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ESG and Risk-Adjusted Performance - A study on equity funds under Swedish management during the COVID-19 pandemic.

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ABSTRACT

This research study examines the risk-adjusted performance and portfolio risk of 60 large cap equity funds - mutual funds - under Swedish management. These funds apply environmental, social and governance criteria in their investment strategies. The empirical context concerns the COVID-19 situation and the context is divided into three periods, **before**, **during** and **after** the COVID-19 crisis. The ESG concept, modern portfolio and stakeholder theories are used to develop a theoretical base for the study on which the hypotheses are based which are summarized in a conceptual model. Secondary data regarding ESG and risk-adjusted returns are collected for each fund based on which the sharpe ratios and standard deviations (total or portfolio risk) for each fund are calculated. While there are associations between ESG and portfolio risk, no associations are found between ESG and sharpe ratios. As a result, this confirms the fact that ESG could be characterized as a mechanism to protect against downside risk in poor economic times but no association was established that ESG could also be used as a mechanism to determine efficiency in terms of risk-adjusted performance.

Sammanfattning

Denna forskningsstudie undersöker den riskjusterade avkastning och portföljsrisken av 60 Large-cap aktiefonder under svensk förvaltning. Dessa fonder tillämpar miljö-, samhälls- och företagsstyrningskriterier i deras investeringsstrategier. Den empiriska kontexten är relaterad till den rådande COVID-19-situationen och kontexten delas in i tre olika tidsperioder, **innan**, **under** och **efter** COVID-19-krisen. ESG-konceptet och den moderna portfölj- respektive intressentteorin används för att utveckla den teoretiska grunden för denna studie, vilket också utgör grunden för utvecklingen av hypoteser som beskrivs i den konceptuella modellen. Sekundära data angående ESG och riskjusterad avkastning samlas in för varje fond, där beräkningar görs för att få fram varje fonds Sharpe kvot och standardavvikelse (totala eller portföljsrisken). Avslutningsvis, konstaterar studien att det föreligger ett samband mellan ESG och portföljsrisken, men att inget samband föreligger mellan ESG och Sharpe kvoten. Detta bekräftar att ESG borde karaktäriseras som en mekanism kan skydda mot kursfall i en krissituation och i andra fall. Studien bekräftar dock inte att ESG också kan vara en mekanism som kan användas för att öka effektiviteten i riskjusterad avkastning.

LIST OF ACRONYMS

CAPM	Capital asset pricing model
ETF	Exchange traded fund
ESG	Environmental social governance
GD	Geographical diversification
GHG	Greenhouse gas
MPT	Modern portfolio theory
MSCI	Morgan Stanley Capital International
PRI	Principle of Responsible Investment
SDGs	Sustainable development goals
SR	Socially Responsible
SR	Sharpe ratio
SRI	Socially responsible investment
TR	Total risk
UN	United Nations
UNPRI	United Nations Principle of Responsible Investment

The following terms are used interchangeably:

Reward-to-volatility, sharpe ratio, risk-adjusted performance

Total risk, portfolio risk and standard deviation

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1. INTRODUCTION

This chapter introduces the concept of socially responsible investment (SRI) and provides information about institutional investors. Information about the ESG metric and its significance is also provided. The chapter ends by using the information to present the problematization followed by the research question and purpose of the study.

1.1 Institutional investors and SRI

It is beyond reasonable doubt that sustainability issues have become increasingly important across various domains of life in the face of climate change and other major historical incidents (Barnett, 2020; Eteokleous, 2016). According to the Paris agreement on climate change as well as the United Nations sustainable development goals (SDGs), a global economic transformation is needed to reduce the greenhouse gas (GHG) emissions and achieve a climate neutral world by mid-century. To materialize the goals set by the Paris agreement and SDGs, socially responsible investments (SRI) have a very essential role to play as it will process the economic transformation towards sustainability. (The Paris Agreement | UNFCCC, 2022; SUSTAINABLE DEVELOPMENT GOALS, 2022)

Institutional investors are defined as financial intermediaries investing money entrusted to them by people by holding shares in a wide range of securities or other assets. Financial institutions consist of mutual funds, pension funds, insurance companies, banks, trusts and other diversified financial forms. These institutions play a very important role in the functioning of the financial markets as they channel financial assets to their uses in the real economy. (Bodie et al., 2021) Furthermore, in the last few decades these institutions have become increasingly influential in their role and have established a “strategy of engagement” over their investments. In other words, today institutional investors are actively engaged in promoting SRI as they are legally required as well as influenced by the public and media to consider the social, environmental and

ethical impact of their investments. (Wen, 2009b) Large financial institutions have highly diversified portfolios and they are the representative of the global capital markets. With their universal scope, their portfolios are exposed to negative environmental consequences as they invest in different companies. Further, financial institutions can play a positive role in tackling challenges associated with environmental, social and ethical aspects of the business world by excluding and targeting companies for investment purposes that behave with regard to the SRI concept. (Cotter & Najah, 2011) According to Boermans and Galema (2019), SRI “has gained momentum among institutional investors, making them a powerful force in shaping responsible company behavior”.

Historically, the concept of SRI dates back to the 19th century and initially it was termed as “ethical investment” and it was set as a standard describing what types of investments were considered ethical and unethical. In the past, investing in businesses related to alcohol, gambling and tobacco were considered unethical products. However, the concept has been expanded and nowadays it covers a large array of issues and practices relating to environmental, ethical and social aspects of businesses. Further, the importance of SRI has been recognized in finance and it has been increasingly integrating into the financial sector and some financial institutions such as mutual funds have established strategies for integrating SRI in their investment portfolios. (Wen, 2009b) In addition, investors have been taking SRI seriously, recognizing that factors related to SRI are relevant to long-term risk and risk-adjusted performance. Due to this, the market for sustainable funds has been growing worldwide (Rompotis, 2022).

1.2 Environmental, social and governance (ESG)

ESG is a metric provided by different agencies evaluating the extent to which businesses and financial institutions take the environmental, social and governance aspects of their organizations into account (Popescu et al., 2021; Lopez De Silanes et al., 2022). For instance, funds are assigned different scores - low or high - depending on to what extent they incorporate ESG criteria into their investment portfolios (Lopez De Silanes et al., 2022). Funds incorporating ESG criteria into their investment portfolios is an increasing trend (Rompotis, 2022) and the amount of global sustainable assets - that apply ESG criteria - under management has exceeded 30

trillion dollars recently (Lopez De Silanes et al., 2022). The largest markets are the United States (48%), Europe (34%), Japan (8%), Canada (7%) and Australia/New Zealand (3%) (Global Sustainable Investment Alliance, 2020). The increase in sustainable investment has resulted in increased academic research in this area (Dai, 2020). Further, funds markets in the Nordic countries exhibit a stronger trend towards ESG aspects compared to the US, UK and central European countries (Sangiorgi & Schopohl, 2021). Furthermore, intergovernmental organizations such as the UN are also involved in promoting sustainable investment. The principles of responsible investment (PRI) is a United nations-supported international network of investors working together to support and promote sustainable investments based on six aspirational principles and committed signatories are obliged to follow the principles (UNPRI, n.d.).

This study focuses on the risk-adjusted performance and total risk of the equity funds under Swedish management incorporating ESG criteria into their portfolios, and whether the aforementioned measures are related to ESG quality and how they change depending on the amount of ESG scores they are assigned. In this study, the ESG metric is employed as a composite, not as individual components (E, S and G). Furthermore, the empirical data collected for this study covers 2019-2021. The empirical data covering 2019 is marked as period 1, a pre-COVID-19 period. The data coevering 2020 is marked as period 2, a period concerning during the COVID-19 pandemic and finally 2021 is marked as period 3, a period after the Covid-19 pandemic or a recovery period. This is to compare and evaluate how the same equity funds performed in the aforementioned periods.

1.3 Problematization

Mutual funds are increasingly incorporating ESG criteria into their portfolios to convey a message of responsibility in relation to the environment, society and a responsible governance of their organizations (Wen, 2009b). Incorporating ESG criteria also means that funds are less exposed to reputation, political and regulatory risks leading to lower volatility and return; offering potential to enhance risk-adjusted performance (Ashwin Kumar et al., 2016; Lopez De Silanes et al., 2022). The conventional wisdom in financial economics is that return on

investment is risk-adjusted; a higher risk premium is translated into a higher return and a lower risk premium is translated into a lower return (Bodie et al., 2021; Rompotis, 2022). In the same spirit, there is a lot of research suggesting that ESG or Socially responsible (SR) funds do not perform better in terms of risk-adjusted performance or perform equally good compared to their non-ESG peers (Hamilton et al., 1993; Krender et al 2005; Kurtz & diBartolomeo, 2011; Renneboog et al., 2011; Dolvin et al. 2019; Chang et al. 2020; Rompotis, 2022). In contrast, there is also evidence showing funds adopting ESG strategy into their portfolios yield better risk-adjusted performance compared to their benchmarks (Kempf & Osthoff, 2007; Derwall et al., 2004; Ashwin Kumar et al., 2016). Furthermore, there is also research claiming funds adopting ESG strategy into their portfolios perform better during crisis periods compared to conventional funds (Varma & Nofsinger, 2012) and this makes the COVID-19 crisis an appropriate context for investigating the relationship between mutual funds' ESG quality and their risk-adjusted performance as well as total risk.

The COVID-19 pandemic has shook the world and it has brought with it long lasting hurmanterian, social and economic challenges (Nielsen, 2003). In 2019, the COVID virus started to spread globally and in response, countries around the world implemented different measures to reduce the risk of infection (Adams-Prassl et al, 2020; Boettke & Powell, 2021). As a result, the global economy plunged into a record recession (World Bank Group, 2022) and its impact was different on different industries (Fox et al, 2020). However, as the real economy, the financial side of the economy was not immune either and experienced great turbulence during the COVID-19 crisis. The extent of the damage to the financial sector is still uncertain and institutional investors have begun to position their portfolios more defensively, which is translated into lower volatility. Therefore, ESG considerations are deemed important, particularly in the times of crisis. According to some institutional managers, ESG factors were deprioritized during the financial crisis of 2008-2009 and the focus was on solvency (*How We Help Clients | Sustainability, 2020*), but now it is the opposite and “if this trend takes root, it would be a departure from precedent”. (Nielsen, 2003)

However, as previously mentioned, there are conflicting research findings regarding the relationship between ESG and risk-adjusted performance and this discrepancy is regarded as a growing gap in the existing literature. Therefore, it is interesting to investigate whether the same or greater investment efficiency is possible with lower portfolio risk. We hope our research contributes by clarifying the discrepancy in the existing literature and encouraging more research to the topic, which will promote better investment decisions as well as bring more attention to the importance of ESG in the financial sector.

1.4 Research Question

In terms of risk-adjusted performance and portfolio risk, how did the equity funds under Swedish management with higher ESG quality perform **during** and **after** the COVID-19 crisis compared to a **pre-crisis period** ?

1.5 Purpose

The authors intend to describe and evaluate how equity funds under Swedish management with higher ESG quality performed during and after the COVID-19 crisis compared to a pre-crisis period. Collecting archival data about equity funds returns from three different periods (2019-2021), will enable us to describe the difference and evaluate it in terms of risk-adjusted performance and portfolio risk (total risk). This is to understand whether ESG criteria can limit downside risk and provide superior risk-adjusted performance in times of crises as well as after as the theory suggests. Overall, this study concerns whether more efficiency in risk-adjusted performance and less portfolio risk is possible by incorporating ESG criteria. This study will be of use to both institutional investors constructing their portfolios and practitioners that want to understand the practical implications of the emerging concept that the risk-adjusted principle might not be applicable when ESG strategy is in place.

2. THEORETICAL FRAMEWORK

This chapter consists of the ESG concept, modern portfolio and stakeholder theories as well as previous studies. Theoretical arguments are developed in relation to the research question and purpose of the study. Subsequently, hypotheses are developed followed by the conceptual model.

2.1 The concept of ESG

ESG stands for Environment, social and governance, and the concept concerns how firms behave in relation to these issues. Furthermore, the concept is also used as a metric and firms are evaluated and scored in terms of how responsibly they behave in relation to issues such as climate change, energy and carbon emission, human rights, equality, child labour and transparency etc. (Galbreath, 2012)

Regarding the **Environmental** component, firms are required to act responsibly in the face of climate change (Peck, 2010) and GHG emissions is an existential threat which has given rise to global warming and potential problems associated with our ecosystem (Liu et al., 2015; United Nations [UN], 1992). The opinions on cost regarding sustainable transition are split, some analysts argue of negative impact on profitability, while others argue the opposite (Klassen & McLaughlin, 1996). A disregard to global warming would mean a disaster in terms of cost and avoiding a potential disaster is more important than profitability (McKinsey & Company, 2020). Siddique et al. (2021) demonstrate that firms in transition will suffer from inferior financial performance in the short run, but will recover in the long run. Klassen and McLaughlin (1996) also find a positive relation between environmental performance and financial performance. Building on this, behaving environmentally friendly is playing an increasingly important role in terms of decision making for institutional investors.

The **Social** aspect is about people. For instance, an investment decision should consider that firms' working environment are not abusive, everyone should be treated equally regardless of

sex or skin color, promote human rights, strengthening diversity and freedom of speech. (Peck, 2010) According to Edman (2012), firms with higher employee satisfaction generate higher stock returns and such firms are more successful in recruiting and keeping talents; higher employee satisfaction is an effective recruitment tool.

The **Governance** aspect concerns issues at corporate level such as transparency and information disclosure (Chen et al., 2007). When the size of firms increases, separation of ownership and control occurs, which will give rise to principal-agent problems and conflict of interests between stakeholders. Information asymmetry and lack of transparency are the root cause of these problems which requires a good governance structure to tackle. (Goergen 2012; Chen et al., 2007) Peck (2010) asserts the lack of corporate governance will damage a firm's value and the owners within it. Furthermore, lack of corporate governance can also lead to unethical behavior like inappropriate accounting, embezzlement or other types of fraud (Peck, 2010). Research findings show there is a strong positive relationship between good corporate governance and its value (Chen et al. 2007; Chung et al. 2010; Attig et al. 2006). Corporate governance must not be seen as a must but rather as an opportunity to increase the firm's value (Balachandra & Faff 2015).

2.2 Modern Portfolio Theory (MPT) and Previous Studies

MPT is defined as the construction and management of optimal risky portfolios aiming to accomplish efficient diversification across asset classes and across individual securities within these assets. Efficient diversification is defined as the construction of investment portfolios that provide the lowest risk for a given level of expected return. Further, the concept of diversification concerns what and when to choose securities to diversify firm-specific risk. While firm-specific risk is diversifiable by constructing an optimal risky portfolio, risks associated with macroeconomic conditions are not diversifiable. However, standard deviation is defined as a common measurement tool for assessing volatility and relative risk of potential portfolios and, mathematically, the concept measures the spread of individual data points from their mean. Equivalently, a higher portfolio standard deviation is translated into a higher portfolio risk whereas a lower portfolio standard deviation is translated into a lower portfolio risk. This

concept is the basis for the capital allocation and CAPM (model) which imply that higher expected return is positively related to a higher risk premium. (Bodie et al., 2021) Building on this, incorporating ESG criteria into portfolio construction means funds are less exposed to risks associated with macroeconomic conditions (reputation, political and regulatory risks) and this will lead to lower volatility (Ashwin Kumar et al., 2016; Lopez De Silanes et al., 2022), which implies a lower portfolio risk.

However, in line with the risk and return paradigm above, Hamilton et al (1993) compared risk-adjusted performance of SR and traditional funds in the US during 1981-1990 and found no significant difference. In Europe, Kremer et al. (2005) compared risk-adjusted performance of SR and traditional funds from Sweden, UK, Germany and Netherland and found no evidence of SR funds superior performance. Furthermore, in research from Cortez et al. (2011) which compared financial performance of USA and European global funds with focus on SRI, no significant difference has been found in relation to both conventional and SR benchmarks. There is also previous research regarding the amount of money flowing into socially responsible funds and financial performance, but no statistically significant correlation has been found between these two variables (Renneboog et al., 2011).

Moreover, previous research also examined stocks and mutual funds in terms of ESG scores - mutual funds with low and high ESG scores - in relation to their risk-adjusted performance and found no significant relation between them (Halbritter and Dorfleitner 2015; Dolvin et al. 2019; Chang et al. 2020). The most recent study conducted by Rompotis (2022) examined 49 ESG ETFs (Exchange Traded Funds) funds in the UK using CAPM, Sharpe and Treynor ratios in order to assess efficiency in terms of risk-adjusted performance. He found no significant alpha achieved by ESG ETFs and no differences were found in Sharpe and Treynor ratios compared to their benchmarks.

In contrast to the risk and return paradigm above, there are other studies claiming superior risk-adjusted performance of SR and funds incorporating ESG criteria compared to their benchmarks. Research from Kempf and Osthoff (2007) examining financial performance of

funds with SR ratings found that funds with high SR ratings outperformed funds with low SR ratings by abnormal returns up to 8.7% on an annual basis. Similarly, Gil-Bazo et al. (2010) compared the financial performance of SR and conventional funds in the USA during the period of 1997-2005 and found that SR funds perform better than their conventional peers. The comparison concerned SR funds managed by companies that specialized in socially responsible investing. Another study conducted by Derwall et al. (2005), which evaluated the eco-efficiency levels of two different portfolios, concluded that the portfolio holding highly ranked securities in terms of eco-efficiency performed better compared to the portfolio holding relatively low ranked securities in terms of eco-efficiency. The study covers the period 1995-2003 and several transaction costs are taken into account.

However, more relevant to our research is the research by Nofsinger and Varma (2014) which finds that SR funds perform better during crisis periods compared to normal market periods. In other words, the authors mean funds that have incorporated ESG criteria into their portfolio are able to limit downside risk and improve their risk-adjusted performance, particularly during crisis periods. Guenster (2012) argues as SR funds subject companies for screening for the purpose of implementing their ESG strategy, they run the risk of constructing undiversified portfolios which in turn could run the risk of underperformance during normal market periods. Building on this, investors are more concerned about downside risk during poor economic times and favor downside protection in return for some gains in good times (Glode, 2011). This argument is also supported by prospect theory which says that investors are more negatively affected by losses than positively affected by gains (Kahneman and Tversky 1979). Thus, downside protection is deemed essential in times of crisis and ESG funds that are characterized by such protection have the potential to yield better risk-adjusted performance compared to their benchmarks in such times.

2.3 Stakeholder Theory and Previous Studies

“Those with a moral claim on the actions of the firm are its stakeholders, namely consumers, employees, competitors, suppliers, government, as well as other actors in society.” (Verbeke & Tung, 2012, p. 529)

The stakeholder theory concerns business ethics and is defined as the influence or impact firms have on individuals or constituencies. These individuals and constituencies could consist of consumers, employees, suppliers, investors, government, community or the environment. (Wagner Mainardes et al, 2011; Pedrini & Ferri, 2019) More specifically, the theory is defined as, *“besides profit maximization, firms are also concerned with the interests of other stakeholders and society and reaching an equilibrium of interests among stakeholders is vital for the long-term survival of the firms” (Safa et al. 2021, p. 7).*

However, due to concern about climate change, socially responsible actions such as SRI is one way to respond to the concerns of the stakeholders (Safa et al. 2021) - individual investors. Furthermore, major historical events such as wars, pandemics or other catastrophes cause behavioral and attitudinal changes which cause further changes in stakeholder preferences. Over time, these preferences are developed into moral and ethical codes which subsequently will affect stakeholder attitude and behavior in terms of decision making. (Verbeke & Tung, 2012) Further, for firms to remain in business and competitive it is important to respond to changing stakeholders preferences and expectations (Verbeke & Tung, 2012) and this could potentially improve their performance during as well as after a crisis. In addition, it is important for firms to recognize key stakeholders essential to their business (Verbeke & Tung, 2012). Following this line of reasoning, due to challenges associated with climate change and other potential problems associated with the social and governance aspects of the business world, investment in socially responsible funds is an increasing trend and institutional investors should respond to this trend by adjusting their portfolios to include more firms that behave socially responsible.

Individual investors - people entrusting their money to financial institutions such as mutual funds which invest them on their behalf in a wide range of securities or other assets - (Bodie et al.,

2021) are considered one of the key stakeholders to financial institutions (Wagner Mainardes et al, 2011; Pedrini & Ferri, 2019) as they bring money to these institutions and their concerns regarding the environmental, social and governance aspects of investment should be taken into account. In turn, institutional investors are one of the key stakeholders (shareholders) to firms as they bring the same money from people in the form of equity to these firms. Building on this, institutional investors such as mutual funds tend to have large influence on firms as they are the shareholders with large equity ownerships compared to individual shareholders. In other words, large equity ownership makes firms more dependent on institutional investors as it means lower capital cost and other benefits and institutional investors' concerns with respect to ESG should be taken into account by these firms. (Wen, 2009b) Following this line of reasoning, public and media pressure influence institutional investors to construct socially responsible portfolios which institutional investors in turn influence firms to behave socially responsible (Wen, 2009b). For instance, firms could behave socially responsible by investing in energy-saving technologies to reduce carbon footprint; investing in green technology to reduce costs; investing in improving social criteria to avoid or limit the risk of controversy or bad publicity; investing in governance structures in order to improve performance and by mitigating risks of agency problems and other misbehavior by management. (Lopez De Silanes et al., 2022)

Based on the arguments above, institutional investors - mutual funds - believe that there is a positive relationship between ESG and risk-adjusted performance (Amel-Zadeh & Serafeim, 2017) and there are several explanations for that. First, funds that incorporate ESG criteria into their portfolios, for instance, investing in companies that constantly reduce their carbon footprint by using energy-saving or green technology is a sign of positive environmental performance and is seen as a high-quality firm by people (Dowell et al., 2000). Research suggests firms that show better environmental performance have higher intangible-asset valuations as well as better risk-adjusted performance (Konar & Cohen, 2001).

Another explanation is the increasing trend among institutional investors towards investing in firms with better ESG performance. For instance, when a large number of mutual funds invest in high quality ESG firms, there will be fewer investors willing to invest in poor-quality firms in terms of ESG and it will be harder for these investors to diversify the risk of holding securities in

these firms. As a result, they will demand a higher risk premium and this will raise the cost of capital to these firms. (Lopez De Silanes et al., 2022) As result, this will have a negative effect on the financial performance of funds with low ESG quality whereas having a positive effect on the financial performance of funds with high ESG quality.

Finally, a third explanation for a positive relationship between ESG and risk-adjusted performance concerns the risk benefits related to firms' ESG characteristics which is in turn related to the impact ESG have on the financial performance at the portfolio level (Lopez De Silanes et al., 2022). Building on this, while to some extent, improved financial performance of ESG funds depends on how the portfolio managers use ESG screening (Heinkel et al., 2001), time is another factor that explains some of the improved financial performance of ESG funds (Varma & Nofsinger, 2012; Lopez De Silanes et al., 2022). The latter argument is more related to this study, as mutual funds invest in firms with better ESG performance, this will limit the tail risks in poor economic times (Lopez De Silanes et al., 2022). There is also research showing that ESG is negatively related to extreme downside risks (Hoepner et al, 2019; Bialkowski & Starks 2016). This means firms with high ESG quality are hedging against the possibility of more strict future environmental regulations or hedging against other potential risks related to the social or governance aspects and hedging in this fashion is translated into lower downside risk in times of crisis - such as COVID-19 - and better risk-adjusted performance both at the company and portfolio levels.

2.4 Econometric model

The capital asset pricing model (CAPM) is used to calculate a rate of return in excess of the risk-free rate. Sharpe ratio is used to calculate excess return per unit of risk. (Bodie et al., 2021)

2.4.1 CAPM

The CAPM model describes a relationship between excess return on an individual security, e.g. a fund, and that of a broad market-index portfolio. The model relates the rate of return in excess of the risk-free rate on a security to its systematic risk as measured by beta. The model is a common tool used widely in estimating cost of capital for firms, returns that investors would require and

evaluating the performance of managed portfolios. (Perold, 2004; Fama & French, 2004) The following linear equation (1) is representing CAPM.

$$E(R_i) - R_f = \alpha_i + \beta * [E(R_m) - R_f] \quad (1)$$

$E(R_i)$ is representing the rate of return in excess of the risk-free rate on a security and $E(R_m)$ is representing expected return of the market. $[E(R_m) - R_f]$ gives us the **risk premium** of the market portfolio. The term, $\beta * [E(R_m) - R_f]$ measures the risk premium of an individual security. Beta (β) measures a security's sensitivity to the marketwide economic shocks. Further, β is a measure of systematic risk relating a security's return to the return on the market portfolio - index. Alpha (α_i) is the vertical intercept of CAMP and indicates a security's excess return when the market return is zero. (Bodie et al., 2021)

For this study, the rates of return collected for each fund is calculated based on the CAPM. Thus, we move directly to another measurement scale called shape ratio to calculate risk-adjusted performance for each fund.

2.4.2 Sharpe Ratio

Sharpe Ratio (2)

$$S_i = \frac{\text{Portfolio risk premium}}{\text{Standard deviation of portfolio excess return}} = \frac{E(r_p) - r_f}{\sigma_p}$$

Sharpe ratio (2) - also called risk adjusted performance or reward-to-volatility - is defined as average return of a portfolio in excess of the risk-free rate per unit of total risk. Total risk or volatility is a portfolio's standard deviation measured by the price fluctuations of the portfolio

during a certain period, e.g. 12 months. Further, $E(r_p)$ is equal to the return of a portfolio, r_f is equal to the risk-free rate and σ_p is equal to the standard deviation of portfolio's excess return. However, a higher sharpe ratio is an indication of more efficient portfolios or a higher return per unit of total risk which means the investor is better compensated for the risks he takes. Furthermore, as standard deviation is an appropriate measure of risk for diversified portfolios, sharpe ratio is an appropriate tool for ranking portfolios return to total risk. (Bodie et al., 2021)

However, applying sharpe ratio will help us understand how efficient different portfolios are and we will investigate further whether any relationship exists between ESG and risk-adjusted performance as well as total risk.

2.5 Hypotheses development

As previously mentioned, there is a lot of research with conflicting findings regarding the relationship between ESG and risk-adjusted performance of funds (Derwall et al. 2005; Hoepner et al, 2019; Bialkowski & Starks 2016 ;Gil-Bazo et al. 2010; Hamilton et al 1993; Renneboog et al., 2011). There is also research suggesting funds incorporating ESG criteria perform better during and in the aftermath of a crisis (Nofsinger and Varma 2014), which this study focuses on. However, previously it was argued that crises cause attitudinal and behavioral changes which cause further changes in stakeholder preferences and these preferences are developed into moral and ethical codes which subsequently will affect stakeholder attitude and behavior in terms of decision making (Verbeke & Tung, 2012). As effects of crises are more pronounced initially (Safa et al. 2021), investors are more concerned about downside risk during such times and favor downside protection in return for some gains in good times (Glode, 2011). This is also in line with prospect theory which says that investors are more negatively affected by losses than positively affected by gains (Kahneman and Tversky 1979). Further, incorporating ESG criteria is suggested to limit downside risks (Hoepner et al, 2019; Bialkowski & Starks 2016; Lopez De Silanes et al., 2022) in the face of potential crises. Based on these theoretical arguments, the following hypotheses are developed.

H1. Reward-to-volatility (sharpe ratio) is positively related to higher ESG scores **during** a crisis compared to pre-crisis periods.

H2: Reward-to-volatility (sharpe ratio) is positively related to higher ESG scores **after** a crisis compared to pre-crisis periods.

H3. Total risk (standard deviation) is negatively related to higher ESG scores **during** a crisis compared to a pre-crisis period.

H4: Total risk (standard deviation) is negatively related to higher ESG scores **after** a crisis compared to a pre-crisis period.

2.6 Conceptual framework

Conceptualization concerns *“the process of specifying what we mean by a term. Conceptualization helps to translate portions of an abstract theory into testable hypotheses involving specific variables.”* (Chambliss, 2022, p. 54) Conceptualization of this study is summarized in *Figure 1* below. The model consists of one independent variable, *ESG scores*, and two dependent variables, *sharpe ratio* (SR) and *total risk* (TR), as well as an intercept dummy variable, *geographical diversification* (GD). However, the conceptual model is based on our theoretical arguments above and it is suggested that higher ESG scores yield more efficiency in terms of risk-adjusted performance (sharpe ratio) during and after (as a result of) a crisis compared to a pre-crisis period. Also, it is suggested that higher ESG scores means lower total or portfolio risk and this relationship should be more pronounced during and after a crisis period compared to a pre-crisis period.

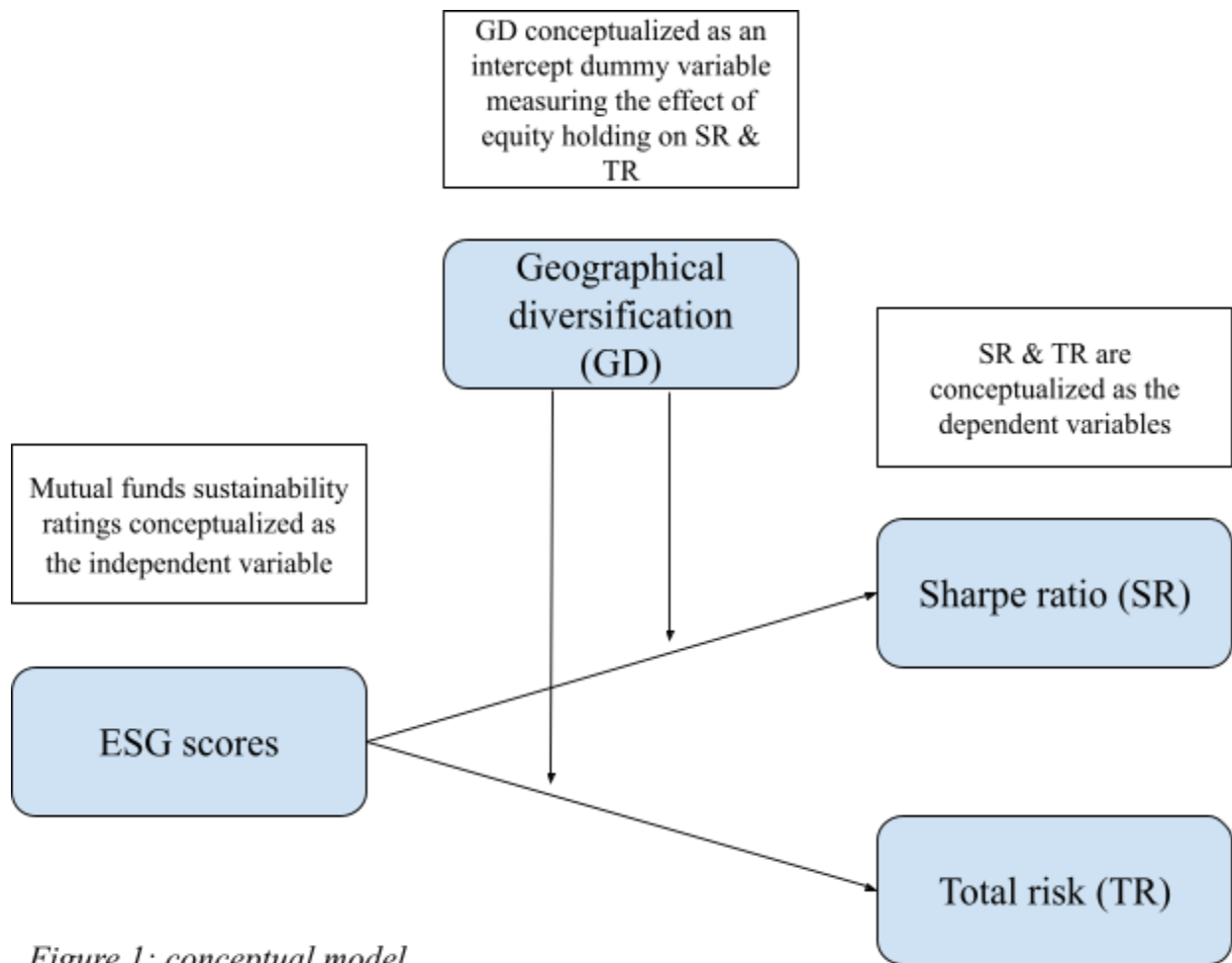


Figure 1: conceptual model

3. METHODOLOGY

This chapter presents the research strategy of this study, followed by data collection. Operationalization, the process by which the concept was measured is explained next, followed by sample selection and data analysis. The chapter ends with reliability and validity concerning the quality of the study.

3.1 Research strategy

There are different methodological choices such as quantitative and qualitative methods on which a research is based. The difference between them is based on the use of numeric and non-numeric data. Further, there are also different research philosophies such as positivism, interpretivism, pragmatism etc, which help us study and understand the social and natural world around us. (Saunders et al, 2016) As investors are concerned about risk and return and ESG is suggested to improve efficiency in terms of risk-adjusted performance and limit portfolio risk (Ashwin Kumar et al., 2016; Lopez De Silanes et al., 2022), a pragmatist position is adopted for this study as it focuses on practical solutions, e.g., whether it is more efficient to construct or reconstruct portfolios by incorporating ESG criteria in crises or poor economic times. Also, an inductive approach to theory development is adopted and it concerns generalizing from the specific to the general (Saunders et al, 2016). Building on this, conflicting research findings suggest a relationship between ESG and more efficiency in terms of risk-adjusted performance (Kempf & Osthoff, 2007; Ashwin Kumar et al., 2016) and an inductive approach is appropriate as it generalizes from specific to general.

Finally, the quantitative method was chosen for this study and this is based on the type of data (numeric), the econometric models used in this study, research question and purpose of the study. Concerning data collection, survey secondary data will be used in this study. Due to digitalization, secondary data are widely available and they offer a rich source of data to analyze.

(Saunders et al, 2016) Collecting secondary data will enable us to test the hypotheses as well as describe and evaluate the outcome of our research.

3.2 The econometric models

The following econometric models are used in this study: CAPM, regression analysis and sharpe ratio. Although the CAPM has not been used directly to calculate the expected rate of return, monthly rates of return collected for each fund used is calculated based on the CAPM. As previously mentioned, the model relates the rate of return in excess of the risk-free rate on a security to its systematic risk as measured by beta (Bodie et al., 2021). It is a common model and widely used in the financial sector to calculate the rate of return on a security. Similar studies have used the CAPM to calculate rates of return. The most recent study by Rompotis (2022) used CAPM to examine the risk-adjusted performance of 49 ESG ETFs (Exchange Traded Funds) funds in the UK. Another study by Erlsson and Björkman (2019) used CAPM to calculate rates of return of global funds to examine the relationship between financial performance and ESG-strategy. Thus, CAPM is the most conventional tool and the rates of return calculated based on this model are appropriate to be used for further analysis.

Sharpe ratio is another measurement tool used in this study. Due to its simplicity and easiness, the tool is widely used to measure risk-adjusted performance on portfolio level. Sharpe ratio which is based on the assumptions of the CAPM; performance is measured as the excess return relative to the risk free rate whereas risk-adjustment is provided by the asset return's volatility, or, the return's standard deviation. (Gatfaoui, 2015) As the study partly concerns efficiency in terms of risk-adjusted performance in relation to ESG, sharpe ratio is the appropriate tool to use as it will give us reward per unit of total risk (portfolio risk). Similar studies have used shape ratio to measure risk-adjusted performance. Rompotis (2022) have used sharpe ratio to evaluate risk-adjusted performance and how well an ESG ETF in the UK compensates its investors per unit of total risk compared to the index and a higher sharpe is translated into better performance of the funds. Another study conducted by Ashwin Kumar et al (2016) uses sharpe ratio exactly for the same purpose; whether efficiency improvement is possible in the relationship between reward and portfolio risk.

As the hypotheses are concerned about the relationships between sharpe ratio (reward-to-volatility) and ESG as well as total risk (standard deviation) and ESG, regression analysis is used to test these relationships. Regression analysis is the frequently used method to estimate relationships in econometrics and it attempts to explain the amount of movement in a dependent variable as a function of movement in an independent variable (Studenmund, 2017). Similar studies have used regression analysis to investigate the relationship between risk-adjusted performance and ESG as well as the relationship between total risk and ESG (Rompotis 2022; Ashwin Kumar et al 2016; Nofsinger and Varma, 2014; Erlasson and Björkman; 2019). However, as we have sharpe ratio and total risk as dependent variables and ESG as an independent variable, regression analysis is necessary to use.

3.3 Data collection

After developing the theoretical framework, survey secondary data were collected from Morningstar to test the hypotheses or the relationship between the variables in our conceptual model. There are different agencies such as MSCI, Bloomberg, Morningstar and Moody's corporation providing financial data and sustainability ratings about funds. However, there are both advantages and disadvantages with secondary data. Advantages are that it is less time consuming to collect, it is unobtrusive; collecting what is necessary depending on the research question and purpose of the study and can provide comparative and contextual data (Saunders et al, 2016). Disadvantages are such as access may be difficult or there may be no real control over data quality (Saunders et al, 2016). For this study, we collected secondary data from Morningstar. This is due to affordability as Morningstar provides free access. The secondary data collected concerns return of the funds and sustainability ratings; all data necessary to test the relationships in our conceptual model. Our supervisor was also consulted to make sure we are collecting the necessary data.

3.4 Operationalization

While conceptualization is the process of translating portions of a theory into testable hypotheses involving specific variables (Chambliss, 2022), operationalization concerns how these variables are measured, particularly, what procedures are used to conceptualize variables and measure them by gathering data (Bell et al, 2018; Saunders et al, 2016). After presenting the research topic followed by the problematization and research question and purpose of the study, MPT and stakeholder theories alongside previous studies were used to develop the theoretical framework. Subsequently, four hypotheses were developed and a conceptual model was created presenting the variables. To measure the strength of relationships between the variables, survey secondary data were collected. The data concerns sustainability rating and risk-adjusted return of the mutual funds. Furthermore, the data concerning risk-adjusted return were collected in two steps. First, monthly data were collected for each fund concerning three years (2019-2021) conceptualized by this study on which an average return and standard deviations were calculated for the same funds. Second, sharpe ratios were calculated for the same funds based on the outcome from the first step.






Finally, the variables in the conceptual model were tested in two steps. First, the relationship between the independent and dependent variables were tested, second, the intercept dummy variable was included to examine its effect on the dependent variables.

3.4.1 Independent variable

An independent variable “*is being manipulated or changed to measure its impact on a dependent variable*” (Saunders et al, 2016, p. 191). This study has one independent variable: *ESG scores*. This variable is measured by collecting sustainability ratings or scores for each fund chosen for this study. According to Morningstar, all funds are assigned sustainability scores which range from 1 to 5. Score 1 is corresponding to low ESG quality whereas score 5 is corresponding to high ESG quality, see *figure 2* below (Morningstar, 2021). As previously suggested, the independent variable measures whether higher quality ESG funds have any correlation with risk adjusted performance and portfolio risk and how strong the potential correlations are.

Figure 2: Sustainability Rating

Morningstar Sustainability Rating

Distribution	Score	Descriptive Rank	Rating Icon
Highest 10%	5	High	
Next 22.5%	4	Above Average	
Next 35%	3	Average	
Next 22.5%	2	Below Average	
Lowest 10%	1	Low	

3.4.2 Dependent variables

A dependent variable is a “*variable that may change in response to changes in other variables; observed outcome or result from manipulation of another variable*” (Saunders et al, 2016, p. 191). This study has two dependent variables, sharpe ratio (SR) and total risk (TR). SR is measured by collecting monthly return for each fund and subsequently calculating its standard deviation and finally dividing each portfolio’s risk premium to its standard deviation. See SR formula in *section 2.4.2*. As previously suggested, SR measures whether risk-adjusted performance changes in the hypothesized direction in response to changes in the independent variable, ESG.

TR is the second dependent variable and measures total or portfolio risk. In other words, TR is equal to a portfolio's standard deviation. As previously hypothesized, TR is to show whether higher ESG quality would mean lower TR; negative correlation.

3.4.3 Intercept dummy variable

Due to their qualitative nature, some concepts are impossible to include in a regression equation as they cannot be expressed as a number. Using a dummy variable is one way to quantify such qualitative concepts into numbers and they take on the value of one or zero depending on whether a certain condition is met. (Studenmund, 2017) Geographical diversification (GD) is the intercept dummy variable for this study representing the geographical diversification of Swedish mutual funds. Swedish mutual funds with European holdings are assigned a value of one and Swedish funds with global holdings are assigned a value of zero. In this study, the intercept dummy variable measures the effect of Swedish funds with European holdings relative to global holdings on the portfolios' SR and TR.

3.5 Sample selection

Risk-adjusted performance is a well known principle in the financial sector and investors desire more efficiency in terms of risk-adjusted performance (Bodie et al., 202). Although there are conflicting research findings about ESG's relation to more efficiency in terms of risk-adjusted performance (Kurtz & diBartolomeo, 2011; Renneboog et al., 2011; Dolvin et al. 2019; Chang et al. 2020; Rompotis, 2022), one way mutual funds can achieve more efficiency in risk-adjusted performance is to incorporate ESG criteria (Kempf & Osthoff, 2007; Derwall et al., 2004; Ashwin Kumar et al., 2016) and the evidence of more efficiency in risk-adjusted performance is more pronounced in times of crisis (Varma & Nofsinger, 2012). As the prospect theory says that investors are more negatively affected by losses than positively affected by gains (Kahneman and Tversky 1979), it means downside protection is important in times of crisis and therefore the COVID-19 context along with the Swedish mutual funds market was selected as an empirical context for this study.

Given the empirical context of the study, the authors collected 60 mutual funds under Swedish management. Mutual funds is a common name for a diverse set of funds such as equity, bond, specialized sector and index funds (Bodie et al., 202). The sample includes only 60 equity funds. Equity funds normally invest in stock and other types of securities at the portfolio manager's discretion (Bodie et al., 202). Further, the sample includes only large cap equity funds both with European and global holdings. Large caps are also characterized as *income funds* and they are

less riskier in times of crisis compared to *growth funds* (Bodie et al., 2021). The sample includes 30 large cap European and 30 large cap global equity funds. This deliberate distinction is made to assess the effect of European large cap equity funds relative to global large cap equity funds in terms of risk-adjusted performance and portfolio risk. Further, the sample data was divided into three periods, 2019, 2020 and 2021. Period 2019 concerns a pre-covid market, 2020 concerns a market period during COVID-19 and 2021 concerns a period post-covid-19 market. This is to investigate whether any difference in terms of risk-adjusted performance and portfolio risk exist between the three periods. Finally, the sample data for all three periods concerns the same equity funds.

3.6 Data analysis

Morningstar was used mainly to collect necessary data and sustainability ratings for each fund. The data was manually transferred to excel sheets in order to calculate necessary metrics for further analysis. In other words, sharpe ratios and standard deviations were calculated first and sustainability ratings were sorted out before running the regressions for each period. Furthermore, descriptive statistics are used to check the central tendency and variability of the data set (Saunders, 2016). More specifically, mean, standard deviation, minimum and maximum values were checked. To further analyze the hypotheses and investigate the strength of the relationship between the variables, three sets of linear regression analyses corresponding to three periods were performed. To check statistical significance, critical t-values were used at 1%, 5% and 10% levels of significance. To check for multicollinearity between the independent and dummy variables, the simple correlation coefficient was measured and it was far below the arbitrary threshold of 0.8 (Studenmund, 2017). Heteroskedasticity was also checked by running Breusch-Pagan test for all regression models. The variables were also checked for outliers. Tools such as Excel and R studio were used to perform these analyses.

3.7 Reliability and Validity

Reliability and validity concern the rigor of a research study which is referred to as precision of a research in terms of planning, collecting data, analysis and reporting. Further, rigor concerns the

quality of a research design which sets the conditions for evaluating research quality. However, reliability refers to replication and consistency of a research design. This means replicating earlier research designs resulting in the same findings means that the research is reliable. In contrast, validity refers to the appropriateness and accuracy of the measures used in research and whether these measures really measure what is intended to be measured according to the research question and purpose of the study. (Saunders, 2016)

Certain criteria are recommended to ensure reliability in a research study such as internal and external reliability (Saunders, 2016). To ensure this, both authors were involved from the very beginning to formulate the research question and have an agreement about its relation to the research problem as well as agreeing about the purpose of the study and its relation to the conceptual model based on the theoretical framework. This was to make sure that the necessary data is collected and a consistent relationship is established between all stages of this study in order to ensure internal reliability. To further ensure reliability, both authors collected the necessary data with most accuracy and explained in detail exactly what type of data were collected, what data collection techniques were used and how the data was analyzed in order to avoid research error and bias and to make it easier for other researchers to replicate this research design.

The quality of a research also depends on validity and certain criteria are also recommended to ensure validity. (Saunders, 2016) To ensure internal validity, a problematization of the phenomenon being studied was developed. Subsequently, relevant theoretical arguments were developed on which the variables and hypotheses are based. Relevant data were collected to measure the strength of the relationships between the variables. To ensure external validity, the authors collected data and divided them into three sets (periods). This is to ensure the samples are representative of the population and avoid sampling bias. As well as due to the sharp decline and recovery of the financial markets in 2020, the authors created three sets of regression models. This is to ensure no unrelated event influences the outcomes and avoid situational effect. Additionally, our supervisor was also consulted to ensure we are using the appropriate measures.

4. RESULTS

This chapter presents and describes the results of this study. The descriptive statistics are presented first, followed by regression analyses. Three sets of regression analyses are performed to explore the relationship between the variables.

4.1 Descriptive statistics

Descriptive statistics describe data in terms of central tendency and dispersion. Measures of central tendency include the mean, median and mode and measures of dispersion include standard deviation, variance, minimum and maximum values. (Saunders, 2016) For this study, the mean, standard deviation, minimum and maximum values for all variables are calculated. As previously mentioned, the same 60 equity funds under Swedish management both with EU and global holdings were used for further analysis in all three periods covering 2019 to 2021. Concerning period 1 (2019), a period marked as pre-COVID-19, the mean and standard deviation values for the independent variable (ESG) are 3.38 and 1.26. The mean and standard deviation values for the first dependent variable (SR) are 0.598 and 0.367. Further, the mean value for the second dependent variable (TR) is 4.33 and its standard deviation is 1.1. For more details, *see table 1*.

Table 1: descriptive statistics (2019) - period 1, pre Covid-19

Variable	Obs	Missing	Mean	StdDev	Min	Max
ESG	60	0	3.38	1.26	1	5
SR	60	0	0.598	0.367	-0.62	2.55
TR	60	0	4.33	1.1	2.64	8.78

Table 2 is presenting the descriptive statistics for period 2 (2020), a period marked as during the COVID-19 pandemic. The mean and standard deviation values for ESG are the same as in period 1. The mean value for SR in period 2 is 0.14, considerably less than its mean value in period 1, 0.598. The standard deviation for the same variable is 0.457, not very different from that of period 1. Furthermore, the mean value for TR is 6.57, considerably larger from that of period 1. A noticeable difference is also observable in their standard deviations, 1.46 and 1.1 respectively. These differences in period 2 are translated into differences in the funds' efficiency in terms of risk-adjusted performance and total or portfolio risk. For more details, *see table 2*.

Table 2: descriptive statistics (2020) - period 2, during Covid-19

Variable	Obs	Missing	Mean	StdDev	Min	Max
ESG	60	0	3.38	1.26	1	5
SR	60	0	0.14	0.457	-1.4	3.15
TR	60	0	6.57	1.46	3.99	10.3

Table 3 is presenting the descriptive statistics for period 3 (2021), a period marked as recovery after the COVID-19 pandemic. The mean and standard deviation values for ESG are the same as in period 1 and 2. The mean value for SR is 0.673 in period 3 and is larger from that of period 1 and 2. This is an indication of more efficiency in terms of risk-adjusted performance in this period compared to the previous periods (1 and 2). The standard deviation is 0.3, not very different compared to the previous periods. Furthermore, the mean value for TR is 3.16 and is smaller from that of period 1 and 2. This is an indication of lower portfolio risk in the recovery period compared to the previous periods. For more details, *see table 3*.

Table 3: descriptive statistics (2021) - period 3, recovering after Covid-19

Variable	Obs	Missing	Mean	StdDev	Min	Max
ESG	60	0	3.38	1.26	1	5
SR	60	0	0.673	0.3	-0.68	1.11
TR	60	0	3.16	0.686	2.11	4.89

Regarding the independent variable, ESG, since the same sustainability scores were used in all three periods, there is no difference between its mean and standard deviation in any period. Regarding the dependent variables, SR and TR, the mean value for SR in 2021 (period 3) is larger than its mean values in the previous periods. This is an indication of more efficiency in risk-adjusted performance in 2021, a period marked as recovery after the COVID-19 pandemic, compared to the previous periods, pre-COVID-19 and during the COVID-19 pandemic. However, the mean value for SR in period 2 is smaller than in period 1, indicating a lower efficiency in terms of risk-adjusted performance during the COVID-19 pandemic compared to the pre-COVID-19 period. Further, the mean value for TR is largest in period 2, indicating higher total risk or portfolio risk during the COVID-19 pandemic whereas it is smallest in 2021 indicating a lower total risk in the recovery period after the COVID-19 pandemic. In sum, there are some differences comparing the descriptive statistics for the three periods and they will be further analyzed in the subsequent chapter. For more details, *see tables 1, 2 and 3*.

4.2 Regression analysis

Simple linear regression analysis is used to assess the strength of relationships between the dependent and independent variables. The variables were also checked for outliers, no outliers were found. Three sets of regression analyses were performed to determine the relationships between ESG, SR, TR and GD and they are summarized in model 1 to 3 below. Model 1 concerns the pre-COVID-19 period, model 2 concerns the period during COVID-19 and model 3 concerns the recovery period after the COVID-19 pandemic.

Regarding model 1, no statistically significant relationship was found between ESG and SR. After including the dummy variable (GD), keeping ESG constant, no statistically significant effect of Swedish equity funds with EU holdings was found on SR. Further, a statistically significant relationship was found between ESG and TR. The association is significant at 5% level. This means there is a relationship between ESG and portfolio risk; better ESG quality should mean less portfolio risk in the pre-COVID-19 period. After including GD, keeping ESG constant, no significant effect of Swedish equity funds with EU holdings was found on TR. In sum, no significant association was found between ESG and SR whereas there is a significant association between ESG and TR concerning the pre-COVID-19 period. For more details, *see table 4.*

Table 4: Model 1 (2019) - period 1, pre Covid-19

Variables	SR	GD	TR	GD
(Intercept)	0.645 *** (0.137)	0.834 *** (0.201)	5.299 *** (0.391)	4.628 *** (0.566)
ESG	-0.014 (0.038)	-0.048 (0.046)	-0.287 ** (0.108)	-0.167 (0.130)
EU		-0.148 (0.116)		0.528 (0.326)
N	60	60	60	60
R2	0.002	0.030	0.108	0.147

*** p < 0.01; ** p < 0.05; * p < 0.1. SR and TR are the dependent, ESG is the independent and GD in the intercept dummy variables. For more details, see sections 2.6 and 3.4.

Regarding model 2, no statistically significant relationship was found between ESG and SR. After including GD, keeping ESG constant, we find no statistically significant effect of Swedish equity funds with EU holdings on SR. Further, a statistically significant relationship was found between ESG and TR, and the association is statistically significant at 10% level. This indicates the same equity funds under Swedish management with higher ESG quality, both with global and EU holdings, were less exposed to total risk during the COVID-19 pandemic. Equivalently, there is a relationship between ESG and portfolio risk; better ESG quality should mean less portfolio risk during the COVID-19 pandemic compared with the pre-COVID-19 period. After including GD, keeping ESG constant, we find a positive effect of EU funds on TR, statistically significant at 1%. This means Swedish equity funds with EU holding are more exposed to total risk compared to the global holding during the COVID-19 pandemic. For more details, *see table 5*.

Table 5: Model 2 (2020) - period 2, during Covid-19

Variables	SR	GD	TR	GD
(Intercept)	-0.028 (0.170)	0.037 (0.252)	7.481 *** (0.534)	5.179 *** (0.673)
ESG	0.050 (0.047)	0.038 (0.058)	-0.270 * (0.148)	0.143 (0.155)
EU		-0.051 (0.145)		1.809 *** (0.388)
N	60	60	60	60
R2	0.019	0.021	0.054	0.316

*** p < 0.01; ** p < 0.05; * p < 0.1. SR and TR are the dependent, ESG is the independent and GD in the intercept dummy variables. For more details, see sections 2.6 and 3.4.

Regarding model 3, no statistically significant relationship was found between ESG and SR. After including GD, keeping ESG constant, we find a statistically significant negative effect of Swedish equity funds with EU holdings on SR. As there is no statistically significant relationship between ESG and SR, GD's significant effect on the relationship between ESG and SR is meaningless as it is an intercept dummy variable. Further, a statistically significant relationship was found between ESG and TR, and the association is statistically significant at 1% level. This says the same equity funds under Swedish management with higher ESG quality, both with global and EU holdings, were even less exposed to total risk in the recovery period after the COVID-19 pandemic compared to the previous periods. After including GD, keeping ESG constant, no statistically significant effect of Swedish equity funds with EU holding was found on TR. For more details, *see table 6*.

Table 6: Model 3 (2021) - period 3, recovering after Covid-19

Variables	SR	GD	TR	GD
(Intercept)	0.517 ***	0.816 ***	4.035 ***	3.882 ***
	(0.110)	(0.154)	(0.226)	(0.334)
ESG	0.046	-0.008	-0.258 ***	-0.230 ***
	(0.031)	(0.035)	(0.063)	(0.077)
EU		-0.235 **		0.121
		(0.089)		(0.193)
N	60	60	60	60
R2	0.038	0.143	0.225	0.230

*** p < 0.01; ** p < 0.05; * p < 0.1. SR and TR are the dependent, ESG is the independent and GD in the intercept dummy variables. For more details, see sections 2.6 and 3.4.

To summarize, we have found correlations between ESG and TR in all three periods, but it does not imply a causation. Correlation between ESG and TR may not reflect the causal effect of ESG quality on portfolio risk and judgements about casualty must also include a healthy dose of economic theory and common sense. There are some differences comparing regression analyses for the three periods but they are not very significant. However, more on these differences in terms of the descriptive statistics and regression analyses will be presented in the subsequent chapter.

5. ANALYSIS

This chapter consists of analysis covering the results discovered during the data analysis. First, the relationship between ESG and risk-adjusted performance was analyzed and the chapter ends by analyzing the relationship between ESG and portfolio risk.

5.1 ESG and risk-adjusted performance

Regarding ESG and risk-adjusted performance of the equity funds under Swedish management, comparing the results of period 3 with periods 1 and 2 in terms of descriptive statistics, there is some indication that the same equity funds performed better concerning risk-adjusted performance in the recovery period after the COVID-19 pandemic compared to the previous periods. Although the mean value for the Sharpe Ratio (SR) in period 3 may not be much larger compared to period 1, there is still a noticeable difference based on which we could conclude that the same funds performed more efficiently in terms of risk-adjusted performance in the recovery period after the COVID-19 pandemic. Considering only the descriptive statistics, this is in line with findings from Nofsinger and Varma (2014) which show that SR funds perform better during and in the aftermath of crises compared to normal market periods. However, the mean value for SR is very low concerning the period during the COVID-19 pandemic (2020) compared to periods 1 and 3, which means the same equity funds indicate a very low efficiency in terms of risk-adjusted performance. This is probably due to the sharp decline and recovery of the stock markets during 2020 as it was the year in which the effect of COVID-19 was realized most on businesses and the wider economy.

Regarding the $H1$ and $H2$, which concern the relationship between reward-to-volatility and ESG scores **during** and **after** a crisis compared to a pre-crisis period, although there are research findings both for and against the hypothesized relationship, we find no statistically significant relationship based on models 2 and 3 to support this. Thus, concerning $H1$ and $H2$, we do not reject the null hypotheses.

However, there are several possible explanations for this. First, for instance, the conventional wisdom or principle in financial economics regarding that return is risk-adjusted is valid regardless of ESG strategies or any crisis period. This means taking more risk is still the valid requirement for more efficiency in terms of risk-adjusted performance. This finding is in line with research from Kremer et al (2005), Hamilton et al (1993), Cortez et al. (2011) and Rompotis (2022), which find no evidence of better risk-adjusted performance of SR funds.

Another reason could be that SRI has only recently received much attention, in particular after the importance of tackling climate change was brought into spotlight (e.g., through the Paris agreement on climate change) as well as a result of the COVID-19 pandemic and how to treat the environment to avoid future crises. However, it normally takes longer until issues such as responsible and ethical investments are institutionalized and developed into preferences and practices both on individual and aggregate levels in order to affect decision making on both levels. When change on this scale takes root, a large number of institutional investors can act together to invest in high quality ESG firms and there will be fewer left to invest in poor-quality ESG firms and it will be harder for these investors to diversify the risk of holding securities in these firms. As a result, they will demand a higher risk premium and this will raise the cost of capital to these firms and it will have a negative effect on the risk-adjusted performance of funds with lower ESG quality. This is in line with research from Lopez De Silanes et al., (2022). This means more time is required until practices such as SRI are institutionalized in a society so that it can affect decision making on different levels and subsequently businesses and financial institutions will follow suit as they will be required by the prevailing institutional values and societies they are operating in.

A third reason could be that the relationship between ESG and risk-adjusted performance is a new phenomena and the extant research findings are conflicting due to data scarcity. More financial data like annual rate of return is needed to understand the effect of this new trend - sustainable funds - on the relationship between ESG and risk-adjusted performance, but that is

only possible in the future as more data regarding the performance of these funds will be available.

Finally, regarding *H1* which is based on period 2 year 2020 (during the COVID-19 pandemic), one reason for finding no statistical significant relation between ESG and reward-to-volatility could be that year 2020 was shook by turbulence caused by COVID-19 onslaught on the financial markets.

5.2 ESG and portfolio risk

Regarding ESG and total or portfolio risk of the equity funds under Swedish management, comparing the results of period 3 with periods 1 and 2 in terms of descriptive statistics, there is a clear indication that the same equity funds were exposed to less total risk in the period recovery period after the COVID-19 pandemic compared to the previous periods. This can be seen by comparing its mean value with that of the other periods, pre and during the COVID-19 pandemic. This result is in line with the previous research that ESG and sustainable funds are exposed to less portfolio risk compared to their benchmarks such as an index. However, considering the descriptive statistics for period 2, the mean value for TR is considerably higher than the two other periods, which indicates the same equity funds were exposed to considerably more portfolio risk during the COVID-19 pandemic. The reason could be the same for TR just as for the SR in the same period and that is probably due to the sharp decline and recovery of the stock markets during 2020 as it is marked by the realization of the COVID-19 effect on businesses and the wider economy. It means, as for other financial instruments and securities, the sudden decline in 2020 must have affected the distribution of return abnormally for the equity funds and such abnormal volatility most probably lead to higher standard deviations and subsequently to more risk on the portfolio level.

Regarding *H3*, which states, “total risk (standard deviation) is negatively related to higher ESG scores **during** a crisis compared to a pre-crisis period”, we have found an association between ESG and TR in the hypothesized direction with a 10% level of significance. Thus, we reject the null hypothesis that there is no negative relationship between ESG and TR during a crisis period.

This relationship means the higher the ESG quality of the equity funds, the less they are exposed to total risk during crisis periods. This conclusion is generally accepted in the extant literature that ESG or sustainable funds are less risky compared to traditional funds both in normal market periods and crisis periods. This result is in line with the risk and return principle; a higher risk premium is translated into a higher return and a lower risk premium is translated into a lower return. This should mean that lower risk premium, which ESG securities are accompanied with, should be considered as a huge advantage during crises as financial instruments seek protection during such times. However, this is also in line with the research findings from Lopez De Silanes et al., (2022); Hoepner et al, (2019); Bialkowski & Starks (2016) which say, investing in firms with better ESG quality will limit the downside risk or tail risk, particularly in poor economic times. This means when firms invest to improve their ESG quality, they hedge or position their investments in a way to avoid or limit potential risks associated with social, environmental and market wide economic aspects of their businesses. The COVID-19 pandemic could also be regarded as one such risk that had the potential to affect financial instruments and securities and the statistically significant association between ESG and TR shows that the equity funds had a limited downside protection during the COVID-19 pandemic. Furthermore, according to the coefficient between ESG and TR during the COVID-19 pandemic (period 2), it seems to be more inelastic compared to the pre-COVID-19 (period 1), which should be translated into that little more ESG scores or quality should yield more downside protection during a crisis situation. This conclusion is also in line with extant literature as improvement of ESG quality provides improved and more downside protection.

Regarding the *H4*, which states, “total risk (standard deviation) is negatively related to higher ESG scores **after** a crisis compared to a pre-crisis period”, we have found an association between ESG and TR in the hypothesized direction with a 1% level of significance. Thus, we reject the null hypothesis that there is no negative relationship between ESG and TR after a crisis period. This relationship means the higher the ESG quality of the equity funds, the less they are exposed to total risk after a crisis period. Comparing the coefficients between ESG and TR in all three models, we find that the coefficient in the third period, recovery after the COVID-19 pandemic, is more inelastic compared to the first two periods. This should mean the same equity funds have

become more sensitive to ESG quality; a little more increase in ESG quality should yield considerably more downside protection. Although the difference between the coefficients are not very huge, a small inelastic trend is observable during as well as in the recovery after the crisis, which should be translated into that ESG or SRI is becoming a more sensitive factor that could determine risk on portfolio level. However, this result is in line with both risk and return principle as well as with the stakeholder theory. Building on this, as historical events such as wars, pandemics or other catastrophes cause behavioral and attitudinal changes which cause further changes in stakeholder preferences, stakeholders both on individual and aggregate levels start to act differently, prefer choices that become more important as result of an event such as a crisis. This is true to some extent as a result of the COVID-19 pandemic and stakeholders such as people, entrusting their money to financial institutions as well as the financial institutions themselves that invest in firms, would prefer to be more prepared in the face of other potential crises and hedge their investments so as to avoid or limit meltdown of their assets.

6. CONCLUSIONS

To summarize, final conclusions are drawn which answer the research question. Subsequently, practical and theoretical implications, limitations and suggestions for future research are presented.

6.1 Final conclusions

The purpose of this study was to describe and evaluate how equity funds under Swedish management with higher ESG scores performed in terms of risk-adjusted performance and portfolio risk during and after the COVID-19 pandemic compared to a pre-COVID-19 period. Modern portfolio and stakeholder theories were used on which four hypotheses were developed. A conceptual model was created presenting the variables of the study. To answer the research question and purpose of the study, secondary data about 60 large cap equity funds under Swedish management both with EU and global holdings were collected. Descriptive statistics and regression analyses were performed and as a result *H3 and H4* were supported whereas no associations were found to support *H1 and H2*.

This study has been partly able to answer the research question. Regarding ESG and risk-adjusted performance, no association was found between them and we can conclude that the risk and return principle is still valid in determining investment efficiency instead of any ESG strategy. Concerning ESG and portfolio risk, the study has shown that there is a relationship between ESG and portfolio risk; higher ESG quality lower TR or portfolio risk. Obviously a relationship between ESG and portfolio risk also existed before the COVID-19 crisis, according to period 1, but what is interesting is that the relationship is getting more inelastic for the same equity funds in the subsequent periods (during and in recovery after the COVID-19 crisis). The conclusion that could be drawn here is that ESG has become a more sensitive factor in determining portfolio risk. In sum, regardless of the importance of ESG and SRI today, it seems that preferences and practices are changing as a result of the increasing importance of

sustainability issues and this necessity will ultimately push ESG and SRI from margins to the mainstream.

6.2 Implications

The study obviously shows that ESG is a determining factor when it comes to portfolio risk and being protected from downside risk in poor economic times has proved to be very important for investors. Practically, the result confirms that ESG strategy could be used as a mechanism to avoid or limit downside risk in poor economic times and this should encourage portfolio managers to construct investment portfolios that provide the lowest risk. This mechanism is utterly important in crisis periods such as COVID-19.

Theoretically, while the study confirms that ESG and lower portfolio risk are related, it fails to fill the gap in the existing literature regarding the relationship between ESG and risk-adjusted performance and adds more to the conflicting research findings and the regarded discrepancy.

6.3 Limitations

There are some limitations of the study. Due to time constraints we were only able to collect a limited amount of data as we had to manually choose, collect and transfer fund data for further analysis. Time constraint limits the sample size and this could contribute to inconsistent results. Further, due to affordability, we chose Morningstar to collect the required data and the agency is regarded as low in quality and credibility compared to others. Low credibility increases the risk of biased data which further lead to inconsistent results. Another limitation could be that only large cap equity funds were chosen for this study and they are regarded as *income funds* and have limited growth opportunities compared to *growth funds*. Equivalently, large caps are not affected as small caps when there is market volatility and this factor could limit the relationship between ESG and risk-adjusted performance. Finally, although the study and the relevant data analysis were conducted with high precision, researcher error should not be ignored which could lead to inconsistent results.

6.4 Future research

Crisis situations such as the COVID-19 pandemic lead to many changes both on individual and aggregate levels and these changes induce interesting avenues for future research. We recommend a larger sample of large cap equity funds to test the conceptual model and validate the results of this study. As large caps are regarded as *income funds*, which are more immune to market volatilities compared to *growth funds*, another recommendation is to collect data about *growth funds* concerning the recovery period after the COVID-19 crisis and compare it to a during and a pre-crisis period in terms risk-adjusted performance (investment efficiency) and portfolio risk. In other words, test the same conceptual model by collecting data about *growth funds*. A third recommendation for future research is to investigate other types of mutual funds such as sector funds. There are sector funds that invest in specific industries such as renewable energy. There are also sector funds specifically focusing on ESG and it would be interesting to use these funds and test the conceptual model of this study.

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