the G low-rated portfolio yields significantly higher risk adjusted returns than both the benchmark and the high-rated portfolio and this is of interest to IPS.

Next, in the financial industry, the high-rated portfolio performs significantly worse than the benchmark when ESG screening is applied and performs significantly worse than the low-rated portfolio when G screening is applied. Thus, the region is not ideal for RPS or IPS. Lastly, in the miscellaneous industry, the E and ESG high-rated portfolios significantly outperform the benchmark; the S and ESG low-rated portfolios significantly underperform the benchmark and the G and ESG high-rated portfolios outperform the respective low-rated portfolios. Consequently, the requirements of VDI and RPS can be met using these screens in the financial industry. Overall, there appears to be a positive relationship between ESG ratings and financial performance in the total sample and the miscellaneous industry. Contrastingly, there appears to be a somewhat slightly negative relationship between ESG ratings and financial performance in the consumption and financial industries. Nevertheless, these results are very sensitive to specific cut-off rates and screens and may suffer from portfolio concentration due to the small sample size. Therefore, it is possible that the results merely indicate that there is no significant financial advantage or disadvantage from SRI in South Africa. This result is in line with Auer and Schuhmacher (2016) who find that there is no significant financial advantage or disadvantage from SRI in the Asia-Pacific region and in the U.S. Thus, to supplement the results of the portfolio analysis, regressions are run to further examine the relationship between ESG ratings and the financial performance of firms.

4.4 REGRESSION ANALYSES

GMM panel regressions are estimated to examine the relationship between ESG ratings and the financial performance of firms. Further, GMM regressions have significant advantages over OLS regressions in that GMM regressions do not have to be serially independent and homoscedastic and are able to overcome the endogeneity problem (Blundell & Bond, 2000). Moreover, GMM

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regressions have the advantage over OLS regressions of providing efficient estimation when heteroskedasticity of an unknown form is present (Baum, Schaffer & Stillman, 2003). The results are presented in Tables 4, 5 and 6. Table 4 reports the results of both regressions 1A and 1B together as the coefficients on the variables that they have in common are largely similar.

Table 4: Regression 1A and 1B outputs for the determinants of financial performance.

	BHR	**ROE**	**ROA**
ESG	-0.0263	0.0019	-0.0045
E	-0.0212	-0.0026	-0.0023
S	0.0115		0.0017
G	0.0044	0.0054	0.0033 .
ESG High-rated (5%)	-0.3278	-0.1607	-0.0276
ESG High-rated (25%)	-0.3020	0.1630	0.1236
ESG low-rated (25%)	0.0719	-0.0258	0.0076
ESG Misc high	-0.2007	-0.0061	0.0132
ESG Cons high	0.5609	-0.0043	0.0157
ESG Fin high	0.1191	-0.0663	-0.0064
Size	-0.2126	-0.2576 *	-0.0488
Growth	0.0174	0.0005	-0.0009
Slack	3.2846 *	0.9807 .	0.3802 *
Leverage	-0.1333	-0.1058	-0.1308
Regression 1A			
Wald test			
Chi squared	33.9020	26.7010	25.3354
p-value	0.0007	0.0051	0.0133
Arellano-Bond test			
1st degree p-value	0.003319	0.1879	0.09469
2nd degree p-value	0.7908	0.4971	0.8964
Sargan test			
P-value	0.36127	0.29241	0.36782
Regression 1B			
Wald test			
Chi squared	22.8816	16.1999	31.9848
p-value	0.0184	0.0941	0.0008
Arellano-Bond test			
1st degree p-value	0.0009961	0.1798	0.09826
2nd degree p-value	0.7814	0.3691	0.9731
Sargan test			
P-value	0.36062	0.65751	0.54937
Note: Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1			

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The coefficient on the ESG variable, although insignificant, is slightly negative in the BHR and ROA regressions. The E variable, although also insignificant, is negative in all the regressions. These results may indicate that the market does not attribute greater value to firms that have higher E and ESG ratings. However, the positive coefficient on the S and G variables for all regressions imply that the market values firms with higher S and G scores and that these firms might have enhanced operating performance due to better management as is suggested by the good management hypothesis. However, these results are insignificant and this corroborates the finding in the portfolio analysis that SRI does not lead to any significant financial advantage or disadvantage in South Africa. Importantly, the coefficient on the G variable is significant at the 10% level, but only in the ROA regression and this implies that firms with stronger corporate governance earn a greater return on investment in total assets than conventional firms. This positive relationship between G scores and financial performance could be due to either the good management hypothesis or the financial slack theory documented by Waddock and Graves (1997). These hypotheses are tested in the regressions below. Overall, the null hypothesis, $H0^a$, of no statistically significant relationship between ESG ratings and financial performance for firms on the JSE cannot be rejected. Further, the results depict that none of the coefficients on the industry interaction dummies are significant and this implies that there is no significant difference in the relationship between SRI and financial performance across industries. Furthermore, some of the control variables are found to be significant. Specifically, size is significant at the 5% level in the ROE regression and financial slack is significant at differing levels in all three regressions. The negative and significant relationship between size and financial performance on the JSE is in line with the results of Basiewicz and Auret (2009) who find a size premium for firms on the JSE. Further, the finding of a positive and significant relationship between financial slack and financial performance is consistent with the results of Vanacker, Collewaert and Zahra (2017) who also find a positive relationship. Thus, it is possible that firms on the JSE use financial slack for activities that create value.

Forthwith, Table 5 presents the results for regression 2, which tests null hypothesis b, $H0^b$, specified in section 1.6 (financial slack theory). Note that the dependent variable in these regressions is ESG scores and that the variable representing lagged financial performance changes in each regression (BHR, ROE, ROA and ROS). Table 5 depicts that the coefficient on lagged financial performance is insignificant in each regression. Thus, the null hypothesis, $H0^b$, of no statistically significant relationship between lagged financial performance and ESG ratings for firms on the JSE cannot be rejected. This reveals that the financial slack theory does not apply to firms on the JSE. Specifically, increasing ESG ratings are not a result of firms having excess recourses that they use to improve ESG

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ratings. Also, seeing that a significant relationship is found between ROA and G scores in regression one, there is a need to test the relationship between G scores and ROA in regressions two and three. In an unreported analysis replacing ESG scores with G scores in regression two, it is found that there is no significant relationship between lagged financial performance, measured by ROA and G scores. Thus, the significant relationship found between ROA and G scores in regression one cannot be explained by the financial slack theory. In addition, the coefficient on size is positive and highly significant in all the regressions. This contrasts with the results of Waddock and Graves (1997) who find a negative and insignificant relationship between CSR and firm size. A possible explanation for this result is that larger firms pay more attention to their ESG ratings as they attract more attention from outside constituents and have a greater duty to respond openly to the demands of stakeholders (Burke, Logsdon, Mitchell, Reiner & Vogel, 1986). Further, the coefficient on leverage is positive and significant at the 10% level and this is in line with the results of Waddock and Graves (1997).

Table 5: Regression 2 outputs for the determinants of ESG ratings.

	BHR*t-1*	**ROE*t-1***	**ROA*t-1***	**ROS*t-1***
ESG	0.2215	-0.9876	0.2972	-0.3866
Size	12.891 **	10.083 *	11.191 **	10.66 **
Growth		0.25053	0.1957	0.2187
Slack	2.6293	-3.3239	2.5583	-2.1629
Leverage	-0.0575	21.552 .	11.902	13.639
Walds Test				
chi-squared	8.9892	12.193	13.626	11.924
p-value	0.0614	0.0322	0.0182	0.0358
Arellano-Bond test				
1st degree p-value	0.5831	0.1628	0.3012	0.2168
2nd degree p-value	0.3931	0.3074	0.3054	0.2735
Sargan test				
P-value	0.34016	0.46238	0.37578	0.3525
Note: Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1				

Moreover, Table 6 presents the results for regression 3 which tests null hypothesis c, $H0^c$, specified in section 1.6 (good management theory). The y-variable in these regressions are the various measures of financial performance (BHR, ROE and ROA). Table 6 depicts that the coefficient on lagged ESG scores is insignificant in each regression. Thus, the null hypothesis, $H0^c$, of no statistically significant relationship between lagged ESG ratings and financial performance for firms on the JSE cannot be rejected. This indicates that the good management theory does not hold for firms on the JSE. In other words, high CSR does not lead to the better management of firms.

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Table 6: Regression 3 outputs for the determinants of financial performance.

	BHR	ROE	ROA
ESG*t-1*	-0.0009	0.0031	-0.0023
Size	-0.0588	-0.2243 .	-0.0429
Growth	0.0220	-0.0028	0.0023
Slack	1.5552 .	0.7454 .	0.3552 .
Leverage	-0.0710	0.1068	-0.0552
Walds Test			
chi-squared	9.4523	12.5157	10.8898
p-value	0.0923	0.0284	0.0536
Arellano-Bond test			
1st degree p-value	6.52E-05	0.2084	0.06359
2nd degree p-value	0.5284	0.3641	0.9653
Sargan test			
P-value	0.2078	0.34209	0.11133
Note: Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1			

Further, in an unreported analysis replacing ESG scores with G scores in regression three, it is found that there is no significant relationship between lagged G scores and financial performance, measured by ROA. Thus, the significant relationship found between ROA and G scores in regression one cannot be explained by the good management theory. Forthwith, the coefficient of the size variable is negative and significant in the ROE regression and this corroborates the results of Basiewicz and Auret (2009) who also find a size premium for firms on the JSE. Moreover, the coefficient on the slack variable is positive and significant in all three regressions as it is in regressions 1 and 1B. Overall, the small size of the sample suggests that all results should be interpreted cautiously.

4.5 CONCLUSION

Descriptive statistics indicate that there may be a relationship between financial performance and ESG ratings but the direction of this relationship is unclear. Further, evidence from the portfolio analysis indicates that although there are certain instances in which SRI may lead to greater risk adjusted returns, this outperformance is very sensitive to specific screens and cut-off rates. Thus, the overall picture is that SRI does not lead to any significant financial advantage or disadvantage at a portfolio level. This finding is consistent with the literature. Further, this result extends to the regression analysis with one exception. Results from the regression analyses indicate that firms with higher corporate governance ratings earn a greater return on investment in total assets than conventional firms, but this outperformance cannot be explained by either the financial slack theory or the good management theory.

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CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

This study identifies a gap in the existing body of literature and seeks to close this gap by empirically investigating the effect of ESG ratings on the financial performance of firms listed on the JSE. Employing a sample of 88 firms listed on the JSE over the period 2013-2019, results show that although there are certain instances in which SRI may lead to greater risk adjusted returns, this better performance is very sensitive to specific screens and cut-off rates. Thus, the overall picture is that SRI does not lead to any significant financial advantage or disadvantage at a portfolio level. This finding is consistent with the literature. Further, this result extends to the regression analysis with one exception. Results indicate that firms with higher corporate governance ratings earn a greater return on investment in total assets than conventional firms, but this outperformance cannot be explained by either the financial slack theory or the good management theory.

Overall, the results of this study must be interpreted with caution due to the small sample size, limited sample period and source of ESG scores. The small sample is problematic as it may bias certain results. For instance, the capital industry only contains five firms and is this is too small of a sample to represent the entire capital industry. This issue, although to a lesser extent, extends to other the industry samples as well. Further, only one sample period is considered for testing in this study meaning that results may differ in alternative periods. Moreover, different ratings agencies may provide differing ESG scores and this study only considers ESG scores extracted from Bloomberg as these are the only scores currently publicly available. Thus, results may differ when using the differing scores of various ratings agencies.

Recommendations for future studies are to further examine the potential reasons for a positive and significant relationship between corporate governance ratings and financial performance and whether or not this relationship can withstand differing sample periods and scores of different ratings agencies. It may also be useful to examine whether ESG screening leads to lower portfolio diversification on the JSE as this provides information on which risk adjusted performance measure would be most appropriate to use for ESG portfolios consisting of JSE listed firms.

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APPENDIX A

RESULTS OF TESTS CONDUCTED ON THE DATA

Figure A1: Pairwise correlation matrix for variables used in the regression.

	pdata.BHR	pdata.ESG	pdata.E	pdata.S	pdata.G	pdata.ESGhigh25	pdata.ESGlow	pdata.ESGhigh5	pdata..ESG.Misc.High.	pdata..ESG.Cons.High.	pdata..ESG.Fin.High.	pdata.lnSize	pdata.Growth	pdata.ROA	pdata.ROE	pdata.ROS	pdata.Leverage	pdata.Slack
pdata.BHR	1	0.07	0.07	0.06	0.04	0.09	-0.03	0.12	0.11	0	-0.01	0.02	0.14	0.19	0.16	0.08	-0.08	0.19
pdata.ESG	0.07	1	0.92	0.66	0.59	0.72	-0.74	0.4	0.53	0.31	0.24	0.37	-0.1	-0.12	-0.09	-0.01	0.06	0.12
pdata.E	0.07	0.92	1	0.49	0.4	0.68	-0.68	0.39	0.53	0.32	0.17	0.39	-0.1	-0.12	-0.09	0.04	0.04	0.07
pdata.S	0.06	0.66	0.49	1	0.08	0.41	-0.53	0.13	0.3	0.13	0.21	0.13	-0.04	0.06	0.03	0.14	0.05	0.18
pdata.G	0.04	0.59	0.4	0.08	1	0.5	-0.37	0.32	0.34	0.23	0.19	0.26	-0.12	-0.18	-0.1	-0.16	0.1	0
pdata.ESGhigh25	0.09	0.72	0.68	0.41	0.5	1	-0.33	0.38	0.72	0.43	0.38	0.38	-0.1	-0.11	-0.06	0.03	0.09	0.06
pdata.ESGlow	-0.03	-0.74	-0.68	-0.53	-0.37	-0.33	1	-0.13	-0.24	-0.14	-0.13	-0.18	-0.01	0.06	0.04	0.07	-0.03	-0.09
pdata.ESGhigh5	0.12	0.4	0.39	0.13	0.32	0.38	-0.13	1	0.28	0.18	0.1	0.24	-0.01	0.05	0.03	0.03	-0.02	0.12
pdata..ESG.Misc.High.	0.11	0.53	0.53	0.3	0.34	0.72	-0.24	0.28	1	-0.1	-0.09	0.21	-0.17	-0.13	-0.14	0	0.03	0.03
pdata..ESG.Cons.High.	0	0.31	0.32	0.13	0.23	0.43	-0.14	0.18	-0.1	1	-0.05	0.07	0.17	0.08	0.11	0.02	0.17	0.1
pdata..ESG.Fin.High.	-0.01	0.24	0.17	0.21	0.19	0.38	-0.13	0.1	-0.09	-0.05	1	0.36	-0.1	-0.09	-0.01	0.03	-0.04	-0.03
pdata.lnSize	0.02	0.37	0.39	0.13	0.26	0.38	-0.18	0.24	0.21	0.07	0.36	1	-0.15	-0.11	-0.02	0.15	0.16	-0.06
pdata.Growth	0.14	-0.1	-0.1	-0.04	-0.12	-0.1	-0.01	-0.01	-0.17	0.17	-0.1	-0.15	1	0.37	0.24	0.07	-0.02	0.41
pdata.ROA	0.19	-0.12	-0.12	0.06	-0.18	-0.11	0.06	0.05	-0.13	0.08	-0.09	-0.11	0.37	1	0.72	0.25	-0.09	0.49
pdata.ROE	0.16	-0.09	-0.09	0.03	-0.1	-0.06	0.04	0.03	-0.14	0.11	-0.01	-0.02	0.24	0.72	1	0.15	0.03	0.33
pdata.ROS	0.08	-0.01	0.04	0.14	-0.16	0.03	0.07	0.03	0	0.02	0.03	0.15	0.07	0.25	0.15	1	0.08	0.09
pdata.Leverage	-0.08	0.06	0.04	0.05	0.1	0.09	-0.03	-0.02	0.03	0.17	-0.04	0.16	-0.02	-0.09	0.03	0.08	1	-0.16
pdata.Slack	0.19	0.12	0.07	0.18	0	0.06	-0.09	0.12	0.03	0.1	-0.03	-0.06	0.41	0.49	0.33	0.09	-0.16	1

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Figure A2A: Autocorrelation function for buy-and-hold returns.

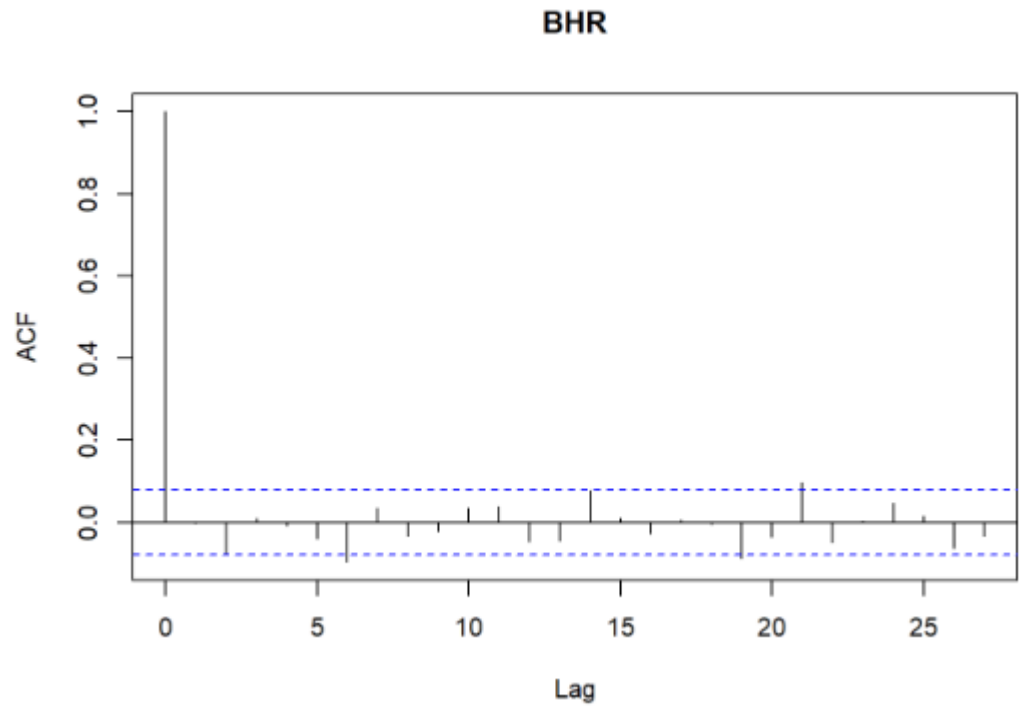

Figure A2B: Partial autocorrelation function for buy-and-hold returns.

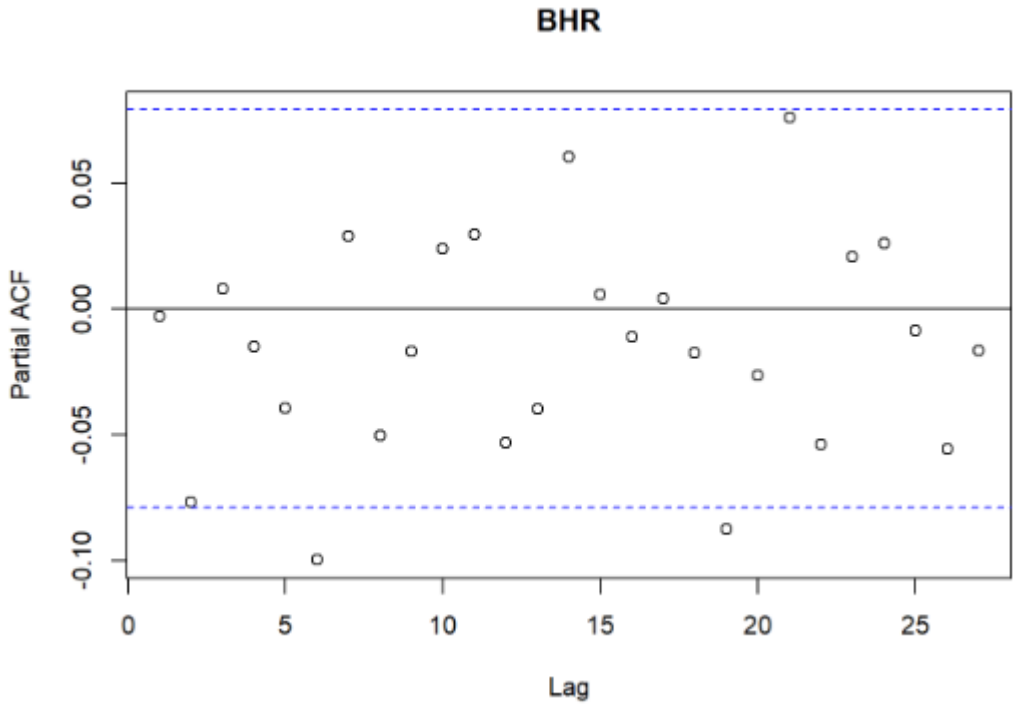

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Figure A2C: Autocorrelation function for return on equity.

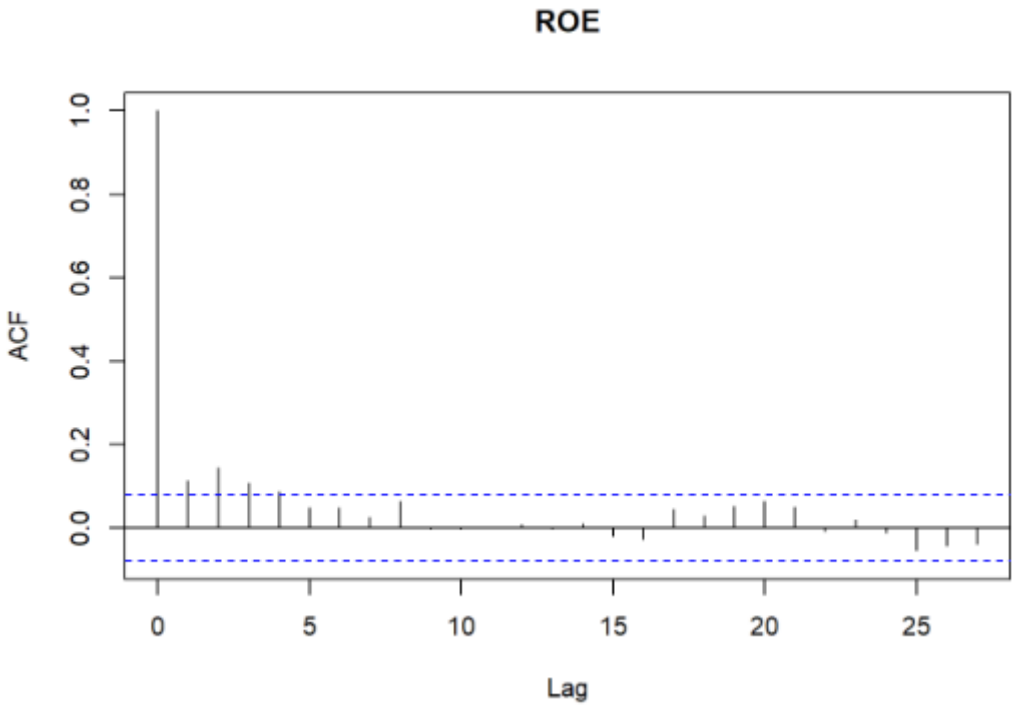

Figure A2D: Partial autocorrelation function for return on equity.

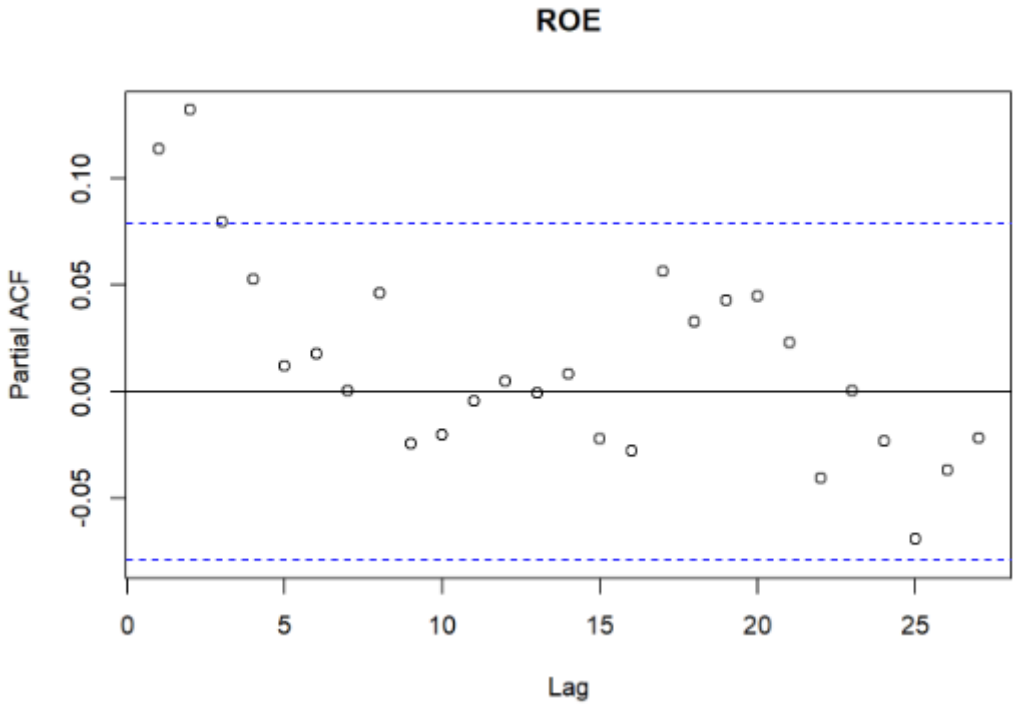

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Figure A2E: Autocorrelation function for return on assets.

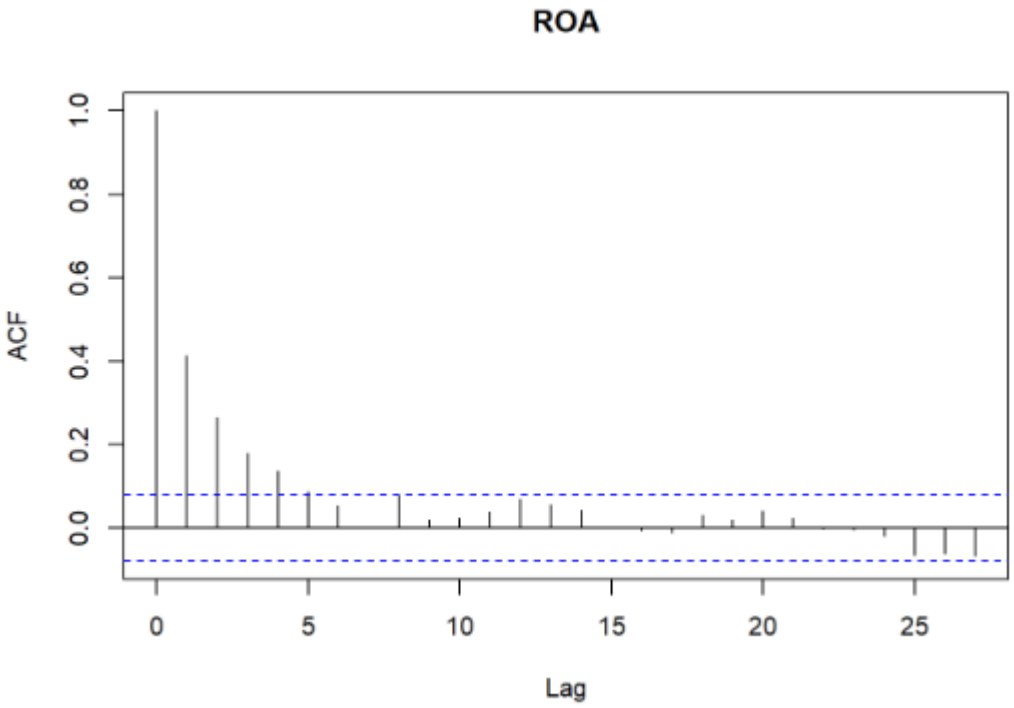

Figure A2F: Partial autocorrelation function for return on assets.

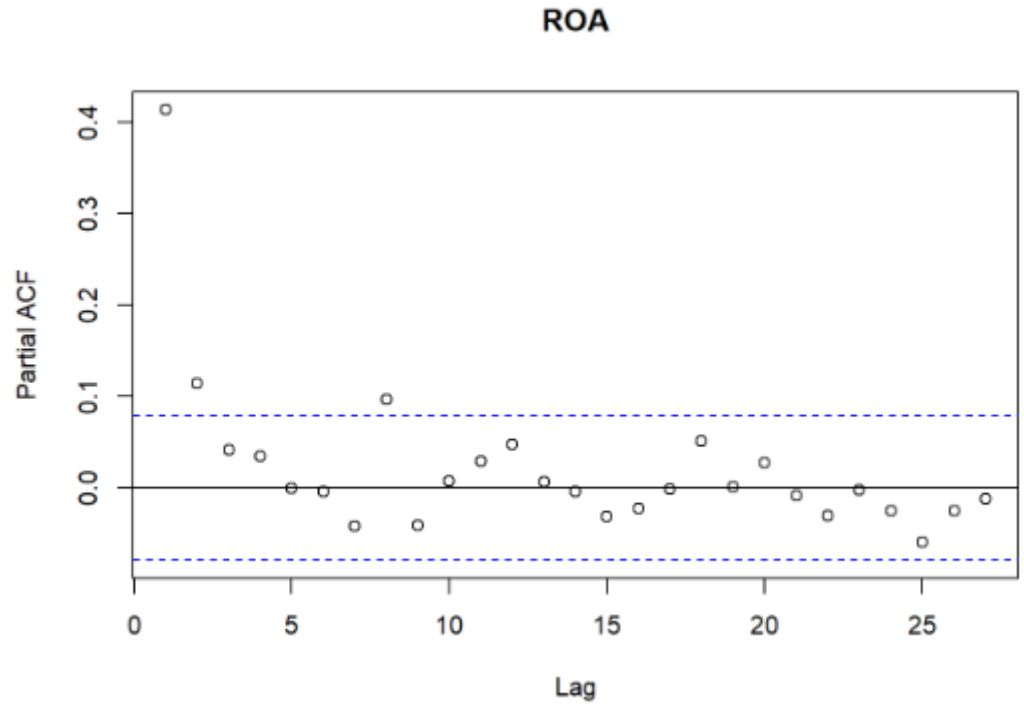

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Figure A2G: Autocorrelation function for return on sales.

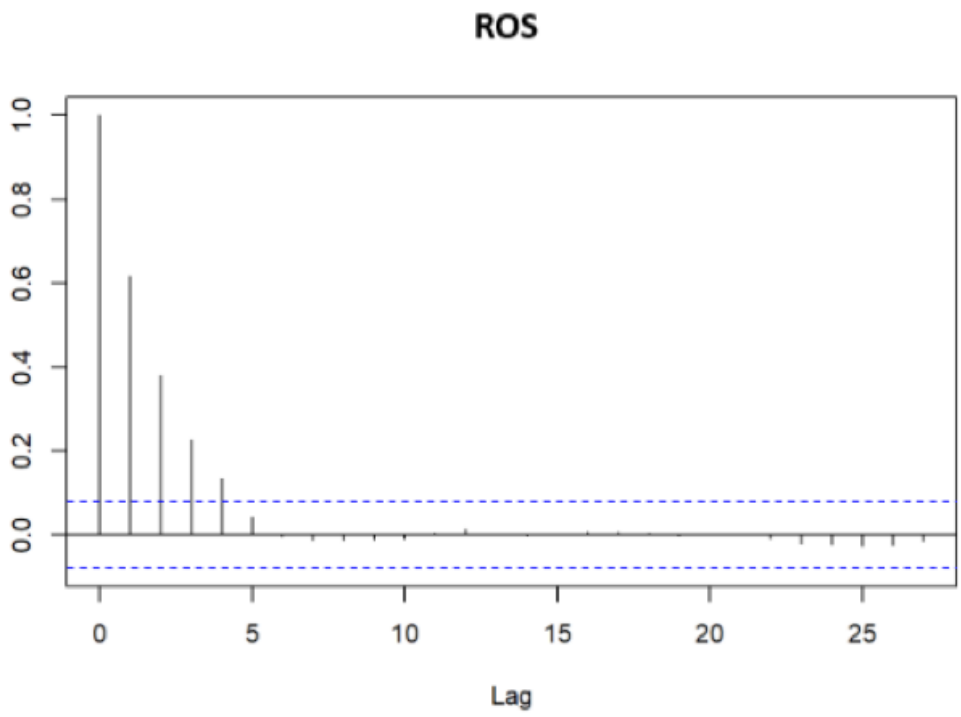

Figure A2H: Partial autocorrelation function for return on sales.

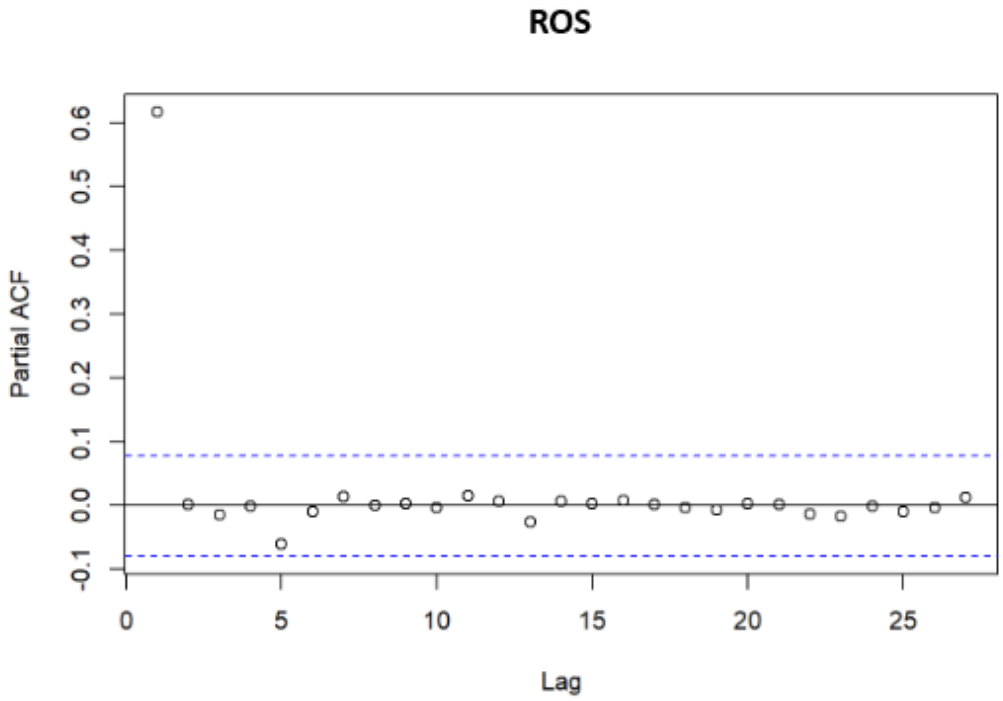

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Figure A2I: Autocorrelation function for ESG scores.

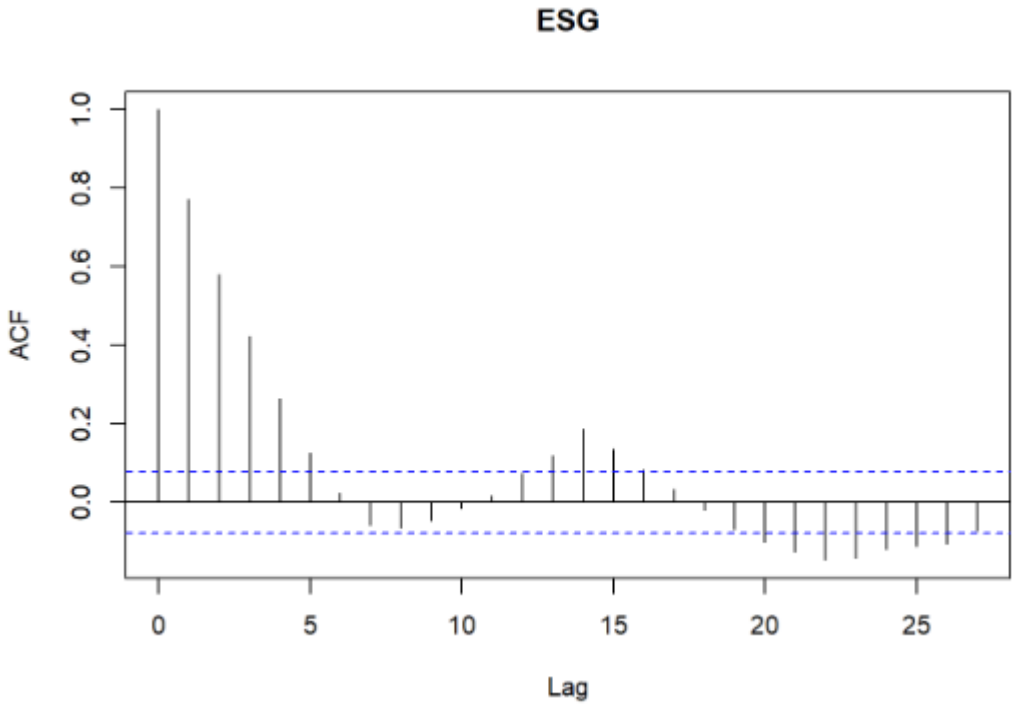

Figure A2J: Partial autocorrelation function for ESG.

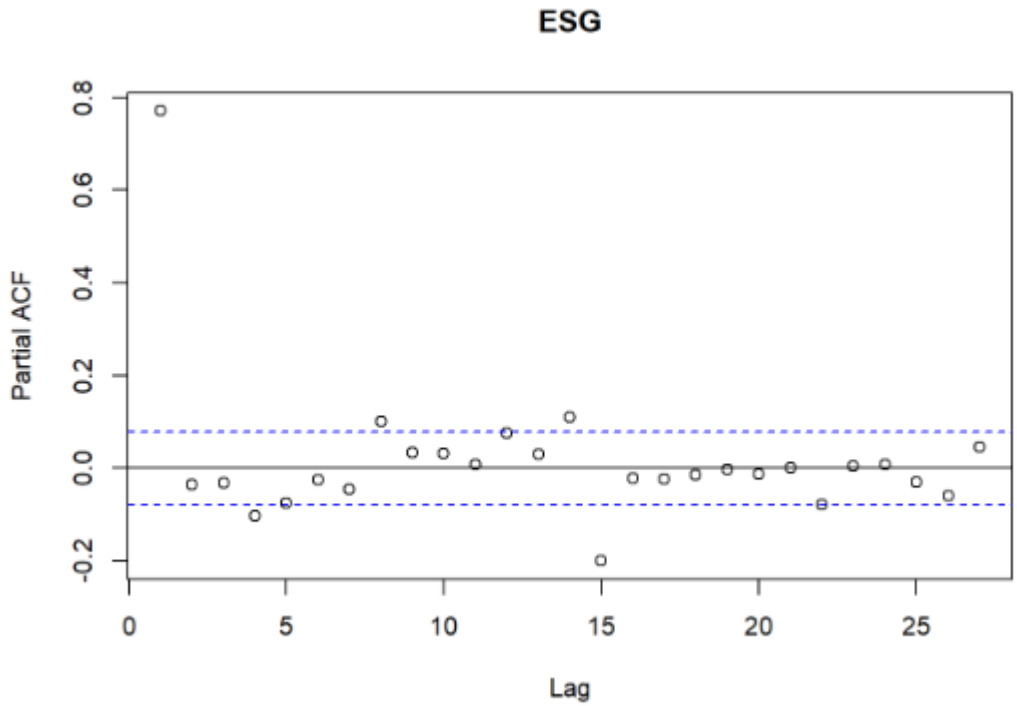

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Table A1: Hausman test results for each of the alternate y-variables used in regression 1A.

Y-variable	**BHR**	**ROE**	**ROA**	**ROS**
P-value	0.01699	3.59E-09	0.003107	0.04687

Table A2: Hausman test results for each of the alternate y-variables used in Regression 1B.

Y-variable	**BHR**	**ROE**	**ROA**	**ROS**
P-value	0.02295	1.14E-09	0.001578	0.003348

Table A3: Hausman test results for each regression with alternate x-variables used in Regression 2.

Y-variable	**ESG ~ BHR**	**ESG ~ ROE**	**ESG ~ ROA**	**ESG ~ ROS**
P-value	0.06734	0.1918	0.0008445	0.05978

Table A4: Hausman test results for each of the alternate y-variables used in Regression 3.

Y-variable	**BHR**	**ROE**	**ROA**	**ROS**
P-value	0.005454	2.48E-10	0.0009563	0.09964

Table A5: Results of tests for heteroscedasticity for buy-and-hold returns in regression 1A.

	Whites test	Breusch-Pagan	studentized Breusch-Pagan
P-value	0.001237	2.20E-16	0.0001271
BP	507.65		
df	415		
Note: BP is the test statistic, df is the degrees of freedom. These values apply to the Whites test only.			

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Table A6: Results of tests for heteroscedasticity for return on equity in regression 1A.

	Whites test	Breusch-Pagan	studentized Breusch-Pagan
P-value	2.20E-16	2.20E-16	1.00E-09
BP	530.63		
df	253		
Note: BP is the test statistic, df is the degrees of freedom. These values apply to the Whites test only.			

Table A7: Results of tests for heteroscedasticity for return on assets in regression 1A.

	Whites test	Breusch-Pagan	studentized Breusch-Pagan
P-value	0.0004848	2.20E-16	0.9276
BP	516.68		
df	415		
Note: BP is the test statistic, df is the degrees of freedom. These values apply to the Whites test only.			

Table A8: Results of tests for heteroscedasticity for return on sales in regression 1A.

	Whites test	Breusch-Pagan	studentized Breusch-Pagan
P-value	3.83E-07	2.20E-16	0.0001014
BP	573.38		
df	415		
Note: BP is the test statistic, df is the degrees of freedom. These values apply to the Whites test only.			

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Table A9: Results of tests for heteroscedasticity for buy-and-hold returns used in Regression 1B.

	Whites test	Breusch-Pagan	studentized Breusch-Pagan
P-value	0.001012	2.20E-16	0.006617
BP	510.74		
df	416		
Note: BP is the test statistic, df is the degrees of freedom. These values apply to the Whites test only.			

Table A10: Results of tests for heteroscedasticity for return on equity used in Regression 1B.

	Whites test	Breusch-Pagan	studentized Breusch-Pagan
P-value	4.21E-08	2.20E-16	5.40E-10
BP	589.43		
df	416		
Note: BP is the test statistic, df is the degrees of freedom. These values apply to the Whites test only.			

Table A11: Results of tests for heteroscedasticity for return on assets used in Regression 1B.

	Whites test	Breusch-Pagan	studentized Breusch-Pagan
P-value	0.1186	2.20E-16	0.8544
BP	450.34		
df	416		
Note: BP is the test statistic, df is the degrees of freedom. These values apply to the Whites test only.			

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Table A12: Results of tests for heteroscedasticity for return on sales used in Regression 1B.

	Whites test	Breusch-Pagan	studentized Breusch-Pagan
P-value	1.57E-08	2.20E-16	3.66E-06
BP	595.84		
df	416		
Note: BP is the test statistic, df is the degrees of freedom. These values apply to the Whites test only.			

Table A13: Results of tests for heteroscedasticity for ESG ~ buy-and-hold returns used in Regression 2.

	Whites test	Breusch-Pagan	studentized Breusch-Pagan
P-value	1.12E-05	5.65E-03	0.00133
BP	212.47		
df	132		
Note: BP is the test statistic, df is the degrees of freedom. These values apply to the Whites test only.			

Table A14: Results of tests for heteroscedasticity for ESG ~ return on equity used in Regression 2.

	Whites test	Breusch-Pagan	studentized Breusch-Pagan
P-value	1.11E-07	6.03E-03	1.58E-03
BP	234.01		
df	132		
Note: BP is the test statistic, df is the degrees of freedom. These values apply to the Whites test only.			

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Table A15: Results of tests for heteroscedasticity for ESG ~ return on assets used in Regression 2.

	Whites test	Breusch-Pagan	studentized Breusch-Pagan
P-value	1.27E-05	8.64E-03	0.001865
BP	211.84		
df	132		
Note: BP is the test statistic, df is the degrees of freedom. These values apply to the Whites test only.			

Table A16: Results of tests for heteroscedasticity for ESG ~ return on sales used in Regression 2.

	Whites test	Breusch-Pagan	studentized Breusch-Pagan
P-value	4.53E-07	7.56E-03	1.77E-03
BP	227.72		
df	132		
Note: BP is the test statistic, df is the degrees of freedom. These values apply to the Whites test only.			

Table A17: Results of tests for heteroscedasticity for buy-and-hold returns used in Regression 3.

	Whites test	Breusch-Pagan	studentized Breusch-Pagan
P-value	3.34E-12	2.20E-16	0.0002646
BP	275.92		
df	132		
Note: BP is the test statistic, df is the degrees of freedom. These values apply to the Whites test only.			

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Table A18: Results of tests for heteroscedasticity for return on equity used in Regression 3.

	Whites test	Breusch-Pagan	studentized Breusch-Pagan
P-value	2.20E-16	2.20E-16	1.92E-08
BP	485.35		
df	132		
Note: BP is the test statistic, df is the degrees of freedom. These values apply to the Whites test only.			

Table A19: Results of tests for heteroscedasticity for return on assets used in Regression 3.

	Whites test	Breusch-Pagan	studentized Breusch-Pagan
P-value	1	2.20E-16	5.27E-01
BP	38.847		
df	132		
Note: BP is the test statistic, df is the degrees of freedom. These values apply to the Whites test only.			

Table A20: Results of tests for heteroscedasticity for return on sales used in Regression 3.

	Whites test	Breusch-Pagan	studentized Breusch-Pagan
P-value	8.77E-14	2.20E-16	3.78E-02
BP	289.26		
df	132		
Note: BP is the test statistic, df is the degrees of freedom. These values apply to the Whites test only.			

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Table A21: Results for Arellano-Bond test for autocorrelation for regression 1A.

Y-variable	**BHR**	**ROE**	**ROA**
1st Degree P-value	0.003319	0.1879	0.09469
2nd Degree P-value	0.7908	0.4971	0.8964

Table A22: Results for Arellano-Bond test for autocorrelation for Regressions 1B.

Y-variable	**BHR**	**ROE**	**ROA**
1st Degree P-value	0.0009961	0.1798	0.09826
2nd Degree P-value	0.7814	0.3691	0.9731

Table A23: Results for Arellano-Bond test for autocorrelation for Regressions 2.

Y-variable	**ESG ~ BHR**	**ESG ~ ROE**	**ESG ~ ROA**	**ESG ~ ROS**
1st Degree P-value	0.5831	0.1628	0.3012	0.2168
2nd Degree P-value	0.3931	0.3074	0.3054	0.2735

Table A24: Results for Arellano-Bond test for autocorrelation for Regressions 3.

Y-variable	**BHR**	**ROE**	**ROA**
1st Degree P-value	6.52E-05	0.2084	0.06359
2nd Degree P-value	0.5284	0.3641	0.9653

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Table A25: Results for Sargan test for instrument validity for regression 1A.

Regression	**BHR**	**ROE**	**ROA**
P-value	0.36127	0.29241	0.36782

Table A26: Results for Sargan test for instrument validity for Regressions 1B.

Regression	**BHR**	**ROE**	**ROA**
P-value	0.36062	0.65751	0.54937

Table A27: Results for Sargan test for instrument validity for Regressions 2.

Regression	**ESG ~ BHR**	**ESG ~ ROE**	**ESG ~ ROA**	**ESG ~ ROS**
P-value	0.34016	0.46238	0.37578	0.3525

Table A28: Results for Sargan test for instrument validity for Regressions 3.

Regression	**BHR**	**ROE**	**ROA**
P-value	0.2078	0.34209	0.11133

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