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# **ESG Integration into a Smart Beta Strategy**

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**ABSTRACT :**

Purpose of this thesis is to examine how integration of environmental, social and governance (ESG) factors affects the risk and return of smart beta strategies. Thesis evaluates whether integration of ESG improves risk-adjusted return, influences downside risk and market sensitivity, and if the magnitude of this effect varies across market regimes. Aim is to develop a literature-based synthesis of effect mechanism and the key evaluation criteria, positioning ESG integration can be seen as a part of rule- and factor-based portfolio construction.

The study is carried out by a literature review in a framework of factor-based investing where returns are explained by systematic risk-factors. Smart beta strategies are viewed as an alternative index like investing which uses transparent and predetermined rules to access factor exposures. ESG is connected to this framework, especially through risk control and information channels. ESG investing is expected to decrease firm specific risk, sector-specific exposure and long-term cash-flow channels and uncertainty about the cost of capital.

ESG integration is usually divided into two different approaches. First, screening method, which excludes firms with weaker ESG score from investable universe or favors specific sectors. Second, ESG -based weighting or rebalancing of weighting, where weighting is adjusted based on ESG metrics, while maintaining defining characteristics of smart beta strategies. These approaches highlight question of how ESG -criteria affect factor exposures, diversification, and the sector allocation of the portfolio.

Earlier studies produced somewhat inconsistent findings. In some settings ESG integration is associated with lower overall risk and improved robustness. The effect is dependent on the strategy's implementation, factor exposures, and differences in ESG measurement. A central challenge concerns attribution, observed changes in risk and return may be explained by other factors additionally to ESG. These factors may be, for example, sector or style tilts. Moreover, implementation is practical side seems to have own effects such as turnover costs and other fees.

The central interpretation is that integration of ESG to smart beta is observed primarily as a change in portfolio construction. It alters investable universe and changes in weighting, thereby modifying factor loadings and the risk profile of the portfolio. For this reason, observed differences should not attribute differences unambiguously to an "ESG effect" without neutralizing the main portfolio construction side effects. In particular, sector exposures and unintended style tilts should be controlled. Sensitivity checks across ESG providers and cost assumptions can further strengthen inference, across market regimes.

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**Key terms:** Smart beta, ESG investing, Risk-adjusted return, Downside risk, Market regimes

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## 1 Introduction

Finance theory relies on simplifying assumptions. One key assumption is that investors demand higher risk premia for bearing higher risk. Markowitz's (1952) portfolio theory introduces risk-return trade-off. Sharpe (1964) building on portfolio theory, introduces capital asset pricing model (CAPM), which shows that only bearing a systematic risk is priced. These ideas are later extended into multifactor-models, where risk factors explain differences in returns outside of the market risk (Fama & French, 1992, 2015; Carhart, 1997).

Over the last few decades, investment strategies have expanded beyond traditional financial metrics to include new sources of information and firm characteristics that capture long-term risks. Environmental, social and governance (ESG) factors have become a central consideration in investor decision-making (Dinh, 2025). In recent literature it has increasingly been seen as a factor that shapes firms' risk profile, affecting both systematic and idiosyncratic risk components (Giese et al., 2019). At the same time smart beta strategies have gained increasing attention in research and in practice as well, with studies documenting a shift toward rule-based factor investing (Giampaoli, 2025). Prior evidence suggests that investors tend to seek a ways to improve the cost-effectiveness of the portfolio while gaining better risk-adjusted returns compared to the market portfolio (Koedijk et al, 2016).

While ESG factors and smart beta strategies have been widely studied in the literature, research has mostly examined them as separate phenomena. Despite the growing adoption of ESG factors and smart beta strategies in investing, their implementation raises questions about how ESG signals should be integrated into smart beta frameworks. While ESG is increasingly seen as relevant for assessing firms' risk profile (Giese et al., 2019), its role in smart beta is still evolving (Lelasi et al., 2020). In particular, whether the integration of ESG characteristics meaningfully affects smart beta strategies' risk-return trade-off or the composition of portfolio risk. This creates a need to examine whether smart beta strategy is materially impacted by ESG integration.

## 1.1 Purpose of the study

The purpose of this thesis is to study how ESG factors integration affects smart beta strategies risk-return trade-off. Research has shown that smart beta strategies and ESG factors in investing are each associated with risk-adjusted return, but their combined effect has not been completely defined. The analysis is further extended by focusing on different risk components. Literature suggests that ESG -factors may affect both firm-specific and systematic risk. Therefore, ESG -integration may not be reflected to portfolio returns but rather change risk components in the overall risk profile.

In addition, ESG effects may vary across different market conditions, so the role of market environment is considered. Many studies suggest that the impact of ESG factors increases in time of uncertainty, while investors emphasize risk management and downside protection. This shows that integration's effect might vary across different market conditions. Based on existing literature, proposed hypotheses are:

H1: Integrating ESG into smart beta strategies improves their risk-adjusted performance relative to the corresponding non-ESG smart beta strategy.

H2: ESG integration into smart beta strategies reduces downside risk and/or market sensitivity relative to the corresponding non-ESG smart beta strategy.

H3: The impact of ESG integration on smart beta strategies is stronger during adverse market regimes than during favorable regimes.

Together, these hypotheses guide the thesis to study ESG factors integration into smart beta strategies from risk-return trade-off perspective. Studies suggest that integration may affect both: return dynamics and the composition of risk. This thesis is motivated by the need to examine how integrating ESG factors into smart beta strategies affects their performance and risk characteristics across different market environments.

## **1.2 Structure of the Study**

Chapter two outlines the theoretical framework by introducing the key concepts of risk, asset pricing, smart beta strategies, and the role of ESG factors in investment analysis. Theoretical framework is built on theories which directly support the development of hypotheses, these are asset pricing theory, factor-based investing, sustainability perspectives, and downside risk considerations. Chapter three provides a literature review of research on smart beta strategies, ESG investing, and their integration, with a focus on risk-return trade-off. The final chapter summarizes key points of the literature review and discusses possible future research opportunities on this topic.

## 2 Theoretical Framework

### 2.1 Asset Pricing and Risk-Return Theory

#### 2.1.1 Risk and Return in Asset Pricing

Understanding risk is important for analyzing portfolio construction choices. Risk is not only a measure of uncertainty, but it is also a key component of the compensation that investors require for holding different assets. The relationship between risk and return is therefore one of the core concepts in asset-pricing theory. This forms the foundation for Markowitz's portfolio selection all the way to the smart beta strategy. In this thesis it is necessary to understand the difference between systematic and idiosyncratic risks in order to study how ESG characteristics may affect them and the risk-return trade-off.

Holton (2004) argues that risk cannot have a single universal definition even though it should have two components: exposure and uncertainty. Instead, its explanation depends on context. However, in finance, the need for comparability and quantification has led to a few metrics being used more commonly: volatility and systematic risk often proxied by beta. In multifactor models, this idea extends to factor loadings (betas) that capture exposure to varying sources of systematic risk. This definition of risk provides a foundation for analyzing changes in trade-off between risk and return when altering the portfolio by integrating ESG in different ways.

The link between risk and expected return is a central principle in finance: investors demand higher compensation for holding an asset that has higher exposure to risk. Portfolios can be positioned along an efficient frontier as formalized by Markowitz (1952). This represents the maximum attainable expected return for any given level of risk. The trade-off arises because increasing expected returns generally increase the variance. Within

this framework, changes in portfolio characteristics that affect the risk exposure are expected to affect the risk-return trade-off as well. This provides a basis for examining how ESG integrations affect smart beta strategies' overall risk-return trade-off.

### **2.1.2 Systematic and Idiosyncratic Risk**

Portfolio risk can be divided into two different components, which together form total risk of the portfolio. This originates from the Portfolio theory of Markowitz (1952), where it is argued that risk of the portfolio can be separated into diversifiable and non-diversifiable components. In this context the diversifiable part corresponds to idiosyncratic risk, which arises from firm-specific events such as surprises in earnings or governance-related issues. This risk can be reduced by building a broadly diversified portfolio.

The non-diversifiable part corresponds to systematic risk, which reflects the market-wide sources of uncertainty. Sharpe (1964) argues that only the covariance between an asset's returns and the market portfolio is relevant. The capital asset pricing model (CAPM) captures this movement through beta. This component is central in modern asset-pricing models as well as in factor-based approaches like the smart beta strategy.

Lintner (1965) further shows that a portfolio's total risk depends on both individual asset variances and the covariances among asset returns. A practical implication is that investors are not compensated for bearing risks that can be diversified away. Idiosyncratic fluctuations may affect individual securities, but they should not drive expected returns in a well-diversified portfolio. By contrast, systematic risk is the portion that remains even when diversification is maximized and therefore becomes central in asset-pricing models risk-return relationship. This also underlines the basic idea in factor-based approaches, where systematic risk sources are identified beyond the CAPM market factor alone.

Although idiosyncratic risk is not compensated in standard theory and it can be reduced through diversification, it can still affect the total risk and realized performance of a portfolio. In the context of smart beta strategies, which implement systematic tilts and are not perfectly diversified compared to the market portfolio, changes in firm level risk characteristics may have a meaningful impact on risk-adjusted performance.

### 2.1.3 Capital Asset Pricing Model (CAPM)

To interpret portfolio risk and expected returns, a benchmark for systematic market risk is required. The Capital Asset Pricing Model (CAPM) can be considered one of the most used frameworks for modeling expected returns. In CAPM, expected returns and investors' compensation for bearing risk are linked to beta which measures the asset's co-movement with the market portfolio:

$$E(R_i) = R_f + \beta_i(E(R_m) - R_f) \quad (1)$$

where  $E(R_i)$  is the asset's expected return,  $R_f$  is the risk-free rate,  $\beta_i$  measures sensitivity to systematic risk and  $E(R_m) - R_f$  is the market risk premium. The model implies that only systematic risk is compensated, because idiosyncratic risk can be diversified away (Sharpe, 1964). The CAPM thus serves as a benchmark for assessing changes in systematic market-wide risk, which is relevant for examining how ESG -characteristics may affect smart beta strategies risk characteristics.

### 2.1.4 Risk-Adjusted Performance and the Sharpe Ratio

To compare portfolio performance, a measure that considers risk and return is required. Sharpe (1964) transformed this idea into a linear pricing relation by showing that once investors can combine the risk-free asset with the market portfolio, the efficient frontier becomes a straight line, known as the capital market line (CML). This implies that the

relationship between risk and return is governed by a single, common trade-off. Therefore, investors choose a point along this line according to the amount of risk they are willing to bear.

Building on the CML, Sharpe (1966) introduced the Sharpe ratio, which measures excess return per unit of total risk. The ratio is widely used as a performance metric for portfolios, because it is standardized and takes into consideration return and volatility. This makes it easy to compare portfolios' risk-adjusted return in a single indicator. Sharpe ratio:

$$\text{Sharpe Ratio} = \frac{(R_p - R_f)}{\sigma} \quad (2)$$

where  $R_p$  denotes the portfolio return,  $R_f$  the risk-free rate, and  $\sigma$  is the volatility of the portfolio. The Sharpe ratio therefore offers a practical way to compare different portfolios performances on a risk-adjusted basis.

## 2.2 Factor Pricing and Smart Beta Theory

Asset pricing theory is based on the idea that only systematic risk that cannot be diversified away is compensated in expected returns (Sharpe, 1964; Lintner 1965). Later developments extend this framework by arguing that multiple sources of systematic risk may be priced, as formalized in the Arbitrage Pricing Theory (Ross, 1976). This framework is extended into multifactor models such as Fama and French (1993, 2015) and Carhart (1997).

This theoretical development implies that exposure to systematic risk is not limited to the market factor but can be decomposed into distinct and identifiable components. On this basis portfolio construction can be designed to target desired risk exposures. Smart

beta strategies are built on this idea by implementing rules that tilt the portfolio towards chosen systematic risk factors (Kahn & Lemmon, 2015).

### **2.2.1 Arbitrage Pricing Theory**

The idea that only bearing systematic risk provides compensation makes the basis for the factor models in which different risk factors are identified. These extensions make it possible to view the risk-return trade-off beyond the market factor and introduce different sources of compensated risk factors. This idea, that multiple systematic risk factors may be priced in equilibrium, was introduced in the arbitrage pricing theory (APT) by Ross (1976). It shows that return on any well-diversified portfolio must be a linear function of its factor loadings. On this basis, later factor models build on APT by specifying concrete risk factors that explain differences in expected returns.

### **2.2.2 Factor Pricing Models**

The Fama-French factor models extend the CAPM by recognizing more than only one systematic risk source, that can explain returns. In the three-factor model they included CAPM's market factor, the size factor (SMB: small minus big market cap) and the value factor (HML: high minus low book-to-market ratio). They motivate usage of these factors by arguing that size and book-to-market are associated with risk components that influence expected returns across assets (Fama & French, 1993). Additionally, beyond the three-factor model Fama & French (2015) later argued that a five-factor model provides a better description of average stock returns. Two new factors are profitability and investment. The profitability factor (RMW: robust minus weak operating profitability) and the investment factor (CMA: conservative minus aggressive investing).

In addition to these model extensions, Carhart (1997) introduced a four-factor model that uses momentum as a factor. The momentum factor (MOM: winners minus losers on

recent returns) captures the tendency for assets with strong recent performance to continue outperforming, while weaker recent performance continues to underperform. Carhart's (1997) model expands the explanation of expected returns beyond the original market, size and value factors. By identifying different sources of systematic risk, these factor models provide a foundation for constructing portfolios with targeted factor exposures.

### **2.2.3 Smart Beta Investing**

Smart Beta strategies are rule-based investing strategies that aim to exploit documented systematic factors beyond the market risk component and seek to improve risk-return trade-off (Besbes & Maher, 2022). Although smart beta and factor investing share a common foundation in systematic risk premia, their development has been different. Factor investing originates from asset-pricing research and seeks to explain expected returns through chosen factors as discussed earlier in the thesis. Smart beta, by contrast, operationalizes these insights by embedding factor-related rules directly into index construction and rebalancing. This aims to capture higher expected returns in a transparent and rules-based manner (Koedijk et al., 2016; Giampaoli, 2025).

Because smart beta strategies rely on predefined rules to target specific sources of systematic risk, changes in portfolio construction, such as integration of ESG characteristics, may alter exposure to the risk components and the strategies' overall risk-return trade-off. This makes smart beta a suitable framework for examining how ESG integration affects risk-adjusted performance and different components of portfolio risk.

## **2.3 Stakeholder Theory and ESG as a Risk Channel**

Environmental, social and governance (ESG) – criteria refer to non-financial characteristics that can be used to evaluate a firm's sustainability, social responsibility and corporate

governance quality. Fundamentals that guide ESG investors are transparency, stakeholder engagement and varying financial instruments (Xia et al., 2023). These principles are partly reflected in smart beta strategies, which rely on transparent and rule-based portfolio construction.

Over time, ESG has progressed from corporate responsibility framework towards analytical tools, that can be used to assess a firm's long-term risk profile and its changes (Friede et al., 2015; Xia et al., 2023). Changes to a firm's risk profile may be caused by operationalizing stakeholder theory (Freeman, 1994), by systematically addressing environmental, social and governance issues. In this way firms may build stronger stakeholder alliances, that can reduce the likelihood of negative shocks, lower earnings volatility, and enhance operational resilience (Peng & Isa, 2020).

Firms' structural weaknesses related to ESG characteristics may increase uncertainty of future cash-flows and exposure to financial, operational or reputational risks. In contrast, strength related to these characteristics may decrease the same risks and that way decrease risk components that are not included in traditional financial modeling (Friede et al., 2015). This way ESG can be conceptualized as an extension of traditional risk analysis, offering additional information on exposure to both systematic and idiosyncratic sources of risk (Friede et al., 2015).

From a risk-return perspective, ESG characteristics can affect portfolios' performance by influencing firm's exposure to different sources of risk, additionally to expected returns. This link is particularly relevant for factor-based and smart beta strategies, where firm-level risk characteristics play a role in shaping portfolio risk.

## **2.4 Behavioral Biases and Downside Risk**

### **2.4.1 Behavioral Biases and Risk Perception**

Behavioral finance shows that risk perception is not purely objective but systematically biased by psychological and emotional factors. Almansour et al. (2023) identify a range of these biases that significantly impact perception of risk and investors' decision making in portfolio construction. In the context of smart beta strategies, which rely on systematic and rule-based portfolio construction, this section concentrates on two behavioral biases that are particularly relevant in this context: herding behavior and overconfidence.

First, herding behavior emerges when investors follow crowd decisions, especially in times of uncertainty. According to Almansour et al. (2023) herding tends to increase when market volatility rises, as investors use others' decisions as a kind of a risk aversion heuristic. In smart beta this can lead to factor crowding.

Second, overconfidence makes investors believe too highly in their own investing decisions and underestimate market uncertainty. According to Almansour et al. (2023) overconfident investors tend to take higher risks and process information differently than rational models predict. This is central in decision making for smart beta strategy because overconfidence can lead to overweighting recent factor performance.

### **2.4.2 Downside Risk**

According to Kahneman & Tversky (1979) people tend to react more strongly to negative outcomes of investment. When aggregated across investors, this loss aversion may contribute to higher volatility and uncertainty in markets. In bear markets, while volatility is high and downside tail risk is more likely to materialize, characteristics that lower the downside risk can become relatively more valuable (Sortino & van der Meer, 1991). These theories together on ESG by Peng & Isa (2020) provide a theoretical basis for hy-

pothesizing that effects of portfolio construction decisions like ESG characteristics integration could vary depending on the market conditions and may have a stronger role during bear markets.

Together asset pricing theory, factor pricing models, stakeholder theory and behavioral finance provide a coherent framework for the hypothesis of this study. ESG integration may improve risk-adjusted return of the smart beta strategies performance by reducing systematic and idiosyncratic risk components. Thus, it motivates the first two hypotheses. Moreover, Behavioral Biases and downside Risk considerations suggest that these effects may be stronger during market stress forming the hypothesis three.

### **3 Literature Review**

This chapter reviews the empirical literature on smart beta strategies, ESG investing, and the integration of ESG into smart beta strategies. The review highlights key findings and limitations that motivate the research question: how ESG integration affects smart beta strategies risk-return trade-off.

#### **3.1 Evidence on Smart Beta Strategies**

Jacobs & Levy (2014), Blitz (2015) argue that exposure to systematic risk factors can be intentionally and systematically targeted, which makes the portfolio transparent and rules-based. Smart beta strategies use these factor insights to set rules in advance, thereby allowing investors to target desired risk premia. Kahn & Lemmon (2015), Giampaoli (2025) find that smart beta strategies are systematic, transparent, and cost-efficient alternatives to traditional passive and active portfolio management. These characteristics motivate examining how smart beta strategies are constructed in practice and how design choices may affect factor exposures and a portfolio's risk profile.

##### **3.1.1 Construction and Characteristics of Smart Beta Strategies**

Blitz (2015) and Jacobs & Levy (2014) highlight that smart beta strategies are designed to improve risk-adjusted returns rather than to generate excess returns relative to the market. This can be achieved by deviating from market-capitalization-weighted portfolios toward structures that have more efficient risk profiles across different market environments. Therefore, smart beta is commonly seen as an alternative investment approach to traditional portfolios that seek factor exposure without any active management.

Unlike traditional active portfolio management, where investment decisions may be influenced by subjectivity and behavioral biases, portfolio construction in smart beta strategies is made according to predefined rules (Jacobs & Levy, 2014; Kahn & Lemmon, 2015). Kahn & Lemmon (2015) argue that this rule-based approach improves the predictability of the investment process and simplifies the identification of the sources of portfolio returns and risks. These rules can determine both the selection of securities and portfolio weights, making smart beta strategies more active than traditional indexing while remaining systematic and transparent. Moreover, the decision to deviate from market-capitalization-weighted weighting is an active investment choice (Jacobs & Levy, 2014).

Several approaches to constructing smart beta portfolios are documented in the literature. First, factor-based weighting tilts portfolio weights towards factors that academic evidence has shown to be associated with long-term rewarded risk premia and improved risk-adjusted performance. These strategies target exposures to factors such as value, momentum, quality or low volatility (Kahn & Lemmon, 2015; Blitz, 2015).

Second, alternative (non-factor) weighting, where weightings do not explicitly target academically defined risk factors, but by deviating from market-capitalization-weighting, they create systematic factor tilts. Examples include equal-weighting, fundamental-weighting, or minimum-volatility weighting (Arnott et al., 2005; Vijaya & Thenmozhi, 2024).

Third, screening-based portfolio construction. Screening includes or excludes companies based on criteria, such as quality or ESG scores. Although this differs from the first two methods in that it does not directly determine weights, it creates an alternative investment universe and thereby results in factor exposures (Kahn & Lemmon, 2015).

Fourth, composite scoring. This method combines multiple factors into multifactor smart beta indices, with each factor assigned a predetermined weight. As a result, the strategy maintains balanced exposure across factors and reduces the risk of weak performance

in a single factor. Literature shows that multifactor strategies results in more stable returns and more desirable risk profile compared to single-factor strategies (Blitz, 2015; Kahn & Lemmon, 2015).

Beyond these core methods, smart beta design typically involves additional layers of choices that influence factor exposures. In practice, smart beta strategies often rely on periodic rebalancing to ensure that the portfolio continues to reflect the targeted factor profile and portfolio rules (Blitz, 2013). This may increase costs compared to fully passive portfolios. Cost efficiency is a recurring theme in smart beta literature as well. Although smart beta strategies typically cause higher costs than market-capitalization-weighted portfolios, they often have better cost efficiency and scalability than fully actively managed strategies (Kahn & Lemmon, 2015; Jacobs & Levy, 2014). This relative cost advantage is often attributed to the rule-based nature of smart beta strategies, which limit portfolio management activity.

### **3.1.2 Performance and Risk Characteristics**

Empirical studies show mixed results on smart beta strategies performance and different factors affect. Numerous studies suggest that certain smart beta strategies may outperform benchmark market-capitalization-weighted indices over the long-term, but performance varies remarkably between time periods, market phases, and factors.

White & Haghani (2020) show that equally weighted long-only US smart beta portfolios using certain factors: Value, Size, Dividend yield, Quality, Momentum, and Low volatility outperformed the market over the 1963-2019 horizon. However, observed outperformance has diminished in more recent periods and even turned into underperformance which raises concerns regarding the persistence of returns.

Complementary evidence has been found in emerging markets. Vijaya & Thenmozhi (2024) find that smart beta indices outperformed markets in India especially during bear

or sideways market phases. In contrast during bull market only certain factors had better return, usually without significant improvement in risk-adjusted returns as measured by the Sharpe ratio. These findings indicate that smart beta performance depends on market phase and factor selection rather than representing a stable outperformance across different market environments.

Moreover, the literature finds that over-performance is largely explained by exposure to Value and Size characteristics (Arnott et al., 2005; Chow et al., 2011; Jacobs & Levy, 2014). Jacobs & Levy (2014) highlight that smart beta strategies may over-perform market over a short period of time, but over longer horizon risk-adjusted returns tend to revert toward the index level, because over-performance reflects the compensation on bearing systematic risk factors.

Differences in risk-adjusted returns across smart beta strategies can be partly explained by their different risk profiles. Several studies show that low volatility and other defensive factor weighting reduce a portfolio's total volatility and the downside risk especially under adverse market conditions. In contrast, Value and Momentum strategies are exposed to greater volatility and can face significant drawdowns during market reversals (Chow et al., 2011; White & Haghani, 2020). Overall, empirical studies suggest that smart beta strategies primarily modify the portfolio risk profile through systematic factor exposures, while their performance and risk-adjusted returns vary significantly across market phases.

### **3.1.3 Critique of Smart Beta Strategies**

Although smart beta strategies aim to capture systematic risk premia, several studies have highlighted limitations and risks that may reduce effectiveness in practice. One key critique concerns data mining and overfitting. Smart beta strategies rely heavily on historical backtests, making them vulnerable to discovering patterns that do not hold out-of-sample (White & Haghani 2020). When investment strategies are constructed based

on historical data, such as backtesting of the best-performing factors, their realized performance often falls short of back tested results.

A second critique concerns factor crowding. As smart beta products grow in popularity, capital is channeled into similar factor exposures, increasing the risk that expected premia may compress. It also raises the risk of factor crashes, where investors attempt to unwind the same positions at the same time. Evidence from Verma et al. (2020) suggests that some factor strategies have experienced sharp drawdowns during market stress due to crowded positioning, undermining the diversification benefits. Additionally, crowding can be linked to behavioral finance, particularly herding behavior. According to Balcilar et al. (2014) in downside markets investors tend to move even more in the same direction in investment decisions, which can intensify factor crowding.

A third issue is related to turnover and implementation costs. Because smart beta strategies are not fully passive and require rebalancing to maintain targeted factor exposures, they tend to have higher transaction costs than traditional market-capitalization-weighted portfolios. Therefore, high turnover may lose portion of theoretical risk premia. Blitz et al., (2020) emphasize that the gap between returns in theory and the real world is partly explained by implementation frictions, including liquidity constraints and market-impact costs.

In addition, although the strategy is rule-based and target specific factors, it may also generate unintended factor exposures as well. This may occur because weighting schemes interact with characteristics unrelated to the intended factor. For example, value strategies usually tilt toward smaller, more distressed firms, while defensive exposure might come from low-volatility strategies. These unintended exposures can disrupt the risk profile of the strategy, sometimes leading to undesired correlations with systematic market-wide shocks (Giampaoli, 2025).

The design choices behind smart beta strategies differ widely and might lead to different outcomes in portfolios that claim to target the same factor. For example, differences in weighting rules, rebalancing timeline, universe selection and scoring methods can drive such differences. Kahn & Lemmon (2015) emphasize that smart beta strategies can differ substantially depending on provider and represent broad category containing different approaches, some of which closely resemble rules-based active management. Despite these limitations, literature does not reject smart beta strategies as a viable approach to accessing systematic risk premia. Instead, these limitations suggest that smart beta strategies' usability depends on their structural design and practical implementation.

Based on smart beta strategies construction, performance, and limitations literature, factor premia and the resulting risk profile depend on portfolio construction choices such as universe selection, weighting rules, and rebalancing design (Blitz, 2013; Jacobs & Levy, 2014; Kahn & Lemmon, 2015). ESG screening and ESG based reweighting operate through these mechanisms by altering the investable universe and portfolio weights. Therefore, ESG integration can shift factor exposures and risk profile, which motivates the first two hypotheses. Moreover, since factor performance varies across market regimes (Vijaya & Thenmozhi, 2024; White & Haghani, 2020), the strength of the effect of ESG integration can differ between market conditions, motivating the third hypothesis.

### **3.2 Evidence on ESG and Financial Performance**

Friede et al. (2015) find strong empirical evidence of a business case for ESG investing. ESG considerations in investment analysis have become an important part of investing as their potential financial implications have gained academic attention. ESG is increasingly viewed as an additional source of information about firm's long-term characteristics. The following section defines ESG in an investment context, discusses challenges and inconsistencies, and how ESG can affect firm's risk profile.

### 3.2.1 ESG and Firm-level Financial Performance

Empirical evidence shows that high ESG quality is generally associated with non-negative financial outcomes and often with positive outcomes, although the magnitude of the effect varies across contexts, metrics, and time periods (Friede et al., 2015). The connection between ESG and financial performance is justified through two mechanisms: the cash flow and profitability channel, which emphasizes that ESG profile might enhance competitiveness and operational quality (Giese et al., 2019).

Pedersen et al. (2021), extend this framework by highlighting the information role of ESG scores. Accordingly, ESG factors may signal future profitability to investors, thus affecting expected returns. The direction of this effect depends on how efficiently markets have priced the connection between ESG and future profitability. If markets underprice this connection, high ESG score stocks may generate abnormal returns if not fully incorporated into prices. This explains why the connection between ESG and financial performance may appear empirically as positive, neutral or even negative (Pedersen et al., 2020).

ESG may also affect firm value through the valuation and cost of capital channel. In framework of discounted cash flows ESG factors may affect not only expected cash flows but also the applied discount rate, because ESG can affect long term risk profile and required risk premia. If firm's ESG practices decrease exposure to regulatory, legal, reputational, and transition risks, among other investors may require a lower cost of equity, which increases firm's valuation even when short-term effects on profitability are modest (Giese et al., 2019; Pastor et al., 2021).

### 3.2.2 ESG and Risks

While ESG was historically viewed mainly as an ethical overlay, much recent research shows that ESG characteristics may influence financial risk in addition to firm's performance. Giese et al. (2019) and Oikonomou et al. (2012) demonstrate three mechanisms through which ESG may affect risk: the cash-flow channel, the idiosyncratic risk channel, and the valuation channel.

First, the cash-flow channel links ESG practices to future cash-flows. Strong ESG practices can improve operational quality by strengthening risk management, stakeholder relations, and regulatory and compliance practices, which can reduce operational disruptions and stabilize operational performance. More stable and predictable performance can lead to higher and more predictable long-term profitability and cash flow. This is reflected in reduced earnings volatility and firm-specific uncertainty, which decreases firm-specific risk and downside risk (Giese et al. 2019). Under this view ESG can affect risk not only through expected profitability but also by stabilizing processes behind cash flow, which can support firm valuation by reducing riskiness of those cash flows.

Second, the idiosyncratic risk channel highlights that better ESG performance may reduce exposure to firm-level tail events. Companies with weak ESG performance face a higher risk of negative incidents, such as environmental accidents, lawsuits or fraud that can trigger sudden and idiosyncratic stock price reactions. Empirical evidence shows that firms with higher ESG scores have fewer extreme negative return realizations, which may indicate reduced idiosyncratic risk (Oikonomou et al. 2012). This channel is particularly relevant for factor strategies such as smart beta, where systematic weighting may lead to concentrated portfolios. Thus, these firm-level tail events may have stronger impact on the whole portfolio.

Third, the valuation channel links ESG to systematic risk. According to Giese et al. (2019) firms with high ESG characteristics usually have lower sensitivity to market-wide shocks. One explanation is that strong ESG practices reduce exposure to market-wide transition

and regulatory risks, which implies that ESG can lower beta. This also aligns with the equilibrium model introduced by Pastor et. al (2021), which shows “green” firms hedging long-horizon environmental and regulatory risks and therefore behaving similarly to a priced systematic factor.

The increasing use of ESG metrics in investment analysis has strengthened the view that ESG indicators complement traditional risk decomposition into systematic and idiosyncratic components. Accordingly, ESG factors may affect a firm’s risk profile by altering exposure not only to firm-specific shocks but also to market-wide risk (Giese et al., 2019). Consequently, ESG performance may be reflected in risk metrics, including volatility, downside risk, and idiosyncratic risk, although the magnitude of these relationships depends on the dataset used, the measurement methodology, and market conditions.

### **3.2.3 Measurement Challenges and Inconsistent Findings**

Although ESG has gained widespread popularity, it lacks a universally accepted definition. Rating agencies and data providers use different methods. This leads to many different indicators, data sources and scoring techniques (Said & Crocker, 2025). This complicates comparability between firms and has implications for structuring a portfolio, as the choice of different rating agencies may lead to a different stock selection and return outcomes.

Berg et al., (2022) show that the scores of major ESG rating providers varies significantly, with an average correlation of approximately 0,54. This divergence is further compounded by the practices of rating providers. Agencies differ in the scope of issues included, the measurement of indicators and the weighting given to each category. These three sources explain most of the disagreement between ESG scores (Berg et al., 2022). As a result, the same company may receive different ESG ratings across agencies, making it hard for investors to consistently use ESG scores.

In addition to differences in methods, ESG measurement suffers from inconsistent or incomplete corporate disclosures. Firms report ESG characteristics related information in varying formats and levels of detail, which leads to measurement gaps and estimation uncertainty (Said & Crocker, 2025). As a result, analysts and data providers often rely on calculations or modelled data, since many metrics, particularly environmental and social, are not standardized, which adds subjectivity beyond provider differences (Pedersen et al., 2021). This results in an additional layer of subjectivity on top of the rating agencies' different methods. In practice, the same thing may be defined in multiple ways, making ESG scores only partially comparable between companies.

Literature on ESG suggests that allocation to firms with stronger ESG characteristics can alter portfolios' expected returns and risk-adjusted returns, while decreasing the probability of negative tail occurrences as well as sensitivity to market risks (Giese et al., 2019; Oikonomou et al., 2012; Pastor et al., 2021; Pedersen et al., 2021). Therefore, integration of ESG into smart beta strategies might improve risk-adjusted returns and lower the downside risk and/or sensitivity to market shocks, which motivates the first and the second hypothesis. At the same time, varying ratings of the ESG scores can make results susceptible to the dataset and rating agency (Berg et al., 2022; Pedersen et al., 2021; Said & Crocker, 2025). Additionally, because ESG is suggested to decrease exposure to shocks or sudden events' effects (Giese et al., 2019; Pastor et al., 2021), this effect can be expected to stand out more clearly under uncertain market conditions, motivating the third hypothesis.

### **3.3 Evidence on ESG Integration into Smart Beta Strategies**

The Smart beta strategy exploits different systematic risk factors beyond the CAPM market beta. Integration of ESG may be interpreted as an additional factor or signal in rule- and factor-based portfolio construction. In practice, ESG can be integrated by limiting

the investing universe, utilizing factor tilting, or treating as its own factor. Literature examines whether this integration adjusts risk-adjusted returns, the risk profile, especially downside risk, and performance across market regimes.

### **3.3.1 Performance and Risk Effects**

Lelasi et al. (2020) divides ESG integration into smart beta into two methods: ex-ante ESG screening and ex-post ESG-rebalancing, where the difference lies in the ordering. In the ex-ante method, the investing universe is first limited to include only firms with high ESG score, and only then is desired factor tilting applied. In contrast, the ex-post method applies first desired factors, after which ESG scores are used for rebalancing. These methods aim to maintain exposure to desired factors while improving the portfolio's ESG profile (Lelasi et al., 2020).

Lelasi et al. (2020) find that ESG integration does not inherently weaken the performance of smart beta portfolios. Using dataset from the U.S. and Europe in the period 2014-2019, ESG-rebalancing often maintains or even improves risk-adjusted return, and results are especially strong when ESG is integrated into defensive strategies such as minimal volatility. At the same time, the results suggest that the impact depends on the chosen factor strategy and integration method. In particular, ex-post rebalancing performs well, for example, with a value style, while ex-ante screening may lead to larger improvements in other factor styles. However, results are not fully consistent across every strategy (Lelasi et al., 2020).

Besbes & Kooli (2022) find complementary evidence from the Canadian market in the period 2014-2019 by building ESG adjusted smart beta indices, where ESG is integrated either by applying it as a new factor or used in rebalancing. Their findings suggest that ESG integration can improve risk-adjusted return compared to traditional smart beta strategies and market-capitalization-weighted indices. Additionally, they find that these

strategies are competitive across both rising and declining markets, and the relative advantage is more consistent under market stress, which is in line with ESG's possible hedge against downside risk.

Giese et al. (2016) show that an ESG factor can be used as a smart beta signal when biases to common exposures are controlled. In their best-in-class study, they select the top ESG performed portion of the benchmark within each country and find over-performance compared to market-capitalization-weighted index with higher information ratio. Key findings are that when the exposure to other common factors is neutralized, observed over-performance is specifically linked to ESG signals and not to other exposures. They further note that the ESG based tilting can lead to positive risk-adjusted returns but emphasize that this over-performance may be due to sector and style tilts if the underlying ESG constraints are not properly controlled.

Tan et al., (2023) provide partially contrasting evidence from Asia-Pacific stock markets. They find that portfolios tilted towards firms with higher ESG scores do not, on average, improve risk-adjusted-returns compared to portfolios with lower ESG score firms. Moreover, ESG integration into smart beta strategy does not lead to a significant change in performance. They highlight that some factors produce better performing portfolios in which case any the ESG additional value becomes less significant.

Stempler (2021) provide an additional study building an ESG smart beta strategy in EURO STOXX 50 universe, changing the market-capitalization-weighting to rule-based weighting using ESG score. This strategy overperforms market-capitalization-weighted indices not only in returns but also in risk-adjusted returns. Moreover, the ESG weighting rule is associated with improved downside risk metrics relative to the benchmark.

Current empirical evidence is still relatively limited but indicates support for the view that ESG integration may improve risk-adjusted return such that metrics like the Sharpe ratio increase without necessarily increasing overall risk (Besbes & Kooli, 2022; Giese et

al., 2016; Lelasi et al., 2020; Stempler, 2021). By contrast, the effect is not universal and may be limited or unclear across some markets and implementations (Tan et al., 2023). Like in traditional smart beta strategies with other factors and weighting rules, the effect of ESG appears to vary across strategies. Empirically, it seems to be the most beneficial when applied to defensive or risk-controlled constructions, while more cyclical styles can have a weaker performance or more varying results on risk metrics.

### **3.3.2 Challenges of ESG Integration into Smart Beta**

Integration of ESG into smart beta strategies can be seen as a design limitation in portfolio construction, which can affect the maximum Sharpe ratio. Pedersen et al. (2021) formalize this through the ESG-efficient frontier which describes the highest Sharpe ratio for different ESG levels. Especially excluding lower ESG score firms may limit this maximization. Therefore, improving an ESG profile through rules may require a trade-off in terms of risk-adjusted return efficiency (Pedersen et al., 2021).

Berg et al. (2022) document differences between ESG score rating providers. In smart beta, this means that the same idea of integrating ESG into smart beta may lead to different investment universes and factor tilts, only because the ESG data comes from a different provider. Therefore, the performance of this integration may reflect provider specific measurement and not necessarily underlying ESG characteristics.

Lelasi et al. (2020), highlights that ESG characteristics are not independent of many factors used in smart beta strategies, which can create style tilts. In practice, ESG screening can shift the portfolio away from the factor's core universe, while ESG-rebalancing can alter the exposure profile between rebalancing dates. At the same time ESG integration may unintentionally increase exposure to some factors that may be associated with ESG characteristics (e.g., firm size). Thus, ESG integration may dilute the intended factor tilt and cause unintended exposures, weakening the core of smart beta, namely transparency and interpretability (Lelasi et al., 2020).

Besbes & Kooli (2022) suggest that ESG integration can also generate unintended exposures through sector tilts that change over time periods. Sector tilts may affect both returns and risk metrics. Thus, some of the improved risk-adjusted returns may be explained by sector reallocation rather than ESG integration. In their study, they construct a sector neutral version and find that sector tilts are a relevant factor but do not alone explain the observed performance differential in their setting (Besbes & Kooli, 2022).

Evidence shows that integration of ESG into smart beta strategies can, in some settings, improve risk-adjusted return and downside risk, which is in line with the hypotheses one and two (Besbes & Kooli, 2022; Giese et al., 2016; Lelasi et al., 2020; Stempler, 2021). However, the evidence does not uniformly support this conclusion (Tan et al., 2023). Moreover, effects seem to vary across market environments (Besbes & Kooli, 2022; Lelasi et al., 2020; Tan et al., 2023), which is in line with the third hypothesis. At the same time integration might have undesired effects on smart beta strategies such as unintended exposures, which further complicates the measurement of ESG effects (Berg et al., 2022; Besbes & Kooli 2022; Lelasi et al., 2020).

### **3.4 Discussion**

Based on the literature, smart beta returns and risk profiles are determined through factor exposures and portfolio construction designs, and performance of factors vary across market segments (Blitz, 2020; Jacobs & Levy, 2014; Kahn & Lemmon, 2015; White & Haghani, 2020). ESG literature, on the other hand, highlights that ESG characteristics may be reflected in returns and risk channels, especially downside-/tail risk and possibly to market sensitivity, but results are inconsistent and sensitive to measurement choices (Giese et al., 2019; Berg et al., 2022; Oikonomou et al., 2012).

Evidence on the implementation of these two approaches: ESG integration into smart beta, is mixed to some extent. In some settings, ESG integration improves risk-adjusted

return and is particularly evident during market stress, while in other settings results remain weak or statistically insignificant (Besbes & Kooli, 2022; Giese et al., 2016; Lelasi et al., 2020; Stempler, 2021; Tan et al., 2023). The research gap relates to attribution and mechanisms: to what extent can the observed difference in the performance be explained by ESG. Alternatively, the difference may reflect side effects such as portfolio constraints, sector and style tilts, weakened factor exposures, and provider specific differences in the ESG data (Berg et al., 2022; Besbes & Kooli, 2022; Lelasi et al., 2020; Pedersen et al., 2021).

## 4 Conclusion

This thesis reviewed the literature on the effects of ESG integration into smart beta strategies from a risk and return perspective. The primary focus was on risk-adjusted returns, downside and tail risk, market sensitivity, and whether the effect varies across market regimes. Overall, the evidence is conditional: ESG integration can improve risk-adjusted returns, particularly during market stress. However, the findings depend on the integration method, the smart beta style, and the ESG data. The key issue of interpretation concerns attribution: differences cannot be fully explained only by ESG alone, but also by how integration changes the sector allocation, factor exposures, and related constraints. Accordingly, this thesis advances the literature by providing an attribution-centered synthesis of the evidence, clarifying when reported effects are more plausibly driven by ESG integration into smart beta rather than by portfolio construction side effects.

Hypotheses H1 (Integrating ESG into smart beta strategies improves their risk-adjusted performance relative to the corresponding non-ESG smart beta strategy) receives conditional support from the literature. The improvement appears most plausible in situations where ESG is integrated such that the strategy's targeted factor profile remains intact and undesirable exposures are tightly controlled. When findings are weak or statistically inconclusive, a credible explanation is that the ESG screening or rebalancing leads to unintended sector and style tilts, thereby diluting the intended factor premia or generating opposing exposures. Accordingly, the literature suggests that ESG integration may improve risk-adjusted returns in some smart beta portfolio constructions, but the effect is not universal.

Hypotheses H2 (ESG integration into smart beta strategies reduces downside risk and/or market sensitivity relative to the corresponding non-ESG smart beta strategy) receives partial but empirically relevant support. Several studies report a decrease in downside risk and/or lower sensitivity to market shocks after ESG integration, which is in line with the ESG risk channels. However, the magnitude and consistency of these effects depend

on construction methods. They are most pronounced when ESG rules do not weaken the desired factor profile, in contrast, they become less clear if ESG integration leads to sector tilts or undesired factor tilts. Therefore, ESG integration can lead to a more defensive risk profile, but only when sector and factor biases are controlled.

Hypotheses H3 (The impact of ESG integration on smart beta strategies is stronger during adverse market regimes than during favorable regimes) receives the clearest support from the literature. Relative benefits of ESG integration appear more consistently under market stress, either through improved risk-adjusted return or through lower downside risk. However, periods of market stress also magnify the influence of constraints, portfolio turnover, liquidity, and factor crowding. These may bias estimates of the “ESG effect” unless exposure are accounted for.

Together, the evidence suggests that the effects of ESG integration into smart beta strategies are determined primarily through changes in sector allocations and factor exposures induced by integration. The effect is most pronounced under market stress. Therefore, future research should focus on setups that strengthen attribution and limit portfolio construction side effects. Neutralizing sector and factor biases would provide more reliable results. In addition, robustness should be tested across multiple ESG data providers and alternative scoring approaches, since differences can change the investable universe and factor weighting. Additionally, future research could focus on how ESG integration affects smart beta strategies’ implementation problems, such as factor crowding and turnover costs.

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