ESG and systematic risk of Canadian equity mutual funds

By

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Dalhousie University is located in Mi’kma’ki,
the ancestral and unceded territory of the Mi’kmaq.
We are all Treaty people.

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Abstract

Investment decisions based on responsible investment (RI) criteria, which incorporate environmental, social, and governance (ESG) factors into consideration are becoming increasingly important in today's financial markets, both in terms of assets under management and number of investors. However, there is no consensus regarding the outperformance of RI relative to conventional investments from the viewpoint of ex-post performance. This research investigates the nature of return differential between responsible investing and conventional investing within the well-known risk-return paradigm. From the viewpoint of ex-ante equity risk premium, the Fama and French five-factor model (2015) combined with an ESG-related factor is applied to returns of 154 Canadian open-end equity mutual funds for the period January 2016 to June 2023. Empirical findings include that Canadian open-end equity funds tend to hedge the ESG-related systematic risk and exposure to ESG-related systematic risk is not significantly priced in the market.

List of Abbreviations Used

ESG	Environmental, Social and Governance
CSR	Corporate Social Responsibility
CSP	Corporate Social Performance
CFP	Corporate Financial Performance
CI	Conventional Investing
RI	Responsible Investing
MPT	Modern Portfolio Theory
ERP	Equity Risk Premium
EMH	Efficient Market Hypothesis
CAPM	Capital Asset Pricing Model

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Chapter 1: Introduction

Over the past decade, responsible investments (RI), frequently called ethical investments, socially responsible investments, or sustainable investments, have grown rapidly around the world. RI is an investment process that incorporates environmental, social, and governance (ESG) factors into the selection and management of investments. Environmental issues generally include the conservation of natural resources, climate change, water and waste management, and more. Social issues are those that relate to people and society and include human capital management, diversity and inclusion, human rights, and Indigenous and community relations. Governance issues relate to the controls, standards, and processes for running a company and overseeing its operations. RI is differentiated with conventional investing (CI), which is exclusively practiced on the basis of financial information. In most empirical findings to date, overall evidence on the historical performance gap between RI and CI is inconsistent (Friede, Busch, and Bassen, 2015).

The nature of the relationship between the socially beneficial behaviours of a corporation and its financial performance has long been debated, yet it remains unresolved. One group of scholars has argued, simply, that social responsibility detracts from a firm's financial performance (Friedman, 1970; McWilliams and Siegel, 1997; Jensen, 2002). Any discretionary expenditures on social betterment unnecessarily raise a firm's costs, thereby putting it at an economic disadvantage in a competitive market. In contrast, another group of scholars has argued that the better a firm's social performance, the better it can attract resources (Cochran and Wood, 1984; Waddock and Graves, 1997), obtain quality employees (Greening and Turban, 2000; Turban and Greening, 1997), market its products and services (Moskowitz, 1972), and even create unforeseen opportunities (Fombrun, Gardberg, and Barnett, 2000). Thus, social responsibility is a source of competitive advantage

(Porter, 1991; Porter and van der Linde, 1995). Empirical tests of these opposing positions have long produced mixed results, and so have not resolved this debate (Ullmann, 1985; Griffin and Mahon, 1997; Margolis and Walsh, 2003; McWilliams and Siegel, 2000; Wood and Jones, 1995). However, when ESG-weighting has a positive impact on financial performance, the nature of observed return differential between RI and CI has not been clearly clarified. For instance, Derwall et al. (2005) present evidence that a stock portfolio consisting of large-cap companies labelled 'most eco-efficient' sizably outperformed a less eco-efficient portfolio over the period 1995–2003. According to their findings, the observed performance difference cannot be explained by differences in market sensitivity, investment style, or industry bias.

Hence, the aim of this research is to explain the nature of return differential between RI and CI within the well-known risk-return paradigm. To do so, I focus on the ex-ante return differential rather than the ex-post return differential. Based on Jin (2018, P. 2), "the ex-post outperformance of RI depends on whether a financial loss is triggered by ESG-related events that the evidence on historical returns is naturally mixed. In contrast, RI can be considered as a hybrid of CI (Conventional Investment) and the downside protection against the ESG-related systematic risk to which CI is exposed. So, the ex-ante return differential between well-diversified RI and well-diversified CI depends on how large the exposure to ESG-related systematic risk is."

Based on this, the total equity risk premium (ERP) on CI can be decomposed into two components: ERP on RI and the price of downside protection by RI. By conducting this research, I want to learn whether corporate social performance (CSP) is compensated systematically through RI in the Canadian mutual fund market.

I conduct an analysis at the level of funds instead of shares of firms. Mutual funds seek to maximize performance across a portfolio of firms, not within a single firm. As with the firm-level debate, the basic issue concerns whether the costs of social responsibility are offset or exceeded by financial returns over some period. However, mutual funds are also concerned with diversification (Sharpe, 1964; Jensen, Black, and Scholes, 1972; Campbell et al., 2001; Geczy, Stambaugh, and Levin, 2021). According to the modern portfolio theory (MPT), diversification can reduce risk to arbitrarily low levels when all risk is firm-specific. If a mutual fund implements strict social performance criteria that exclude firms, industries, or sectors from its portfolio, that mutual fund may be unable to adequately diversify. Without ample diversification, the fund will be exposed to additional risk for a given level of return and so by definition will incur a loss in risk-adjusted financial returns. RI proponents argue that while there may be less potential breadth in an RI fund's portfolio, those firms chosen for the portfolio are substantively better managed than the average firm and so tend to generate equal or higher financial returns, even on a risk-adjusted basis. Critics of corporate social responsibility point out that it is costly and administratively burdensome for a fund to engage in socially responsible practices. They insist that these additional costs and administrative burdens directly detract from the bottom line and so can put socially responsible firms at a competitive disadvantage relative to rivals who do not engage in such practices (Friedman, 1970; McWilliams and Siegel, 1997; Jensen, 2002). However, even extensive diversification cannot eliminate risk when common sources of risk affect all firms. Thus, if it is found that RI is compensated systematically, then RI can be justified as an investment principle differentiable from CI. Also, since the systematic risk of RI would be compensated according to MPT, it would result in the ex-ante performance differential between RI and CI.

I modify the conventional Fama and French five-factor model (2015) (broad-market-related factor, size-related factor, valuation-related factor, profitability-related factor, and investment-related factor), and incorporate the ESG-related factor into the model (six-factor model, hereafter). Then, replicating the two-step procedure of Fama and MacBeth (1973), I estimate factor betas (loadings) of a sample of funds through the time-series regression. As the next step, I estimate the reward earned per unit of exposure to risk factors through the cross-section regression.

This two-step procedure is applied to returns on 154 Canadian open-end equity funds for the period of 90 recent months (January 2016 to June 2023). Empirical findings include that Canadian open-end equity funds tend to hedge the ESG-related systematic risk, and that the exposure to ESG-related systematic risk is not significantly priced in the market.

Contribution

This research aims to fill gaps in the existing literature by contributing in the following ways: (1) To the best of my knowledge, there is no research that specifically investigates the role of ESG as a systematic risk factor of Canadian mutual funds. (2) I apply Fama–French six-factor model (2018) and incorporate the ESG-related factor into the model (seven-factor model, hereafter) in the robustness test to answer the research question. This is the first time this model is used in this research context. (3) I also compare the pre– and post–Covid-19 periods to detect whether the pandemic affects the model's performance.

Limitation

There are some limitations to this research: (1) The sample studied in this thesis was obtained from the Kenneth French Data Library. As such, it does not construct its own factors or create its own test portfolios. Therefore, this study trusts that the portfolios and factor definitions are appropriate for use in reaching the study's research objectives. (2) The number of open-end equity funds in the period of this research is small, which can affect the thesis's results. (3) The ESG index has a crucial effect on the results. An important ESG index in Canada is the S&P/TSX Composite ESG Index, but its launch date was July 2020, so I could not use this index in my research due to lack of historical data.

Structure of the Thesis

This thesis is composed of five themed chapters. Chapter 2 presents a literature review of relevant papers to build a frame of reference. Chapter 3 introduces the data, sample of the study, methodology employed, and it develops the hypotheses. Chapter 4 presents data analysis and empirical findings. Lastly, Chapter 5 states the study's conclusions and proposes suggestions for future research.

Chapter 2: Review of Literature

2-1- Corporate Social Responsibility

The concept of CSR (corporate social responsibility) emerged in the early 20th century in the U.S. It is mainly about whether a corporate entity should be responsible to its stakeholders, including its customers, shareholders, employees, suppliers, and the community. Although the subject of CSR was proposed in the early 20th century, it was never accorded great importance until a series of events, including the Enron fraud, at the end of 2001 highlighted the issue of corporate governance. Examples include Nike with its sweatshops highlighting the issue of insufficient labour rights protection in developing countries, the Coca-Cola bottle pollution incident in India highlighting environmental issues of water resource protection, the tainted milk incident involving the Japanese Snow Brand Dairy Co. in 2000, and China's Sanlu melamine milk poisoning incident in 2008. Such a series of scandals involving major enterprises suggests that more stakeholders will suffer if CSR is not sufficiently recognized. In the 21st century, in addition to profit maximization to create value for shareholders, enterprises are devoted to CSR-related activities and strive to instill such concepts into corporate culture and business operations to create higher social value. Under the requirements of the international community, companies also can no longer pursue profit maximization as their sole purpose. A responsible company should take social responsibility in business (Yang et al., 2010).

Increasing interest has been focused on the impact of CSR on the economic and financial performance (FP) of listed companies. Many economists have abandoned the axioms of classical economics, self-regulation, and market efficiency (Fama, 1970, 1976), recognizing the corrective function that CSR can have on a less sustainable market characterized by strong information asymmetries (Moskowitz, 1972, 1975). The growing awareness of top managers about the different categories of stakeholders has produced a positive impact on medium and long-term profitability of the managed entities. Such profitability is attributable to several factors whose nature and scope are not always grasped by the stock exchange market, namely, variables that are not typical of technical or fundamental analysis. Hence, investors' inability to detect such variables has led some rating agencies to specialize in the formulation of indicators that express the degree of social and environmental responsibility of a listed company's decisions. Moreover, the pandemic instability of international financial markets and their close relationship has turned the spotlight on other non-financial parameters (e.g., ethics rating, corporate sustainability assessment), as typical instruments of stock market analysis that have not been able to prevent several latent risks (Landi and Sciarelli, 2018).

The topic of CSR has accrued greater importance in various countries, and companies create corporate social performance (CSP) as they fulfill such corporate social responsibilities. However, it is debatable whether companies should be devoted to CSR-related activities or whether enhancing CSP can result in better corporate financial performance (CFP). In a review of past literature, the study on the relationship between CSP and CFP is inconclusive (Ullman, 1985).

2-2- Corporate Social Performance

The term "corporate social performance" (CSP) has been used for several years in the Finance literature. In most cases, CSP has not been defined precisely; it has been used as a synonym for corporate social responsibility, corporate social responsiveness, or any other interaction between business and the social environment. More recently, however, CSP has started to take on a more precise meaning (Wartick and Cochran, 1985).

Carroll (1979) described CSP as the three-dimensional integration of corporate social responsibility, corporate social responsiveness, and social issues. This integrative nature of CSP is what makes it unique. Instead of arguing that economic responsibility and public policy responsibility are inconsistent with social responsibility (Friedman, 1970; Heyne, 1968; Preston and Post, 1975), the CSP model integrates economic responsibility and public policy responsibility into its definition of social responsibility. Instead of viewing responsibility, responsiveness, and issues as separate, alternative corporate concerns (Ackerman and Bauer, 1976; Frederick, 1994; Murphy, 1978; Sethi, 1979), the CSP model reflects an underlying interaction among the principles of social responsibility, the process of social responsiveness, and the policies developed to address social issues. The CSP model relies on this expanded version of social responsibility and this principle/process/ policy approach to provide a distinctive view of a corporation's overall effort towards satisfying its obligations to society (Wartick and Cochran, 1985).

By integrating social responsibilities, social responsiveness, and social issues, the CSP model provides a valuable framework for overall analyses of business and society. CSP has a micro-level dimension: it focuses on the interface between the firm and its environment, rather than on the relationship between business as an institution and the society in which it operates (Jones, 1983; Preston and Post, 1975). However, CSP does retain an emphasis on the macro-level by continuing to use social responsibility as the starting point for corporate social involvement. As such, the CSP model describes the totality of a firm's efforts to meet changing societal conditions, and thus it provides a starting point for the eventual development of a central paradigm for business and society (Preston, 1975).

As a general model of CSP, Wartick and Cochran (1985, P. 759) define it as "the underlying interaction among the principles of social responsibility, the process of social responsiveness, and the policies developed to address social issues." Consequently, Miles (1987) explained corporate responsiveness from two perspectives: the firm's external affairs strategy, defined as a function of top-management philosophy, and external affairs design, a function of business exposure. Later, Wood (1991) took a step further and defined CSP as a business organization's configuration of principles of social responsibility, processes of social responsiveness, and policies, programs, and observable outcomes as they relate to the firm's societal relationships. A more recent version of a CSP definition can be found in Wood (2015), in which CSP refers to the principles, practices, and outcomes of businesses' relationships with people, organizations, institutions, communities, societies, and the Earth, in terms of the deliberate actions of businesses toward these stakeholders as well as the unintended externalities of business activity. In sum, CSP is integrated with related subjects, including corporate social responsibility (CSR), responsiveness, stakeholder theory, business ethics, corporate political action, issues management, and sustainability. In particular, CSP incorporates CSR, the structural principles of CSR, and business engagement with others as its elements (Wood, 2015).

Many empirical studies have noted the uncertain relationship between CSP and CFP (Alexander and Buchholz, 1978; Aupperle, Carroll, and Hatfield, 1985; Ullman, 1985; Shane and Spicer, 1983); and some studies have pointed out that the relationship between CSP and CFP has a positive correlation (Wokutch and Spencer, 1987; McGuire, Sundgren, and Schneeweis, 1988; Waddock and Graves, 1997), while other studies find that the relationship between CSP and CFP has a negative correlation (Marcus and Goodman, 1986; Lerner and Fryxell, 1988; Holman, New, and Singer, 1990).

In the causal relationship between CSP and CFP, one view is that the commitment to CSP activities results in rising costs and lower CFP. Another view is that it results in enhancing reputation which improves its CFP. Consequently, CSP affects CFP. Contrarily, it may be attempts to improve its CSP to hide its poor CFP, or thanks to high CFP, that the business is willing to spend more on CSR-related activities to benefit society, allowing CFP to affect CSP.

CSP of companies is evaluated by ESG factors (Bassen and Senkl, 2011), and a high CSP has the potential to increase a company's cash flows and/or reduce the cost of capital (Plumlee et al., 2015). Since firm risk is an important determinant of the cost of capital, CSP has an impact on shareholder value if it affects firm risk (Bouslah, Kryzanowski, and M'Zali, 2013).

2-3- CSP and ESG-related risks

It is assumed that a high CSP has the potential to increase a company's value by means of an increase in corporate financial performance (CFP), i.e., cash flows, and/or a reduction in the cost of capital (Plumlee et al., 2015). Thus, if one considers that firm risk is an important determinant of the cost of capital, CSP has an impact on shareholder value if it affects firm risk (Bouslah et al., 2013). Against this background, integrating ESG factors into a firm's strategy fits into the overall concept of risk governance. This concept incorporates risk management at a macro and micro level, with the macro level focusing on society's CSR requirements and the micro level on operational and financial risks (Renn, 2008; Renn et al., 2011).

Sassen, Hinze, and Hardeck (2016) point out that while a huge body of literature has examined the relationship between CSP and CFP (Van Beurden and Gössling, 2008; Margolis and Walsh, 2003; Margolis, Elfenbein, and Walsh, 2009; Orlitzky, Schmidt, and Rynes, 2003), only a small amount has addressed the relationship between CSP and the cost of capital. Orlitzky and Benjamin (2001) performed a meta-analytic review and investigated CSP and firm risk. They provide support for the argument that a higher CSP decreases a company's financial risk. However, their review covered only 18 US-based primary studies with relatively small samples (mostly n<100) and a differing operationalization of CSP. Most reviewed studies found evidence that higher CSP leads to lower financial risk.

More recent research has investigated different aspects related to the correlation between CSP and firm risk in various contexts: marketing (Luo and Bhattacharya, 2009), analyst coverage (Jo and Harjoto, 2014), investor utility (Oikonomou et a., 2012).

Regarding CSP measures, the aggregate CSP-level studies find generally consistent results and state a negative association between their CSP measures and firm risk (Sassen et al., 2016). At the disaggregate level, recent research provides mixed results depending on the samples, databases, CSP measurements, and risk measures. For instance, Salama, Anderson, and Toms (2011) and Sharfman and Fernando (2008) found a negative relationship between environmental performance and firm risk, whereas Bouslah et al. (2013) found ambiguous relations for different subsamples. Similar ambiguities can be stated for diversity and corporate governance (Oikonomou et al., 2012; Bouslah et al., 2013). The relationship between community or employee relations and firm risk seems to be negative (Oikonomou et al., 2012; Bouslah et al., 2013). In contrast, the product dimension tends to have no influence (Bouslah et al. 2013) or a negative impact (Oikonomou et al. 2012).

Nofsinger and Varma (2014) investigated the performance of SRI funds during crisis and non-crisis periods to empirically test the hypothesis that SRI funds dampen downside risk for investors during poor economic conditions. Using a dataset of US domestic equity SRI funds for the period 2000–2011, they showed that socially responsible mutual funds, compared to conventional mutual funds, outperform during periods of market crises.

2-4- Returns differential between CI and RI

Responsible investment has a rich literature that dates to the early 1970s. Overall evidence supporting RI to date is mixed even after a large body of literature compared the historical returns of RI with those of CI. The pioneering study of Moskowitz (1972) argues that responsible corporate behaviour might manifest in superior financial performance. In contrast to Moskowitz, Friedman (1970) claims that including ESG criteria in managerial decisions generates additional costs which, in turn, results in weaker financial performance. These two contradictory views, supplemented by a third one on neutrality, have persisted until today and fundamentally determine research initiatives (Naffa and Fain, 2020).

As mentioned, there exist three competing hypotheses in the management literature. The first one accepts the views of Moskowitz and emphasizes the positive relationship between ESG and financial performance. Various management theories underpin this concept. Stakeholder theory (Freeman, 2010; Clarkson, 1995; Mitchell, Agle, and Wood, 1997; Hillman and Keim, 2001) or good management theory (Waddock and Graves, 1998) argue that the satisfaction of primary stakeholders (e.g., customers, employees, local communities, shareholders, natural environment) is critical in achieving superior financial performance.

The second hypothesis argues for a negative relationship, namely, higher ESG performance lowers financial performance. The trade-off hypothesis (Friedman, 2007; Preston and O'Bannon, 1997; Vance, 1975; Aupperle et al., 1985; Dam, 2008) declares that higher ESG performance is expensive: resource reallocation to socially responsible activities like charity and community development do not pay off (Preston and O'Bannon, 1997), but higher operating costs are incurred due to internalization of externalities (Dam, 2008).

The third hypothesis is the 'no effect' premise, which is often attributed to McWilliams and Siegel (2000, 2001). The authors claim that incorporating R&D factors in the analysis of the ESG and financial performance relationship eliminate the positive impact, resulting in neutrality. Over the past 50 years, many studies have examined the actual relationship between ESG and financial performance.

The viewpoint for positive correlation between CSP and CFP suggests that as a company's explicit costs of CSP reduces hidden costs of stakeholders. Therefore CSR should be considered as activities that result in avoiding cost to major stakeholders and enhancing their satisfaction (Cornell and Shapiro, 1987). This argument is meaningful and reasonable, as good relationships with employees, suppliers, and customers are necessary for the survival of a company. Bowman and Haire (1975) pointed out that some shareholders regard CSR as a symbolic management skill, namely, CSR is a symbol of reputation, and the company reputation will be improved by actions to support the community, resulting in a positive influence on sales. Therefore, when a company increases its costs by improving CSP to increase competitive advantage, such CSR activities can enhance company reputation. Thus, in the long run, CFP can be improved by sacrificing the short-term CFP. Graves and Waddock (1994) demonstrated that institutional investors prefer to promote CSR practices, choosing to invest in socially responsible organizations even if they are not socially responsible themselves. Griffin and Mahon (1997) explored the social and FP of six firms in the petrochemical industry between 1990 and 1992 and discovered that their quantifiable metrics indicated a positive relationship between the KLD and Fortune indices. Margolis and Walsh (2001) found 122 studies published between 1971 and 2001 and used these investigations to empirically examine the positive relationship between CSR and FP screening. By developing different portfolios of high-ranked and low-ranked equities, these authors found that SRI screening produces a highly significant increase in asset performance. Orlitzky et al. (2003) conducted a meta-analysis of 52 studies on CSP and CFP and found that social performance and environmental performance are likely to have a positive impact on CFP, with the extent of the impact being somewhat lower for environmental performance. Margolis and Walsh (2003) investigated 127 studies on the association of corporate social conduct and CFP and found that most evidence supports a positive impact, and little a negative impact, of CSP on CFP. Van Beurden and Gössling (2008) performed a systematic literature review of 34 studies. They also found clear empirical evidence for a positive association between CSP and CFP and stated that studies arguing the opposite relied on outdated material because society has changed since the beginnings of the CSR debate. Margolis et al. (2009) investigated the relationship between CSP and CFP by using a meta-analytical approach (251 studies) and found an overall small positive effect. Petersen and Vredenburg (2009) investigated the oil sector in Canada, revealing evidence of economic value added by CSR practices and showing that investment efforts in CSR projects are recognized and rewarded in capital markets by a higher economic profitability. In addition, Lee and Faff (2009) found that European and American investors bet on the success of CSR firms. In the Mexican case, Alonso-Almeida et al. (2012) showed that Mexican firms evinced a strong, positive relationship between social responsibility and FP, as evaluated by the return on equity (ROE), return on assets (ROA), earnings per share, and price over book value (P/VL) variables. Eccles et al. (2014) showed that ‘‘high sustainability companies’’, i.e., those that adopted high social and environmental standards early on beyond what is legally required, outperformed ‘‘low sustainability companies’’ over an observation period of 18 years. Also, Hamilton, Jo, and Statman (1993) and Renneboog, Ter Horst, and Zhang (2008) claim that investors may do well while doing good, viz., investors earn positive risk-adjusted returns while contributing to a good cause. Outperformance happens if ESG screening procedures generate value-relevant information otherwise not available to investors. 'Value-relevant information' indicates that the 'doing well while doing good' hypothesis might hold if markets misprice social responsibility (Bauer and Otten, 2005; Hamilton et al., 1993); therefore, it is against the EMH (Renneboog et al., 2008).

Some equilibrium models support the 'trade-off' hypothesis (Dam, 2008; Merton, 1987; Heinkel, Kraus, and Zechner, 2001). Each suggests that socially responsible stocks have a lower cost of capital either due to incomplete information (Merton, 1987), investor preferences (Heinkel et al., 2001) or the internalization of externalities (Dam, 2008) which, in turn, results in higher valuation and lower future (expected) return (Henriksson et al., 2018; Galema, Plantinga, and Scholtens, 2008). Another critical view, according to Bauer, Koedijk, and Otten (2005), is that ESG investments are likely to underperform in the long run because ESG portfolios are by nature a subset of the market portfolio, i.e. the degree of diversification is lower (Bauer et al., 2005). This view of the negative correlation between CSP and CFP suggests that the fulfillment of CSR will bring competitive disadvantages to the company (Aupperle et al., 1985) as the consequential costs may happen due to need to use other methods or need to bear other costs. When carrying out CSR activities, increased costs will outweigh the resulted gain. Neglecting some stakeholders, such as employees or the environment, can result in a lower CSP for the enterprise and CFP may be improved. Hence, Waddock and Graves (1997) indicated that this theory assumed of negative correlation between CSP and CFP. Mueller (1991), Hamilton et al. (1993), Statman (2000), and Crisóstomo et al. (2011) all demonstrated that socially responsible mutual funds perform less well than conventional mutual funds. Mueller (1991) examined the risk-adjusted returns of ten SRIs from 1984 to 1988 and found that socially responsible mutual funds earned an average of 1.03 per cent less in annual returns than comparable, unrestricted investments. Hamilton et al. (1993) used estimates of Jensen's Alpha to examine risk-adjusted performance of all the socially responsible mutual funds listed in the Lipper Analytical databank as of December 1990. They discovered that socially responsible mutual funds tend to exhibit similar or lower performance relative to comparable unrestricted mutual funds on a risk-adjusted basis. Statman (2000) reported that the Domini Social Index, an index of socially responsible stocks, performed as well as the S&P 500 index during the 1990–1998 period. Hong and Kacperczyk (2009) showed that so-called sin stocks (i.e., companies in such industries as alcohol, tobacco, and gaming) outperform non-sin stocks. Lima Crisostomo et al. (2011) discovered an inverse relationship between CSR and FP for 78 Brazilian firms from 2001 to 2006, conjecturing that this was caused by the role of traditional cultural beliefs in producing a lack of motivation for investing in responsible firms. Cheng, Hong, and Shue (2013) found a negative relationship between ESG scores and returns. Barber et al. (2018) showed that venture capital funds that seek a significant social Impact earn lower returns than traditional funds. Chan et al. (2020) found that portfolios optimized purely on ESG scores underperformed relative to other benchmarks.

Some other studies suggested that CSR is not related to CFP at all. Ullmann (1985) pointed out that there is no reason to anticipate the existence of any relationship between CSR and CFP as there are many variables in between the two. On the other hand, the issue of CSP measurement may also cover the link between CSP and CFP (Waddock and Graves, 1997). Diltz (1995), Guerard (1997), and Sauer (1997) concluded that there were no statistically significant differences between the returns of ethically screened and unscreened universes. Evidence from mutual fund literature is predominantly focused on the US and UK retail markets. Hamilton et al. (1993) and Statman (2000) compared the returns of ethical and regular US funds to each other, and to both the S&P 500 and the Domini Social Index (DSI). Their Jensen's alpha estimates suggest that the risk-adjusted returns of ethical mutual funds are not different from those of conventional funds. Sauer (1997) compared the DSI with two unrestricted indices and concluded that the application of social responsibility screens does not necessarily produce an adverse impact on investment performance. Goldreyer and Diltz (1999) considered an extended sample of ethical funds, including equity, bond, and balanced funds, using Jensen's alpha estimates, Sharpe ratios, and Treynor ratios and concluded that social screening does not affect the investment performance of ethical mutual funds in any systematic way. Goldreyer and Diltz (1999) used an extended sample of ethical funds including equity, bond, and balanced funds. Using Jensen's alpha and Sharpe and Treynor ratios, they found that social screening does not affect the investment performance of ethical mutual funds in any systematic way. McWilliams and Siegel (2000) also proved that the relationship between CFP and CSP would disappear with the introduction of more accurate variables, such as R&D strength, into the economic models. Stone et al. (2001) studied the impact of SR screening on managed portfolios in the US equity market by adopting the SR rating provided by KLD and found no significant differences between SR and non-SR returns. Bauer et al. (2005) used an international database containing 103 German, UK, and US ethical mutual funds and found no statistically significant difference in performance between ethical and conventional mutual fund returns after controlling for common factors such as size, book-to-market, and momentum. After controlling for investment style, Bauer et al. (2005) found no evidence of significant differences in risk-adjusted returns between ethical and conventional funds for the 1990–2001 period. Schröder (2007) analyzed 29 SRI stock indices and found that they neither led to a significant outperformance or underperformance compared with their benchmark indices. Statman and Glushkov (2009) analyzed returns on KLD-rated US stocks for the years 1992–2007 and found no evidence that SR investors had any return advantage compared to conventional investors. Naffa and Fain (2020) point out that the no-effect hypothesis is closely related to the modern portfolio theory (MPT) of Markowitz (1952) and the efficient market hypothesis (EMH) of Fama (1970). The former argues that there is no return premium for factors that bear only idiosyncratic risk, i.e. it is assumed that ESG risks can be diversified (Bauer et al., 2005). The latter maintains that stock prices reflect all available and relevant information; hence it is impossible to achieve superior risk-adjusted returns relative to the market portfolio (Bodie, Kane, and Marcus, 2013).

Derwall et al. (2005) classify prior empirical studies on RI into three categories: multivariate regression studies, event studies, and portfolio studies. First, multivariate regression studies (Chen and Metcalf, 1980; Mahapatra, 1984) have primarily examined whether a long-term relationship exists between ESG-related factors and financial performance. Taken as a whole, these studies provide only limited support for such a relationship. Second, event studies (Klassen and McLaughlin, 1996; Rao, 1996) have found pronounced evidence of a link between ESG-related factors and financial performance. Most of them documented that positive/negative ESG-events are associated with positive/negative subsequent abnormal returns. Exceptionally, Yamashita, Sen, and Roberts (1999) did not find significant financial responses to ESG-events. Third, portfolio studies (Yamashita et al., 1999) typically compose mutually exclusive portfolios based on various ESG-criteria and investigate the portfolios' return differences over some investment horizon. Some of them found that ESG-weighted portfolios provide significantly better financial performance than their counterparts. However, other studies concluded that ESG-weighted portfolios do not perform differently from unweighted ones (Cohen, Fenn, and Konar, 1997; Guerard, 1997).

Jin (2018) and Lioui (2018) have investigated whether ESG is systematically compensated for by the broad market. According to their findings, ESG-related systematic risk is significantly priced in the US. Fiskerstrand et al. (2020) apply the same methodology using the two-step procedure of

Fama and MacBeth (1973) to investigate if ESG-risk is priced in the Norwegian stock market. They find that the constructed ESG portfolios do not show any significant return difference based on a high-low strategy; therefore, there is no supporting evidence for a connection between ESG and stock returns in the Norwegian stock market.

In sum, while some empirical works indicate an ambiguous relationship between corporate social performance and financial performance, most investigations found a positive relationship. Waddock and Graves (1997) argue that the fundamental reason for the uncertainty between the CSP and FP relationship is the problem of measuring CSP.

Most studies found that responsible constraints are not able to reduce funds' returns, either before or after fees (Ielasi and Rossolini, 2019). Some authors have highlighted an over- or underperformance of responsible funds compared to conventional ones with respect to a specific period. For example, the effect of the business cycle was studied (Bauer et al., 2005; Das and Rao, 2014; Nofsinger and Varma, 2014; Paul, 2017) or the importance of establishment date, distinguishing between more and less young funds (White, 1995; Haigh and Hazelton, 2004; Minor and Morgan, 2011), as well as the behaviours of sustainable and responsible products during financial crisis (Nofsinger and Varma, 2014; Lins, Servaes, and Tamayo, 2017; Kim, Li, and Li, 2014). Studies demonstrated in general that responsible investments perform better than conventional ones during periods of economic recession (Statman and Glushkov, 2009; Lins et al., 2017; Verheyden, Eccles, and Feiner, 2016).

This lack of consensus may stem from various methodological issues that have been identified in recent literature (Chordia, Goyal, and Shanken, 2019). For example, it is well known that because betas are generated regressors, they suffer from an error-in-variables (EIV) problem. A common practice groups stocks into portfolios to improve the estimates of the betas and avoid this problem

(Ciciretti, Dalò, and Dam, 2023). However, Lewellen, Nagel, and Shanken (2010) point out that the method chosen to conduct the portfolio grouping can have a dramatic impact on the test results of an asset-pricing model. Studies that use risk-adjusted returns can also avoid the EIV problem (Brennan, Chordia, and Subrahmanyam, 1988), but such an approach cannot identify the separate contributions of loadings and characteristics because the risk premiums are constrained to be equal to the sample mean of the risk factor. Another concern is the potentially mechanical relationship between factor loadings and characteristics, which would imply that the relation between factor loadings and expected returns might be mechanical as well (Ferson, Sarkissian, and Simin, 1999). A mechanical correlation between loadings and characteristics potentially complicates the identification of the relative contribution to expected returns. Finally, studies that use a global sample often adopt the global risk factors provided by Fama and French (2012, 2017) in their analysis. However, the constituents included among the Fama and French risk factors are often very different from the firms used in a particular sample. Using risk factors that are not representative of the investment universe under investigation likely reduces the pricing performance of a multi-factor model (Becchetti et al., 2015).

2-5- Equity risk premium (ERP)

The return differential between RI and CI can be viewed as the differential in ERP (Jin, 2018). The equity risk premium reflects fundamental judgments we make about how much risk we see in an economy/market and what price we attach to that risk. Conceptually, the ERP is the compensation investors require to make them indifferent at the margin between holding the risky market portfolio and a risk-free bond. Because this compensation depends on the future performance of stocks, the ERP incorporates expectations of future stock market returns, which are not directly observable.

Arnott and Bernstein (2002) show an estimate of the objective forward-looking U.S. equity risk premium relative to bonds through history since 1802 and demonstrate that the long-term forward-looking risk premium is nowhere near the level of the past and it may well be near zero, perhaps even negative recently.

Mehra (2003) emphasizes that two different interpretations of the term 'equity premium' must be distinguished. The ex-post one is the actual, historically observed difference between the return on the market and the risk-free rate (Mehra and Prescott, 1985). The ex-ante one is a forward-looking measure of the premium that is expected to prevail in the future.

Duarte and Rosa (2015) classify the models for ERP into five categories based on their underlying assumptions: historical mean of realized returns, dividend discount models, cross-sectional regressions, time-series regressions, and surveys. Among them, cross-sectional regressions find the level of ERP that makes expected returns on a variety of stocks consistent with their exposure to the market index. The estimation consists of two steps: the first step is to find the exposures of assets to the market index by estimating a time-series equation, and the second step is to find ERP associated with the market index by estimating the cross-sectional equations.

Damodaran (2016) looks at approaches to estimating equity risk premiums. They show that historical risk premiums are very poor predictors of both short-term movements in implied premiums and long-term returns on stocks. Instead, they suggest two alternatives. One is the survey approach where investors and managers are asked to assess the risk premium and the other is the implied approach where a forward-looking estimate of the premium is derived using either current equity prices or risk premiums in non-equity markets.

2-6- Asset Pricing Models

2-6-1- Risk, Return and Efficient markets.

In theory, an efficient market is one wherein price can and will reflect available information fully (Fama, 1970), therein asserting that the investor should not be able to consistently beat the market. This theory is conditioned on the following fundamental assumptions: (1) Investor rationality, which implies that investors are willing to adapt to new information as soon as it is made available, and as they are rational, they cannot systematically make over- or underestimations of asset characteristics and prospects given information possessed. (2) Arbitrage, which maintains that despite irrationality the market can remain efficient as rational investors rid the market of mispricing through arbitrage trading, the simultaneous buying and selling of discrete substitute securities to earn a riskless profit. (3) Independent deviation, which is deviation from rationality, is the offsetting of investors' excess optimism and pessimism, making the market rational on average as irrationalities form a double-sided margin around the correct price (Jain, 2012).

The efficient markets hypothesis (EMH) comprises three tiers of efficiency – the weak, semi-strong, and strong (Fama, 1970). The tiers reflect the assumed information that makes up market prices. The weak form reflects all historical information, where prices are unpredictable and run along a "random-walk", defined as a price series where all adjustments represent random departures from earlier prices (Malkiel, 2003). The semi-strong form incorporates all publicly available information, and prices adjust according to new public information. The strong form of the hypothesis includes all information no matter the level of privacy and publicity. This is the most stringent form as it portrays an informationally efficient market that accounts for all information, past and present, including information obtained through monopolistic access (Fama, 1970). Grossman and Stiglitz (1980) argued that some inefficiency is a necessary dynamic to facilitate the correction of prices because there would be no incentive for data collection if prices strictly reflect all available information. This was also an implicit belief of Fama's (1970) discussion on the absence of proper methodologies for its measurement. A more economically sensible interpretation of the EMH was given by Jensen (1978), allowing prices to reflect information until the marginal benefits of acting upon it no longer exceeded the marginal costs (Fama, 1991). The EMH can be observed from the rational and behavioural points of view as finance theory has questioned the efficiency of the rational 'risk-based view' whereby informed investors offset irrationality (Shiller, 2003). Therefore, there exist variables beyond risk and return, to which the markets react, and the 'behavioural view' observes these deviations from theoretical assumptions of frictionless markets and rational investors. Malkiel (2003) pointed out that investors collectively making mistakes is an inherent property of stock markets, resulting in persistent mispricing in the short term. Shiller (2003) proposed that the markets reflect irrational human behaviour, hence certain factors may be explained by skillful exploitation of biased beliefs. Indeed, behavioural finance, the study of finance from the perspective of sociology and psychology, offers new perspectives, often paradoxical, to the theory of efficient markets (Shiller, 2003).

Because the future is unknown, ideal investment strategies merely frame the best result given available information, as no investment portfolio is exactly quantifiable. On these grounds Markowitz (1952) divided the portfolio selection process into two stages: moulding observation into beliefs, and transliteration of beliefs into portfolios. In Markowitz's modern portfolio theory (MPT), diversification is a central tenet. Investors are risk-averse and simultaneously consider expected return desirable and variance undesirable (Markowitz, 1952). The cornerstone of MPT is that holding expected return constant, investors should minimize variance, and holding variance constant, they should maximize expected return (Elton and Gruber, 1997). This assumes that investors only consider variance and mean return, which they estimate over a single period (Elton and Gruber, 1997). It is also assumed that risk is controlled through diversification, and market imperfections are ignored (Markowitz, 1952). Diversification reduces variance for a level of expected return as the investor considers how assets co-move with one another. This means one can create more efficient portfolios than if the interaction between the assets were ignored (Elton and Gruber, 1997). Accordingly, MPT shows that rational investors choose mean-variance efficient portfolios that offer the least variance for the level of return.

As the MPT inputs are all estimation and require effort to estimate, simpler frameworks were sought after (Elton and Gruber, 1997). This led to the earliest asset pricing models emerging, prominently the single-index model of Sharpe (1964), which required fewer estimates (Elton and Gruber, 1997). Sharpe's model eventually evolved into the CAPM. While the tools have changed, this process is still relevant today.

2-6-2- The Capital Asset Pricing Model

The capital asset pricing model (CAPM), developed by Treynor (1962), Sharpe (1964), Lintner (1965a, 1965b), and Mossin (1966) can be credited for the first precise definition of risk and expected return. The CAPM is a single-factor model built upon the MPT and adds two further assumptions: investors are able to borrow and lend at the risk-free rate of interest unlimitedly, and investors have homogeneous expectations (Sharpe, 1964). The CAPM states that there is a linear relationship between expected return of an asset and its covariance with market portfolio (Huberman and Wang, 2022), meaning risk and return are determined by market beta exposure alone. The CAPM can price individual assets and. if it holds, assets are priced appropriately when the estimation equals the present value of the future discounted cash flows. While the model was ground-breaking at the time, and motivated through empirical evidence by Jensen et al. (1972), Fama and MacBeth (1973), and Blume and Friend (1973) of the model, Basu (1977), Banz (1981), De Bondt and Thaler (1985), and Fama and French (1992, 1993) offer a particularly dim view of its practical use. The CAPM equation can be summarized as follows:

$$R_{it} - R_{Ft} = \alpha_i + (R_{Mt} - R_{Ft})\beta_i + \varepsilon_{it} \qquad (1)$$

Where R_{it} is the return of security I in month t, R_{Mt} is the market portfolio return, R_{Ft} is the risk-free rate, ε_{it} the error term, αi the intercept, β_i is the sensitivity of the expected asset excess return to the expected market excess return which is equal to:

$$\beta_i = \frac{Cov[R_i, R_m]}{\sigma_m^2} \qquad (2)$$

The CAPM has been criticized for being too restrictive in its assumptions, which Sharpe (1964) already forecasted in his seminal paper. The assumption that investors may unlimitedly borrow and lend at the risk-free rate of return is not realistic. As studies have revealed, arbitrage may not be free of market friction and involves some risk on the part of the investor (Shleifer and Summers, 1990). However, whether this matters for its real-world implications is still a topic for researchers to confirm, as asset-pricing models are approximations rather than true stories of return. Some criticism also targets the empirical applicability of the model, perhaps most notably criticism for its limited empirical success (Fama & French, 2004). Fama and French (2004) criticize the model's ability to capture stock returns and the model's validity in the applications, the main source of criticism being the market risk factor in explaining stock returns. The CAPM is still popular due to its ease of deployment but is nevertheless not an exemplary model in its capacity to capture variation in equity return.

2-6-3-Asset pricing factors

- **Size & Value**

The size factor small-minus-big, SMB, captures the difference in return of an index of only small companies versus an index with only large companies with similar book-to-market equity (Fama and French, 1993). Fama and French (1992, 1993) justified its inclusion by referencing empirical evidence that smaller firms often earn higher risk-adjusted returns than larger ones.

As for its theoretical motivation, Banz (1981) suggested size originates from the theory of mergers, where large firms may pay a premium for small firm stocks. Fama and French (1995) speculate that size may be explained as a risk premium for earnings persistence after demonstrating a link between size factors in earnings and returns. Banz (1981) references market inefficiency by suggesting that some investors have inferior information about smaller stocks, resulting in a natural aversion. The Merton model provides intuition for perceived risks by investors. This theory suggests that investors' desire to hold stock is impacted by their self-perception regarding information about the firm. This implies that investors would demand a premium for owning smaller firms they believe they have an informational disadvantage in owning (Merton, 1987). An explanation from Shleifer and Vishny (1997) highlights the limits of the arbitrage condition that requires investors to be rational and not limited by market adversities. They propose that the pool of investors with the information and the means of conducting arbitrage is limited. The increased difficulty of performing arbitrage positions on small firms makes them more prone to mispricing, and therefore they provide a premium in relation to large stocks.

Recently, researchers have speculated that the size premium has diminished due to its time-variation and the recently observed small premiums (Asness et al., 2018; Van Dijk, 2011). One possible reason is that investor overreaction to other quality measures drowns out the size premium when all metrics are controlled. The premium reappears when controlling for quality or junk of a firm (Asness et al., 2018).

A vast body of literature connects book-to-market ratio to average stock returns in most markets around the world (Asness, Moskowitz, and Pedersen, 2013). This has come to be called the value effect, indicating that equities with high book-to-market ratio tend to achieve better average returns than those with a low ratio. The value factor High-Minus-Low, HML, captures the difference in return between an index of value stocks and an index of growth stocks, this time controlling for similar size (Fama and French, 1993). As with the size premium, the literature documents value as related to economic fundamentals (Fama and French, 1992, 1993). The general interpretation is that certain companies are less popular among investors and therefore sell at lower prices relative to their book value or earnings. The value effect implies that "value stocks" with high book-to-market have outperformed "growth stocks" with low book-to-market. While the firm fundamental approach has been known since Graham and Dodd (1934) coined value investing, the mysteries of the premium were uncovered by the research of De Bondt and Thaler (1985), Rosenberg, Reid, and Lanstein (1985), Fama and French (1992), and Lakonishok, Schleifer, and Vishny (1994).

- **Profitability & Investment**

The profitability factor robust-minus-weak, RMW, captures the effect where profitable companies have achieved a better return. Earlier evidence illustrates a relation between expected profitability and future stock returns to mispricing (Fama and French, 2006). The profitability premium has been explained from the behavioural view, suggesting it may be related to overpricing with systematic frictions limiting the efficiency of the market to diversify away the anomaly. Lam, Wang, and Wei (2020) suggest the profitability anomaly is explained by both behavioural and risk-based reasoning, as macroeconomic risk would account for part of it, and mis-valuation based on investor sentiment for a part of the remaining premium. As for the factor, Fama and French (2015) use operating profitability less interest expenses, whereas Novy-Marx (2013) uses gross profitability. Subsequent studies have incorporated multiple alternative proxies, including cash profitability and ROE to proxy profitability (Fama and French, 2018; Barillas and Shanken, 2018).

The investment factor conservative-minus-aggressive, CMA, captures the effect where companies with large investments have achieved smaller returns. Like profitability, investment is often associated with mispricing (Fama and French, 2006). Risk-based explanations exist for investments that point toward macroeconomic and business cyclicality. At the centre of the theory is the documented tendency of investment going up as the risk profile of projects are low. Per the systematic risk and return relationship, the return achieved by such investing firms should decrease (Berk, Green. and Naik, 1999).

- **Momentum**

The momentum factors up-minus-down, UMD, or winners-minus-losers, WML (henceforth used interchangeably) capture the effect coined by Jegadeesh and Titman (1993) where past return information would have predictive power on future returns, as a historical excess return spread of the "winners" and "losers". The momentum anomaly refers to the empirical evidence that overperforming equities continue to overperform in the near future, and vice versa for those that have underperformed (Jegadeesh and Titman, 1993). Momentum seems to exhibit the strongest prevalence in shorter horizons of a month or less but has also been documented for horizons lasting upwards of a year (Moskowitz and Grinblatt, 1999). Asness et al. (2013) demonstrate that momentum effects exist across several markets and asset classes. Further, they discover a linkage between value and momentum that may be especially important internationally and speculate there may even exist a global momentum factor.

Carhart (1997) created a four-factor model by adding momentum to the Fama–French three-factor model and, through comparison, provided evidence implying that momentum is a valuable addition. The Carhart model quickly grew popular, and momentum has since joined size and value as standard risk factors for practical applications. Because of this, Fama and French's (2015) decision to leave out momentum has been a topic of discussion. Fama and French (2008) earlier commented that momentum may fragment the EMH rationale. A fundamental problem is the difficulty in viewing momentum as a priced risk. However, it bears asking whether Fama and French's risk-based reasoning is adequate given the direct violation of the EMH that momentum presents. Asness et al. (2014) state that regardless of whether momentum has behavioural or rational explanations, theory is likely to provide consensus on it at some point.

2-6-4- Equilibrium Asset Pricing Models

Asset pricing models attempt to describe the returns of assets such as stocks. Each asset pricing model developed to date involves risk as the key element (Erdinç, 2018). Models generally adopt a set of useful variables that add accuracy in the pricing process by eliminating the mispricing of risks. The selection of an adequate asset pricing model is critical as the anomalous effects are to be benchmarked relative to these models given the bad model hazard (Fama, 1991). Most anomalies have been discovered in tests conducted relative to the CAPM. But some anomalies might be rewards for taking on a specific risk that the model itself is unable to explain. This offers credibility to the task of investigating different factor models. The most common such factor model is the Fama–French three-factor model, but others such as the Carhart four-factor model are also widely used. There is no true model, rather all models simplify the description of returns (Fama and French, 2016a). Moreover, for the model to remain parsimonious, it is important to achieve accuracy with as few factors added as possible. Many of the factors build upon the empirical theories of arbitrage pricing theory (APT) of Ross (1976) and have been benchmarked with a previously vetted asset-pricing model. With intuition from the literature stemming from the search for persistent anomalous effect and from the APT, researchers have motivated the addition of factors to these models.

2-6-5- Fama and French Three-Factor Pricing Model

With the CAPM critique in mind, Fama and French (1992) studied a wide range of factors and in Fama and French (1993) published the three-factor model with two new factors they argued would capture an additional dimension of systematic risk over the CAPM's market beta. The Fama and French mission can be narrowed down to a few key steps: (1) identify factors with explanatory power and unique properties; (2) identify factors that produce spreads among securities that are easily tradable, hence the practice of factor and portfolio sorting with breakpoints; (3) identify variables that forecast returns in presence of other factors; (4) compare asset-pricing models and make judgments on the number of necessary variables and whether they are unique and independent.

Fama and French's (1993) three-factor model augments the CAPM with the additional factors SMB and HML, which proxy the size and value effects, respectively. Fama and French (1996) document that the model explains several regularities that are anomalous under the CAPM, including firm size, book-to-market, past sales growth, long-run reversals, cash-flow-to-price as well as earnings-to-price. The Fama–French three-factor model is composed of value-weighted (VW) excess market returns, size-, and book-to-market-related portfolio return spreads. Fama and French (1996) recommended that the size factor be measured by taking the return of a portfolio of a diversified set of small firm stocks minus the return of a portfolio of a diversified set of bigger firm stocks, and the value factor be measured by taking the return of a portfolio of well-diversified high B/M firms minus the return of a portfolio of well-diversified low B/M firms. The size-factor SMB and the value factor HML augment the CAPM to form the following equity return regression formula:

$$R_{it} - R_{Ft} = a_i + b_i(R_{Mt} - R_{Ft}) + s_i SMB_t + h_i HML_t + e_{it} \quad (3)$$

In this equation, R_{it} is the month t return on asset i, R_{Ft} is the one-month US Treasury bill rate observed at the beginning of t, $R_{Mt} - R_{Ft}$ is the return on the value-weight (VW) portfolio of NYSE, AMEX, and Nasdaq stocks in excess of R_{Ft}, SMB_t (small minus big) is the size factor which the difference in return of an index of only small companies versus an index with only large companies with similar book-to-market equity and HML_t (high minus low book-to-market equity) is the value factor that is the difference in return between an index of value stocks and an index of growth stocks and e_{it} is the error term.

2-6-6- Fama and French Five-Factor Pricing Models

Fama and French (2015) point out that there is much evidence that average stock returns are related to the book-to-market equity ratio, B/M. There is also evidence that profitability and investment add to the description of average returns provided by B/M. The dividend discount model can be used to explain why these variables are related to average returns. The model says the market value of a share of stock is the discounted value of expected dividends per share,

$$m_t = \sum_{\tau=1}^{\infty} E(d_{t+\tau})/(1+r)^{\tau} \tag{4}$$

In this equation, m_t is the share price at time t, $E(d_{t+\tau})$ is the expected dividend per share for period $t+\tau$, and r is (approximately) the long-term average expected stock return or, more precisely, the internal rate of return on expected dividends. Based on this equation, if at time t the stocks of two firms have the same expected dividends but different prices, the stock with a lower price has a higher (long-term average) expected return. If pricing is rational, the future dividends of the stock with the lower price must have higher risk. They show that the predictions drawn from (4), are, however, the same whether the price is rational or irrational. With a bit of manipulation, they extract the implications of this equation for the relations between expected return and expected profitability, expected investment, and B/M. Miller and Modigliani (1961) show that the time t total market value of the firm's stock implied by this equation is,

$$m_t = \sum_{\tau=1}^{\infty} \frac{E(Y_{t+\tau} - dB_{t+\tau})}{(1+r)^{\tau}} \tag{5}$$

In this equation, $Y_{t+\tau}$, is total equity earnings for period $t+\tau$ and $dB_{t+\tau} = B_{t+\tau} - B_{t+\tau-1}$ is the change in total book equity. Dividing by time t book equity gives,

$$\frac{m_t}{B_t} = \frac{\sum_{\tau=1}^{\infty} \frac{E(Y_{t+\tau} - dB_{t+\tau})}{(1+r)^{\tau}}}{B_t} \tag{6}$$

Based on Fama and French (2015), this equation makes three statements about expected stock returns. First, fix everything in (6) except the current value of the stock, m_t, and the expected stock return, r. Then a lower value of m_t, or equivalently a higher book-to-market equity ratio, (B_t/m_t), implies a higher expected return. Next, fix m_t and the values of everything in (6) except expected future earnings and the expected stock return. The equation then shows that higher expected earnings imply a higher expected return. Finally, for fixed values of B_t, m_t, and expected earnings, higher expected growth in book equity – investment – implies a lower expected return. Stated in perhaps more familiar terms, (6) says that (B_t/m_t) is a noisy proxy for expected return because the market cap m_t also responds to forecasts of earnings and investment.

The research challenge posed by (6) has been to identify proxies for expected earnings and investments. Novy-Marx (2013) identifies a proxy for expected profitability that is strongly related to average return. Aharoni, Grundy, and Zeng (2013) document a weaker but statistically reliable relation between investment and average return. Furthermore, Fairfield, Whisenant, and Yohn (2003) and Titman, Wei, and Xie (2004) found the same results.

The evidence of Novy-Marx (2013), Titman et al. (2004), and others says that (3) is an incomplete model for expected returns because its three factors miss much of the variation in average returns related to profitability and investment. Motivated by this evidence and the valuation Equation (6), profitability and investment factors were added to the three-factor model,

$$R_{it} - R_{Ft} = a_i + b_i(R_{Mt} - R_{Ft}) + s_i SMB_t + h_i HML_t + r_i RMV_t + c_i CMA_t + e_{it} \qquad (7)$$

In this equation R_{it} is the month t return on asset i, R_{Ft} is the one-month US Treasury bill rate observed at the beginning of t, $R_{Mt} - R_{Ft}$ is the return on the value-weight (VW) portfolio of NYSE, AMEX, and Nasdaq stocks in excess of R_{Ft}, SMB_t (small minus big) and HML_t (high minus low book-to-market equity), RMV_t is the difference between the returns on diversified portfolios of stocks with robust and weak profitability, and CMA_t is the difference between the returns on diversified portfolios of the stocks of low and high investment firms, which they call conservative and aggressive. If the exposures to the five factors, b_i, s_i, h_i, r_i, and c_i, capture all variation in expected returns, the intercept a_i in (7) is zero for all securities and portfolios i.

- **Factor definitions**

To examine whether the specifics of factor construction are important in tests of asset pricing models, Fama and French (2015) use three sets of factors to capture the patterns in average returns. The first approach augments the three factors of Fama and French (1993) with profitability and investment factors defined like the value factor of that model. The size and value factors use independent sorts of stocks into two Size groups and three B/M groups (independent 2 × 3 sorts). The Size breakpoint is the NYSE median market cap, and the B/M breakpoints are the 30^{th} and 70^{th} percentiles of B/M for NYSE stocks. The intersections of the sorts produce six VW portfolios. The Size factor, SMB_{BM}, is the average of the three small stock portfolio returns minus the average of the three big stock portfolio returns. The value factor HML is the average of the two high B/M portfolio returns minus the average of the two low B/M portfolio returns. Equivalently, it is the average of small and big value factors constructed with portfolios of only small stocks and portfolios of only big stocks. The profitability and investment factors of the 2 × 3 sorts, RMW and CMA, are constructed in the same way as HML except the second sort is either on operating profitability (robust minus weak) or investment (conservative minus aggressive). Like HML, RMW and CMA can be interpreted as averages of profitability and investment factors for small and big stocks.

The 2 × 3 sorts used to construct RMW and CMA produce two additional Size factors, SMB_{OP} and SMB_{Inv}. The Size factor SMB from the three 2 × 3 sorts is defined as the average of $SMB_{B/M}$, SMBOP, and SMB_{Inv}. Equivalently, SMB is the average of the returns on the nine small stock portfolios of the three 2 × 3 sorts minus the average of the returns on the nine big stock portfolios.

To test the sensitivity of asset pricing results to this choice, Fama and French construct versions of SMB, HML, RMW, and CMA in the same way as the 2 × 3 sorts, but with 2 × 2 sorts on Size and B/M, OP, and Inv, using NYSE medians as breakpoints for all variables (Table 1). Since HML, RMW, and CMA from the 2 × 3 (or 2 × 2) sorts weight small and big stock portfolio returns equally, they are roughly neutral with respect to size. Since HML is constructed without controls for OP and Inv, however, it is not neutral with respect to profitability and investment. This likely means that the average HML return is a mix of premiums related to B/M, profitability, and investment. Similar comments apply to RMW and CMA.

To better isolate the premiums in average returns related to Size, B/M, OP, and Inv, the final candidate factors use four sorts to control jointly for the four variables. Fama and French (2015) sort stocks independently into two Size groups, two B/M groups, two OP groups, and two Inv groups using NYSE medians as breakpoints. The intersections of the groups are 16 VW portfolios. The Size factor SMB is the average of the returns on the eight small stock portfolios minus the average of the returns on the eight big stock portfolios. The value factor HML is the average return on the eight high B/M portfolios minus the average return on the eight low B/M portfolios. The profitability factor, RMW, and the investment factor, CMA, are also differences between average returns on eight portfolios (robust minus weak OP or conservative minus aggressive Inv). They interpret the value, profitability, and investment factors as averages of small and big stock factors.

In the 2 × 2 × 2 × 2 sorts, SMB equal weights high and low B/M, robust and weak OP, and conservative and aggressive Inv portfolio returns. Thus, the Size factor is roughly neutral with respect to value, profitability, and investment. Likewise, HML is roughly neutral with respect to

Size, OP, and Inv, and similar comments apply to RMW and CMA. However, that neutrality with respect to characteristics does not imply low correlation between factor returns. Joint controls likely mean that the factors from the 2 × 2 × 2 × 2 sorts better isolate the premiums in average returns related to B/M, OP, and Inv. But factor exposures are more important in our eventual inferences. Since multivariate regression slopes measure marginal effects, the five-factor slopes for HML, RMW, and CMA produced by the factors from the 2 × 3 or 2 × 2 sorts may isolate exposures to value, profitability, and investment effects in returns as effectively as the factors from the 2 × 2 × 2 × 2 sorts.

Table 1. Construction of size, B/M, profitability, and investment factors

Sort	Breakpoints	Factors and their components
2 × 3 sorts on	Size: NYSE median	$SMB_{B/M}$=(SH+SN+SL)/3 – (BH+BN+BL)/3
Size and B/M, or		SMB_{OP}=(SR+SN+SW)/3 – (BR+BN+BW)/3
Size and OP, or		SMB_{INV}=(SC+SN+SA)/3 – (BC+BN+BA)/3
Size and Inv		SMB=($SMB_{B/M}$+SMB_{OP}+SMB_{INV})/3
	B/M: 30th and 70th NYSE	HML=[(SH-SL)+(BH-BL)]/2
	OP: 30th and 70th NYSE	RMW=[(SR-SW)+(BR-BW)]/2
	Inv: 30th and 70th NYSE	CMA=[(SC-SA)+(BC-BA)]/2
2 × 2 sorts on	Size: NYSE median	SMB=(SH+SL+SR+SW+SC+SA)/6 - (BH+BL+BR+BW+BC+BA)/6
Size and B/M, or	B/M: NYSE median	HML=[(SH-SL)+(BH-BL)]/2
Size and OP, or	OP: NYSE median	RMW=[(SR-SW)+(BR-BW)]/2
Size and Inv	Inv: NYSE median	CMA=[(SC-SA)+(BC-BA)]/2
2 × 2 ×2 × 2 sorts on	Size: NYSE median	SMB=(SHRC+SHRA+SHWC+SHWA+SLRC+SLRA+SLWC+SLWA)/8
Size, B/M, OP and	B/M: NYSE median	-(BHRC+BHRA+BHWC+BHWA+BLRC+BLRA+BLWC+BLWA)/8
Inv	OP: NYSE median	HML=(SHRC+SHRA+SHWC+SHWA+BHRC+BHRA+BHWC+BHWA)/8
	Inv: NYSE median	-(SLRC+SLRA+SLWC+SLWA+BLRC+BLRA+BLWC+BLWA)/8
		RMW=(SHRC+SHRA+SLRC+SLRA+BHRC+BHRA+BLRC+BLRA)/8
		-(SHWC+SHWA+SLWC+SLWA+BHWC+BHWA+BLWC+BLWA)/8
		CMA=(SHRC+SHWC+SLRC+SLWC+BHRC+BHWC+BLRC+BLWC)/8
		-(SHRA+SHWA+SLRA+SLWA+BHRA+BHWA+BLRA+BLWA)/8

Fama and French use independent sorts to assign stocks to two Size groups, and two or three B/M, operating profitability (OP), and investment (Inv) groups. The VW portfolios defined by the intersections of the groups are the building blocks for the factors. They label these portfolios with two or four letters. The first always describes the Size group, small (S) or big (B). In the 2 × 3 sorts and 2 × 2 sorts, the second describes the B/M group, high (H), neutral (N), or low (L), the OP group, robust (R), neutral (N), or weak (W), or the Inv group, conservative (C), neutral (N), or aggressive (A). In the 2 × 2 × 2 × 2 sorts, the second character is B/M group, the third is OP group, and the fourth is Inv group. The factors are SMB (small minus big), HML (high minus low B/M), RMW (robust minus weak OP), and CMA (conservative minus aggressive Inv).

2-6-7- Fama and French Six-Factor Pricing Models

Jegadeesh and Titman's (1993) seminal work on the momentum anomaly prompted Carhart (1997) to develop the factor up minus down, UMD. Carhart also augmented the three-factor model with the UMD factor to create the Carhart four-factor model in response to the three-factor model's inability to explain momentum,

$$R_{it} - R_{Ft} = a_i + b_i(R_{Mt} - R_{Ft}) + s_i SMB_t + h_i HML_t + m_i UMD_t + e_{it} \quad (8)$$

In Equation (8), R_{it} is the return of security i in month t, R_{Mt} is the market portfolio return, R_{Ft} is the risk-free rate, the factors and betas of size, value, and momentum, and last is the error term e_{it}. Momentum is commonly abbreviated WML, winners minus losers.

Like the three-factor model, the Carhart model enjoys empirical motivation and WML has become a common addition in asset-pricing literature. When the three-factor model was created, it was commonly believed that the momentum effect would go away over time. However, one reason for WML's continued popularity relates to the empirical evidence that the momentum effect persists, and where it is found it is often found to be strong (Asness et al., 2013). Moreover, reasons that have held back the WML's acceptance are perhaps no longer relevant, as suggested by Asness et al. (2014). They dedicate their paper to refuting commonly cited reasons for leaving out momentum: (1) momentum returns are negligible and inconsistent; (2) momentum is likely to disappear; (3) momentum is not universal and only exists among small cap stocks; (4) momentum is not useful as a factor in portfolio construction or different measures govern the results; (5) long-only investors cannot take advantage of momentum; (6) momentum is limited by trading costs and taxes; and (7) momentum is wholly absent of theory. Asness et al. (2014) end by stating that the empirical evidence is in favour of including momentum, and not including it is a question of caution on the part of individual researchers, perhaps stemming from lack of consensus on the theoretical cause of the factor. Another reason for the Carhart model's continued use is the considerable evidence that neither the three- nor five-factor model can price momentum (Fama and French, 2016b).

In part due to the above, studies have proposed that a sixth factor should be tested (Asness et al., 2014; Blitz et al., 2018). WML was initially left out when creating the five-factor model due to a lack of an academic consensus and risk-based reasoning because straying from theory might enable data dredging (Fama and French, 2018). Asness et al. (2014) do not believe this to be a problem and criticize the strict limitation to risk-based factors. Similarly, Blitz et al. (2018) argue that the literature that remains conflicted about whether theoretical motivation should focus on risk or mispricing is a problem for consensus. Although some researchers consider empirical motivation to be enough, Asness et al. (2014) propose that the consistent empirical evidence implies there are theoretical explanations behind WML, but researchers do not yet have the tools to understand it.

Heeding these calls, Fama and French (2016b) augment the five-factor model with WML to test a six-factor model on U.S. Size-Mom portfolios. They find that the model partly alleviates the five-factor model's inability to price momentum. Further, Fama and French (2018) include the six-factor model, and several variations, in tests on a comprehensive US dataset. Barillas and Shanken (2018) test ten common new factors and find that a six-factor model that includes momentum performs well, albeit this model used different factor proxies for some of the effects than Fama and French. Below is the equation for the Fama and French six-factor model:

$$R_{it} - R_{Ft} = a_i + b_i(R_{Mt} - R_{Ft}) + s_i SMB_t + h_i HML_t + r_i RMV_t + c_i CMA_t + m_i UMD_t + e_{it} \qquad (9)$$

In Equation (9), R_{it} is the month t return on asset i, R_{Ft} is the one-month US Treasury bill rate observed at the beginning of t, $R_{Mt} - R_{Ft}$ is the return on the value-weight (VW) portfolio of NYSE, AMEX, and Nasdaq stocks in excess of Ft, SMB_t (small minus big) and HML_t (high minus low book-to-market equity) are the size and value factors of the Fama–French (1993) three-factor model, RMV_t (robust minus weak) is a profitability factor, CMA_t (conservative minus aggressive) is an investment factor, and UMD_t (up minus down) is a momentum factor.

Chapter 3: Data and Methodology

3-1- Research Design

3-1-1- Theoretical background

In my attempt to explain the nature of return differential between RI and CI in the well-known risk-return paradigm, I apply the research design of Jin (2018) – the perspective of systematic risk. First, I investigate the return differential between RI and CI in ex-ante viewpoint. Since the ex-post ERP differential between RI and CI is the realization of a stochastic process over a certain period (Mehra, 2003), it depends on the occurrence of ESG-related events. Even if the current ex-post ERP differential is negative, it does not imply that the ex-ante ERP differential is negative. Second, I consider RI as the investment practice to mitigate the ESG-related systematic risk. The stakeholder theory suggests that better CSP leads to less financial risks and therefore to a lower degree of market risk and a lower likelihood of downside risk (Oikonomou et al. 2012). The risk management theory proposes that RI investors are less sensitive to negative returns than CI investors (Bollen, 2007; Renneboog, Ter Horst, and Zhang, 2011). In contrast, the managerial opportunism theory suggests that management predominantly pursues private goals (Preston and O'Bannon, 1997). This research relates the performance of funds to ESG-related systematic risk since investments in well-diversified funds are compensated only for their systematic risk. Third, I factor the ESG-related systematic risk into the conventional performance evaluation model. When RI is viewed as a hybrid of CI and hedging against the ESG-related systematic risk, the ESG-related component of ERP can be explicitly attributed to ESG-related factor. Since portfolios are expected to deliver returns proportional to associated systematic risk only, the ex-ante hedging cost (i.e., the ESG-related component of ex-ante ERP) can be captured by the expected return differential between RI and CI (Jin, 2018).

3-1-2- Development of hypotheses

Considering the mixed empirical results and the ambiguous theoretical predictions, I phrase hypotheses as:

(H1) The risk exposure to ESG-related factor is not significantly different from zero, and

(H2) The ESG-related component of ERP is not significantly different from zero.

3-1-3- Methodology

I use the cross-sectional regression as a model for ERP discussed in Duarte and Rosa (2015). To do so, I first introduce the six-factor model including the Fama and French five-factor model (2015) and the ESG-related factor, apply it to the Canada mutual fund sample, then replicate the two-step procedure of Fama and MacBeth (1973).

- **ESG-related factor**

The conventional Fama and French five-factor model (2015) is based on five value-weighted, zero-investment, factor-mimicking portfolios: broad-market-related factor (MKT), size-related factor (SMB), valuation-related factor (HML), profitability-related factor (RMW), investment-related factor (CMA). I additionally identify an ESG-related factor and incorporate it into the five-factor model. Inspired by Jin (2018), I use return difference between an ESG-score weighted portfolio and an unweighted market portfolio as an ESG-related factor (UME: Unweighted minus ESG-score weighted).

This apparently implies that UME is designed using large capitalization securities. However, Jin (2018) points out that it does not limit the validity of the results for two reasons. First, the size of firms does not confound the relationship between CSP and firm financial performance. For instance, Orlitzky and Benjamin (2001) show by integrating three meta-analyses that CSP and firm financial performance remain positively correlated even if firm size is controlled for across studies (comprising, on average, over 15,000 observations). Next, the impact of RI tends to be revealed more clearly when it is measured by the gap between ESG leaders and laggards. For instance, Derwall et al. (2005) investigate the difference portfolio, which is constructed by subtracting the low-ranked portfolio returns from the returns on the high-ranked stock portfolio. They find that the performance of a difference portfolio is somewhat sensitive to changes in portfolio formation. According to their results, the performance gap is widened when the distinction in environmental performance between the highest and lowest ranked portfolios is increased. Once larger number of securities has ESG scores, an alternative ESG-related factor could be defined as the return difference between ESG leaders and laggards (Jin, 2018).

- **Fama–MacBeth Two-Step Regression**

Theoretical Background

Theories of asset pricing frequently use “risk factors” to explain asset returns. These factors can range from macroeconomic (for example, consumer inflation or the unemployment rate) to financial (firm size, etc). The Fama–MacBeth two-step regression is a practical way of testing how these factors describe portfolio or asset returns. The goal is to find the premium from exposure to these factors. In the first step, each portfolio’s return is regressed against one or more factor time series to determine how exposed it is to each one (the “factor exposures”). In the second step, the cross-section of portfolio returns is regressed against the factor exposures, at each time step, to give a time series of risk premia coefficients for each factor. The insight of Fama–MacBeth is to then average these coefficients, once for each factor, to give the premium expected for a unit exposure to each risk factor over time.

In equation form, for n portfolio or asset returns and m factors, in the first step the factor exposure βs are obtained by calculating n regressions, each one on m factors (each equation in the following represents a regression):

$$\begin{cases} R_{1,t} = \alpha_1 + \beta_{1,F_1} F_{1,t} + \beta_{1,F_2} F_{2,t} + \cdots + \beta_{1,F_m} F_{m,t} + \epsilon_{1,t} \\ R_{2,t} = \alpha_2 + \beta_{2,F_1} F_{1,t} + \beta_{2,F_2} F_{2,t} + \cdots + \beta_{2,F_m} F_{m,t} + \epsilon_{2,t} \\ \vdots \\ R_{n,t} = \alpha_n + \beta_{n,F_1} F_{1,t} + \beta_{n,F_2} F_{2,t} + \cdots + \beta_{n,F_m} F_{m,t} + \epsilon_{n,t} \end{cases} \tag{10}$$

Where $R_{i,t}$ is the excess return of portfolio or asset i at time t (i = 1, ... n), $F_{j,t}$ is the factor j ($j = 1, \ldots m$) at time t, β_{i,F_m} are the factor exposures, or loadings, that describe how returns are exposed to the factors, and t (t = 1, ... T). Notice that each regression uses the same factors F because the purpose is to determine the exposure of each portfolio's return to a given set of factors.

The second step is to compute T cross-sectional regressions of the returns on the m estimates of the βs (call then $\hat{\beta}$) calculated from the first step.

$$\begin{cases} R_{i,1} = \gamma_{1,0} + \gamma_{1,1} \hat{\beta}_{i,F_1} + \gamma_{1,2} \hat{\beta}_{i,F_2} + \cdots + \gamma_{1,m} \hat{\beta}_{i,F_m} + \epsilon_{i,1} \\ R_{i,2} = \gamma_{2,0} + \gamma_{2,1} \hat{\beta}_{i,F_1} + \gamma_{2,2} \hat{\beta}_{i,F_2} + \cdots + \gamma_{2,m} \hat{\beta}_{i,F_m} + \epsilon_{i,2} \\ \vdots \\ R_{i,T} = \gamma_{T,0} + \gamma_{n,1} \hat{\beta}_{i,F_1} + \gamma_{n,2} \hat{\beta}_{i,F_2} + \cdots + \gamma_{n,m} \hat{\beta}_{i,F_m} + \epsilon_{i,T} \end{cases} \tag{11}$$

where the returns R are the same as those in Equation 10, γ are regression coefficients that are later used to calculate the risk premium for each factor, and in each regression i goes from 1 through n. In the end there are $m + 1$ series γ (including the constant in the second step) for every factor, each of length T. If the ϵ are assumed to be i.i.d, calculate the risk premium γ_m for factor F_m by averaging the mth γ over T, and get standard deviations and t-stats.

- **First-pass regression: Estimating risk exposure**

First, by replicating the first-pass regression of Fama and MacBeth (1973), sample funds' exposures to six risk factors are estimated through Equation (12):

$$r_{it} - r_{ft} = a_i + b_i MKT_t + s_i SMB_t + h_i HML_t + w_i RMW_t + c_i CMA_t + e_i UME_t + \varepsilon_{it} \qquad (12)$$

$$t = 1, 2, \dots, 60$$

Where $r_{it} - r_{ft}$ is the return on a fund in excess of the one-month T-bill return; MKT is the excess return on a value-weighted aggregate broad-market-related factor; SMB represents return difference between a small-cap portfolio and a large-cap portfolio; HML represents return difference between a high and low book-to-market equity portfolio; RMW represents return difference between a robust profitability portfolio and a weak profitability portfolio; CMA represents return difference between a low investment (conservative) portfolio and a high investment (aggressive) portfolio; and UME represents return difference between an unweighted market portfolio and an ESG-score weighted portfolio.

The sensitivities of individual funds to factors are measured by estimating the factor betas from Equation (12): regressions of fund excess returns on the return of six-factor portfolios (MKT, SMB, HML, RMW, CMA, and UME). The coefficient on UME indicates the exposure to ESG-related factor. In this step, 60 monthly returns on each fund are used for a time-series regression.

- **Second-pass regression: Estimating risk premium**

The ERP associated with exposure to each risk factor can be estimated by replicating the second-pass regression of Fama and MacBeth (1973). The contribution of each factor to the total ERP on a fund is equal to the sum of ERP components times its factor betas, which are the estimates from the first pass regression in Equation (12). To get ERP, the average excess returns of funds are regressed against the estimated factor betas for each month as:

$$\bar{r}_i - \bar{r}_f = \gamma_0 + \gamma_{MKT}\hat{b}_i + \gamma_{SMB}\hat{s}_i + \gamma_{HML}\hat{h}_i + \gamma_{RMW}\hat{w}_i + \gamma_{CMA}\hat{c}_i + \gamma_{UME}\hat{e}_i + \theta_i \qquad (13)$$

$$i = 1, 2, \ldots, n_t$$

Where $\bar{r}_i - \bar{r}_f$ is average over 60 excess returns on each fund; $\hat{b}_i, \hat{s}_i, \hat{h}_i, \hat{w}_i, \hat{c}_i, \hat{e}_i$ are sample estimates of betas of fund i on six factors; n_t is the number of funds operated at month t.

In Equation (13), the coefficient on each factor beta is the extra average return earned as the loading increases, and thus it is an estimate of ERP for corresponding risk factor from that month's data. The coefficients indicate the proportion of mean ERP attributable to strategies that manage exposures to six risk factors (MKT, SMB, HML, RMW, CMA, and UME).

- **Rolling windows**

Considering constant betas over a long period of time is not accurate in practice, therefore I assume that factor betas vary over the period of this research. To do so, I apply attribution analysis in a dynamic way, by using a rolling window analysis. First, I set a 60-month rolling window for which sample estimates of betas on six factors for each fund are estimated through Equation (12). Next, the reward earned per unit of exposure to each factor is estimated through Equation (13). Then, the estimation period is rolled forward month by month and the process is repeated for each period. Therefore, in this procedure, Equation (12) and Equation (13) are estimated for 31 periods (each includes 60 months).

3-2- Data and Variables

Monthly total returns of Canada-domiciled open-end equity mutual funds are obtained from Thomson Reuters DataStream database. I obtained Rolling Performance that includes capital gains of an investment and the income yield from dividends or interest payments. The calculation of total return assumes that interest payments or dividends are immediately reinvested. To prevent duplication of various classes, I use fund screener and primary flag in Refinitiv Eikon. Finally, the sample is selected based on the following criteria: First, focusing on Canada-domiciled equity funds denominated in CAD with total net assets of C$200 million or higher at the end of June 2023 (which is the end of sample period). Second, all available alive and obsolete funds over the sample period are included. By including non-surviving equity funds, the data are free of survivor bias. It is essential to reduce survivorship bias in the fund performance analysis (Elton et al., 1996; Carhart et al., 2002). Third, I consider funds whose launch date is before January 2016. Therefore, during the sample period, the data contain historical returns for 154 open-ended equity mutual funds. Table 2 summarizes all independent variables, their definition, and the source of data.

Table 2. Independent Variables, Definition and Source of data

Variable	Definition	Source
MKT	Monthly market (TSX composite) returns less risk-free rate	Thomson DataStream database
R_f	Canadian 1-month T-bill rate	Website of Bank of Canada
SMB	Return difference between a small cap portfolio and a large cap portfolio	Kenneth R. French's Internet Data Library*
HML	Return difference between a high-B/M portfolio and a low-B/M portfolio	Kenneth R. French's Internet Data Library*
RMW	Return difference between a robust profitability portfolio and a weak profitability portfolio	Kenneth R. French's Internet Data Library*
CMA	Return difference between a low-investment (conservative) portfolio and a high-investment (aggressive) portfolio	Kenneth R. French's Internet Data Library*
UME	Return difference between TSX composite Index (Unweighted) and MSCI Canada ESG Universal Index (ESG-score weighted)	Website of MSCI**

* Data are for North America (https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html).

** MSCI is a global provider of equity, fixed income, real estate indexes, multi-asset portfolio analysis tools, ESG and climate products. MSCI is one of the top 10 data providers for ESG indices.

Chapter 4: Empirical Results

4-1- Descriptive statistics

Table 3 reports descriptive statistics for six-factor portfolios and the statistics indicate a few interesting findings. First, the average return on MKT is significantly positive. It shows that the ex-post difference between the return on the market and the risk-free rate, observed during the sample period, is positive. Next, average returns on four factors (SMB, HML, RMW, and CMA) are significantly different from zero. Next, the negative average return on UME means that ESG events occurred more frequently than expected.

Table 3. Descriptive statistics (January 2016 to June 2023).

						t-test for mean=0	
Factor Portfolio	N	Mean	SD	Skewness	Kurtosis	t-value	p-value
MKT	90	0.389	3.972	-1.437	6.792	8.821	0.000
SMB	90	-0.149	2.585	-0.333	1.401	-5.183	0.000
HML	90	-0.269	4.007	0.449	0.719	-6.049	0.000
RMW	90	0.433	1.847	0.403	0.561	21.096	0.000
CMA	90	0.162	2.746	0.760	1.806	5.321	0.000
UME	90	-0.024	0.445	0.035	1.738	-4.855	0.000

Data: Thomson DataStream database, Website of Bank of Canada, Website of MSCI, and Kenneth R. French's Internet Data Library. The table reports descriptive statistics for six-factor portfolios. MKT is the excess return on Fama and French's (2015) market proxy. SMB, HML, RMW, and CMA, are Fama and French's factor-mimicking portfolios for size, capitalization, profitability, and investment equities, respectively. UME is a factor-mimicking portfolio for ESG which is proposed in this research. Regarding t-tests for Mean = 0, both t-values and p-values are provided.

Table 4 presents the correlation coefficients among six factors during the whole sample period (90 months). The table reports that UME has significantly negative correlation with HML and CMA, which are statistically different from zero at the 1% and 5% level, respectively. In addition, UME has cross-correlation coefficients with MKT, SMB, and RMW, which are not statistically different from zero.

Table 4. Correlation among six factors (January 2016 to June 2023).

	MKT	SMB	HML	RMW	CMA	UME
MKT	1					
SMB	0.441*** (0.00)	1				
HML	0.198* (0.06)	0.283*** (0.00)	1			
RMW	0.021 (0.84)	-0.476*** (0.00)	-0.185* (0.08)	1		
CMA	0.041 (0.69)	0.046 (0.66)	0.827*** (0.00)	-0.024 (0.82)	1	
UME	0.0626 (0.55)	0.151 (0.15)	-0.291*** (0.00)	-0.035 (0.74)	-0.220** (0.03)	1

Data: Thomson DataStream database, Website of Bank of Canada, Website of MSCI, and Kenneth R. French's Internet Data Library. The table presents the correlation coefficients among six factors during the whole sample period (90 months). Numbers in parenthesis represent p-values against the null hypothesis that the cross-correlation coefficient is not statistically different from zero (H_0: ρ = 0).

4-2- Risk exposure to ESG-related factor (UME)

Table 5 summarizes average coefficients and t-values obtained from Equation (12) for the full period (January 2016 to June 2023) as well as three sub-periods (1st sub-period includes 11 months, 2nd and 3rd sub-periods include 10 months each). I divide the data sample into subperiods to observe the trends across time.

Table 5. Average exposures: six factor model (MSCI Canada Universal Index).

Period		MKT	SMB	HML	RMW	CMA	UME	Adj. R2
Full Period	Ave. Coeff	0.878***	0.065	-0.026	0.095	-0.040	-0.592***	0.884
	Ave. *t*-value	26.203	0.697	-0.282	1.010	-0.217	-2.421	
1st sub-period	Ave. Coeff	0.883***	0.063	-0.033	0.093	-0.016	-0.523**	0.892
	Ave. *t*-value	19.516	0.362	-0.377	0.566	-0.039	-2.028	
2nd sub-period	Ave. Coeff	0.892***	0.055	-0.035	0.082	-0.010	-0.565**	0.896
	Ave. *t*-value	25.793	0.386	-1.065	0.661	-0.024	-2.167	
3rd sub-period	Ave. Coeff	0.882***	0.077	-0.033	0.113	-0.016	-0.539**	0.907
	Ave. *t*-value	25.355	0.747	-0.384	0.997	-0.061	-1.938	

*, ** and *** indicate significance at 10%, 5%, and 1% levels, respectively.

The table presents results from the first-pass regression for the full period (January 2016 to June 2023) as well as three sub-periods: December 2020 to October 2021, November 2021 to August 2022, and September 2021 to June 2023. The table shows average estimated coefficients and average corresponding t-values from regression of excess fund returns on six risk factors which are obtained from the rolling window process: (MKT, SMB, HML, RMW, CMA, and UME). Adjusted R-squares are reported in the last column of the table.

In the full period, the average risk exposure to MKT is 0.9 and significant at the 1% level, indicating that sample funds in the full period of this research have risk-averse investment strategies and show small change in their rate of return, compared with change in market return. The factor exposure to MKT, which is close to one, implies that these portfolios are sufficiently diversified. The results for all three sub-periods are consistent with the full period and average risk exposure to MKT for the funds is lower than systematic risk of market for all three sub-periods.

Estimated coefficients for SMB and RMW for the full period and all three sub-periods are positive, but not statistically significant. The estimated coefficients for HML and CMA are negative and statistically insignificant for the full period as well as all three sub-periods. In addition, the estimated coefficient for UME in the full period is negative and significant at 1% significance level. This coefficient, for all three sub-periods, is negative and significant with statistical significance at 5% level.

When ESG-related systematic risk rises, it is expected that RI outperforms compared to CI, so UME is likely to show a lower value because it is constructed as the performance gap between CI and RI. As shown in Table 3, UME has a negative mean during the period of this research, which reflects that ESG events occurred more frequently than expected. When we expect that ESG events occur more frequently in the future, the negative average exposure to UME indicates that sample funds have hedged the risk caused by ESG-related events on average. Therefore, by an increase in ESG-related systematic risk, the expected rate of return will not decrease.

Therefore, the results obtained from first-pass regression of Fama and MacBeth shows that the risk exposure to ESG-related factor is significantly different from zero; therefore, the first hypothesis of this research is rejected at 1% significance level for the full period and 5% level for all three sub-periods.

According to Jin (2018), average risk exposures to MKT, SMB, HML, RMW, CMA, and UME are 0.980, 0.149, 0.015, -0.020, -0.131, and -0.135, respectively. However, t-values of the estimated coefficients are not reported in that paper, so I am not able to conclude whether those coefficients are significant in the US equity mutual fund in the period of Jin's research.

4-3- ERP on ESG-related Factor (UME)

Equation (13) is estimated for every month of the sample period. Table 6 shows average coefficients and t-values for the full study period over 31 observations as well as for three sub-periods (1st sub-period includes 11 months, 2nd and 3rd sub-period include 10 months). Since ERP estimates are averaged across months, reported figures are less subject to sampling error.

Table 6. Average of risk premiums: six-factor model (MSCI Canada Universal Index)

Period		MKT	SMB	HML	RMW	CMA	UME	Adj. R2
Full Period	Ave. Coeff	-0.123	0.129	-0.622***	-0.305**	-0.012	0.022	0.316
	Ave. *t*-value	-0.702	0.797	-5.772	-2.062	-0.347	0.916	
1st sub-period	Ave. Coeff	-0.156	0.291*	-0.746***	-0.345***	-0.252**	0.054**	0.459
	Ave. *t*-value	-0.892	1.632	-7.560	-2.385	-1.668	2.206	
2nd sub-period	Ave. Coeff	-0.143	0.153	-0.634***	-0.416***	-0.017	0.004	0.287
	Ave. *t*-value	-0.912	1.176	-6.362	-3.037	-0.268	0.273	
3rd sub-period	Ave. Coeff	-0.067	-0.072	-0.475***	-0.148	0.259	0.003	0.193
	Ave. *t*-value	-0.284	-0.500	-3.216	-0.732	1.025	0.140	

*, ** and *** indicate significance at 10%, 5%, and 1% levels, respectively.

The table represents results from the second-pass regression. It shows results for the full period as well as three sub-periods: December 2020 to October 2021, November 2021 to August 2022, and September 2021 to June 2023. The table shows average estimated coefficients and average corresponding t-values, from the regressions of 60-month average excess fund returns (in percent) on six-factor betas which are obtained from the rolling window process: the broad-market related factor beta (MKT-beta), the capitalization-related factor beta (SMB-beta), the valuation-related factor beta (HML-beta), the profitability-related factor beta (RMW-beta), the investment-related factor beta (CMA-beta), and the sustainability-related factor beta (UME-beta). The estimated figures represent the average ERP on each of six factor betas during each period. Adjusted R-squares are reported in the last column.

As shown in Table 6, while the estimated coefficient on UME-beta in the full period is positive, it is not statistically significant, indicating that this risk factor does not have impact on ERP of mutual funds in the period of this research. According to the results for three sub-periods, the estimated coefficient for UME-beta in sub-periods 1, 2, and 3 are also positive, but only significant at 5% significance level in the first sub-period. We can conclude that only in the first few months of this research does UME-beta have positive and significant impact on the ERP of mutual funds.

Thus, the insignificant average of ERP on UME for the full period and second and third sub-periods implies that the ESG-related systematic risk is not priced because investors are not sensitive to the potential implications of ESG-related events in Canada.

In sum, based on the result from second pass regression of Fama and MacBeth, the second hypothesis of this research, that the ESG-related component of ERP is not significantly different from zero, will be rejected for the first sub-period at 5% significance level but cannot be rejected in the full period or in sub-periods 2 and 3.

Based on Jin (2018), the estimated coefficients on MKT-beta, SMB-beta, HML-beta, RMW-beta, CMA-beta, and UME-beta are 0.668, 0.064, -0.214, 0.037, 0.177, and 0.049, respectively. The estimated coefficients on factor betas are significant except for RMW. Since the estimated coefficients of UME-beta are positive and significant, investors in the US mutual fund market are willing to forfeit a component of ERP for the downside protection against the ESG-related systematic risk in the period of Jin's research.

4-4- Robustness Test

For a robustness check, I modify the research design in three ways. First, instead of a six-factor model (Fama and French five-factor model (2015) plus ESG-related factor), I apply a seven-factor model (Fama and French six-factor model (2018) plus ESG-related factor). Except for UMD, other factors (MKT, SMB, HML, RMW, CMA, UME) are defined in Table 2. UMD represents return difference between a portfolio of past 12-month winners (Up portfolio) and a portfolio of past 12-month losers (Down portfolio); the source of data for UMD is Kenneth R. French's Internet Data Library for North America. I also use the CAPM model, which consists of two factors, MKT and UME.

Tables 7 and 8 present estimation results from the first and second pass regression of Fama and MacBeth, respectively, when the alternative seven-factor model and CAPM are employed.

Table 7. Average exposures: Alternative asset pricing model.

Model		MKT	SMB	HML	RMW	CMA	UMD	UME	Adj. R2
Seven-factor	Ave. Coeff	0.878***	0.065	-0.025	0.095	-0.040	0.001	-0.593**	0.884
	Ave. *t*-value	26.107	0.643	-0.292	0.945	-0.216	-0.089	-2.283	
CAPM + UME	Ave. Coeff	0.890***						-0.434**	0.857
	Ave. *t*-value	26.111						-2.094	

*, ** and *** indicate significance at 10%, 5%, and 1% levels, respectively.

The table presents results from the first-pass regression and shows results for the full period (January 2016 to June 2023). It shows average estimated coefficients and average corresponding t-values for two alternative asset pricing models from the regressions of excess fund returns on risk factors which are obtained from the rolling window process. Adjusted R-squares are reported in the last column.

Results shown in Table 7 indicate that the estimated coefficient for UME for both seven-factor and CAPM is negative with statistical significance at 5% level. Considering the results shown in Table 5, we can conclude that changes in the asset-pricing model do not affect the results obtained from

Fama–MacBeth first-pass regression. Therefore, the first hypothesis of this research is rejected by considering different asset-pricing models.

Table 8. Average risk premiums: Alternative asset pricing model.

Model		MKT	SMB	HML	RMW	CMA	UMD	UME	Adj. R2
Seven-factor	Ave. Coeff	-0.138	0.110	-0.669***	-0.308**	-0.040	0.268	0.034	0.327
	Ave. *t*-value	-0.742	0.606	-5.439	-1.831	-0.525	0.947	1.073	
CAPM + UME	Ave. Coeff	-0.171						0.053**	0.107
	Ave. *t*-value	-0.917						2.307	

*, ** and *** indicate significance at 10%, 5%, and 1% levels, respectively.

The table presents results from the second-pass regression. It shows average estimated coefficients and average corresponding t-values, for two alternative asset-pricing models, which are obtained from the rolling window process from the regressions of 60 months average excess fund returns (in percent) on factor betas. The estimated figures represent the average ERP on each of factor betas. Adjusted R-squares are reported in the last column.

Results shown in Table 8 signify that the estimated coefficient for UME-beta is positive for both seven-factor model and CAPM. Thus, by considering the estimated results from the main model of this research, it can be said that in all these asset pricing models the estimated coefficient for UME-beta is positive. However, according to the results shown in Tables 6 and 8, this coefficient is only significant in CAPM at the 5% level but statistically insignificant in six-factor and seven-factor models. So, based on the result obtained from second-pass regression of Fama and MacBeth, the second hypothesis of this research – that the ESG-related component of ERP is not significantly different from zero – is rejected for the CAPM model at 5% significance level but cannot be rejected in seven-factor model. We can conclude that while changes in the asset-pricing models do not affect the direction of relationship of UME-beta on ERP, it affects the significance level of the estimated coefficient.

However, Jin's (2018) results are robust by changing the asset pricing model to the Fama and French three-factor model (1993) and Carhart (1997). It can imply that while applying alternative asset-pricing models do not affect the results for the US mutual fund market, it has an important impact on the Canadian mutual fund during the period of this research.

Second, I modified alternative ESG-related indices by applying MSCI Canada IMI Extended ESG Focus Index and MSCI Canada SRI Index instead of MSCI Canada Universal Index. Tables 9 and 10 summarize the result of the first- and second-pass regression of Fama and MacBeth, respectively, when alternative ESG-related factors are applied.

Table 9. Average exposures: Alternative ESG-related factor.

ESG Factor		MKT	SMB	HML	RMW	CMA	UME	Adj. R2
MSCI Canada IMI Extended ESG Focus Index	Ave. Coeff	0.870***	0.035	0.011	0.102	-0.064	-0.193	0.875
	Ave. *t*-value	22.495	0.140	0.383	0.952	-0.558	-0.325	
MSCI Canada SRI Index	Ave. Coeff	0.827***	0.140	0.007**	0.191	-0.046	-0.282	0.875
	Ave. *t*-value	22.004	0.780	1.880	0.200	-0.234	-0.105	

*, ** and *** indicate significance at 10%, 5%, and 1% levels, respectively.

The table presents results from the first-pass regression and shows results for the full period (January 2016 to June 2023). It shows the results for two ESG-related factors, each of which represents return difference between an unweighted market portfolio and an ESG-score-weighted portfolio. The table shows average estimated coefficients and average corresponding t-values, from the regressions of excess fund returns on six risk factors which are obtained from the rolling window process: MKT, SMB, HML, RMW, CMA, and UME. Adjusted R-squares are reported in the last column.

Results shown in Table 9 imply that by considering MSCI Canada IMI Extended ESG Focus Index and MSCI Canada SRI Index, the estimated coefficient for UME is negative but not statistically significant. Based on the results of the main model of this research (Table 5), we can conclude that in all ESG indices for UME, the estimated coefficient is negative. However, according to the results in Tables 5 and 9, this estimated coefficient is only significant when MSCI Canada Universal Index is considered as the ESG-related factor and is not statistically significant for the two alternative indices. Based on the result obtained from first-pass regression of Fama and MacBeth, the first hypothesis of this research – that risk exposure to ESG-related factor is not significantly different from zero – cannot be rejected by changing ESG-related factors. This indicates that while changing the ESG-related factor does not affect the direction of relationship of this factor on ERP of mutual funds, it affects the significance level of the estimated coefficient.

Table 10. Average of risk premiums: Alternative ESG-related factor

ESG Factor		MKT	SMB	HML	RMW	CMA	UME	Adj. R2
MSCI Canada IMI Extended ESG Focus Index	Ave. Coeff	-0.119	0.158	-0.554***	-0.313**	-0.070	0.034	0.329
	Ave. *t*-value	-0.705	1.162	-5.211	-2.087	-0.638	1.253	
MSCI Canada SRI Index	Ave. Coeff	-0.129	0.094	-0.582***	-0.280**	-0.115	0.256*	0.332
	Ave. *t*-value	-0.740	0.694	-5.276	-1.896	-0.924	1.501	

*, ** and *** indicate significance at 10%, 5%, and 1% levels, respectively.

The table represents results from the second-pass regression. It shows the results for two ESG-related factors, each of which represents return difference between an unweighted market portfolio and an ESG-score-weighted portfolio. The table shows average estimated coefficients (in percent) and average corresponding t-values on six factor betas which are obtained from the rolling window process. The betas are broad-market related factor beta (MKT-beta), capitalization-related factor beta (SMB-beta), valuation-related factor beta (HML-beta), profitability-related factor beta (RMW-beta), investment-related factor beta (CMA-beta), and sustainability-related factor beta (UME-beta). The estimated figures represent the average ERP on each of six factor betas. Adjusted R-squares are reported in the last column.

Results shown in Table 10 signify that, by considering MSCI Canada IMI Extended ESG Focus Index and MSCI Canada SRI Index, the estimated coefficient for UME-beta is positive but only significant for SRI Index at the level of 10%. Based on the results of the main model of this research (Table 6), it can be concluded that in all three ESG indices for UME, the estimated coefficient is positive but only significant when MSCI Canada SRI Index is considered as the ESG-related factor. Therefore, the result obtained from second-pass regression of Fama and MacBeth shows that the second hypothesis of this research – that the ESG-related component of ERP is not significantly different from zero – is rejected for MSCI Canada SRI Index at 10% significance level but cannot be rejected for MSCI Canada Universal Index and MSCI Canada IMI Extended ESG Focus Index. Thus, while changing the ESG-related factor does not affect the direction of relationship UME-beta on ERP, it affects the significance level of the estimated coefficient.

However, Jin's (2018) main results remain robust despite the change of UME. The coefficients on UME-beta remain significantly positive for all alternative ESG-related factors.

Third, I divide the period of the research into pre-Covid (January 2016 to December 2019), Covid (January 2020 to May 2022), and post-Covid (June 2022 to June 2023) to check whether the pandemic affects the model's performance. The results of the first- and second-pass regression of Fama and MacBeth are reported in Tables 11 and 12, respectively.

Table 11. Average exposures: Pre-Covid, Covid, and Post-Covid.

Period		MKT	SMB	HML	RMW	CMA	UME	Adj. R2
Pre-Covid	Ave. Coeff	0.847***	0.041	-0.015	0.043	-0.127	-0.639**	0.804
	Ave. *t*-value	18.460	0.202	-0.003	0.488	-0.835	-2.190	
Covid	Ave. Coeff	0.914***	0.086	-0.051	0.086	-0.032	-0.998**	0.919
	Ave. *t*-value	19.603	0.492	-0.540	0.427	-0.024	-2.054	
Post-Covid	Ave. Coeff	0.867***	0.127	0.006	0.249**	-0.095	1.305	0.940
	Ave. *t*-value	25.933	0.870	0.329	2.598	-0.637	1.060	

*, ** and *** indicate significance at 10%, 5% and 1% levels, respectively.

The table presents results from the first-pass regression for three sub-periods: January 2016 to December 2019 (pre-Covid), January 2020 to May 2022 (Covid), and June 2022 to June 2023 (post-Covid). The table shows average estimated coefficients and average corresponding t-values, from the regressions excess fund returns on six risk factors: MKT, SMB, HML, RMW, CMA, and UME. Adjusted R-squares are reported in the last column.

Results reported in Table 11 show that the estimated coefficient for UME in pre-Covid and Covid is negative and significant at the 5% level. Therefore, results obtained for pre-Covid and Covid are consistent with those of the main model of this research as well as with results that I obtained by changing asset-pricing model in the robustness test. However, the estimated coefficient for UME in post-Covid is positive but not statistically significant, indicating that in the post-Covid period the estimated coefficient for UME shows different results in both the direction of relationship on the ERP and the significance level.

Table 12. Average of risk premiums: pre-Covid, Covid, and post-Covid.

Period		MKT	SMB	HML	RMW	CMA	UME	Adj. R2
Pre-Covid	Ave. Coeff	0.351***	-0.203*	-0.138*	-0.043	0.219***	0.036*	0.334
	Ave. *t*-value	5.144	-1.591	-1.481	-0.419	2.646	1.366	
Covid	Ave. Coeff	-0.405*	0.601***	-0.031	-0.693***	0.331**	0.044**	0.270
	Ave. *t*-value	-1.476	2.883	-0.149	-2.819	1.412	2.336	
Post-Covid	Ave. Coeff	0.172	-0.785***	-1.001***	0.597***	-0.585**	0.025	0.429
	Ave. *t*-value	0.546	-3.541	-3.106	3.153	-1.288	0.592	

*, ** and *** indicate significance at 10%, 5%, and 1% levels, respectively.

The table presents results from the second-pass regression and shows results for three sub-periods: January 2016 to December 2019 (pre-Covid), January 2020 to May 2022 (Covid), and June 2022 to June 2023 (post-Covid). The table shows average estimated coefficients and average corresponding t-values, from the regressions of average excess fund returns (in percent) on six-factor betas: the broad-market related factor beta (MKT-beta), the capitalization-related factor beta (SMB-beta), the valuation-related factor beta (HML-beta), the profitability-related factor beta (RMW-beta), the investment-related factor beta (CMA-beta), and the sustainability-related factor beta (UME-beta). The estimated figures represent the average ERP on each of six factor betas and average corresponding t-values during each period. Adjusted R-squares are reported in the last column.

The results shown in Table 12 indicate that the estimated coefficient for UME-beta in pre-Covid and Covid period is positive and significant at the 10% and 5% level, respectively. However, the estimated coefficient in post-Covid is positive but not significant at any level. So, based on the result obtained from second-pass regression of Fama and MacBeth, the second hypothesis of this research – that the ESG-related component of ERP is not significantly different from zero – is rejected for pre-Covid and Covid periods at 10% and 5% significance level, respectively; but cannot be rejected for post-Covid.

Chapter 5: Conclusion

This study investigates whether the ESG-related systematic risk is priced in the Canadian mutual fund market and investigates the nature of return differential between RI and CI in the well-known risk-return paradigm. To do so, I focus on the ex-ante return differential rather than the ex-post return differential. So, the ex-ante return differential between well-diversified RI and well-diversified CI depends on how large the exposure is to ESG-related systematic risk. Based on this, the total equity risk premium (ERP) on CI can be decomposed into two components: ERP on RI and the price of downside protection by RI. By doing this research, I want to learn whether corporate social performance (CSP) is compensated systematically through RI in the mutual fund market. I develop two hypotheses: (H1) The risk exposure to ESG-related factor is not significantly different from zero, and (H2) The ESG-related component of ERP is not significantly different from zero.

To test these hypotheses, I modify the conventional five-factor model (Fama and French, 2015) and incorporate the ESG-related factor into the model. Then, the two-step procedure of Fama and MacBeth (1973), is applied to returns on 154 Canadian open-end equity funds for the period of 90 recent months (January 2016 to June 2023).

For a robustness check, I modify the research design in three ways. First, instead of six-factor model (Fama & French, 2015) plus the ESG-related factor, I apply seven-factor model (Fama and French, 2018) plus ESG-related factor and CAPM plus the ESG-related factor. Second, I modify alternative ESG-related indices by applying MSCI Canada IMI Extended ESG Focus Index and MSCI Canada SRI Index instead of MSCI Canada Universal Index and, third, I divide the period of this research into pre-Covid (January 2016 to December 2019), Covid (January 2020 to May

2022), and post-Covid (June 2022 to June 2023) to check whether the pandemic affects the model's performance.

The major results can be highlighted as follows. First, the exposure (factor beta) to the ESG-related factor is significantly negative. Since the ESG-related factor is computed by subtracting returns on RI from returns on CI, the negative exposure implies that sample funds tend to hedge the ESG-related systematic risk. This finding confirms that the downside protection by RI is materially utilized in the Canadian mutual fund market. Results of the robustness test confirm the findings of the main model of this research indicating that by changing the asset pricing model, our outcome is not altered. Moreover, by applying alternative ESG-related factors, while the estimated coefficient remains negative, it is not statistically significant. Therefore, considering different ESG-related factors can affect the results of the research. It also can be shown that the findings of the main model of this research remain robust for pre-Covid and Covid periods, while the estimated beta is positive but is not statistically significant.

Next, the price of downside protection by RI can be measured by the coefficient on UME-beta and it is positive but insignificant in the main model of this research. Because the downside protection price mirrors the compensation for taking the ESG-related systematic risk, investors do not expect compensation for taking the ESG-related systematic risk in the Canadian fund market. Although the estimated coefficient for UME-beta is positive and insignificant in the main model of this research, it is positive and significant in the robustness test done for the CAPM model, when SRI Index used as an alternative ESG-related factor, and for pre-Covid and Covid periods. Thus, it can be concluded that applying different asset-pricing models and different ESG-related factors as well as considering different periods of time can affect the results obtained from testing the second hypothesis of this research.

From the above-mentioned, it can be shown that the findings of this research relating to the first hypothesis are consistent with Jin (2018). However, while the estimated coefficient for testing the second hypothesis is also compatible with Jin (2018) regarding the direction of the relationship, it is not statistically significant.

There are some limitations to this research that indicate possible future work. First, the number of open-end equity funds in the period of my research is small, which can affect the thesis's results; thus, the sample for future research needs to be extended. Second, the ESG index has a crucial effect on the results, but the launch date of S&P/TSX Composite ESG Index, an important ESG index in Canada, was July 2020. Therefore, over time, more research can be done on this topic by having sufficient historical data. In addition, researchers can apply alternative regression models such as non-linear and non-parametric model for the estimation.

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