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The impact of ESG disclosure and performance on the liquidity and riskiness of the European stocks

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Abstract

ESG (Environmental, Social, and Governance) criteria have already established the significance for investors during the recent years, with many investors considering them an important measure of the sustainability of the business model. This study investigates the impact of ESG scores and disclosures on the liquidity and riskiness characteristics of European stocks. To investigate this topic, I applied OLS regression models using a sample of 1146 European companies from diverse sectors on several liquidity and riskiness metrics. The data are publicly available and is retrieved from database Thomson Reuters for the year 2019. My results suggest that there is a correlation between liquidity metrics and ESG performance, specifically more ESG-friendly companies tend to have narrower bid-ask spread. However, there was no significant correlation found between riskiness metrics and ESG performance and disclosure. Additionally, the analysis indicates that ESG ratings are not harmonised between different rating providers, which limits comparability of results across various studies, as well as makes results highly dependent on ESG rating providers chosen.

Abstrakt

ESG-Kriterien (Environmental, Social und Governance) haben in den letzten Jahren für Investoren zunehmend an Bedeutung gewonnen. Viele Anleger betrachten sie inzwischen als ein wichtiges Maß für die Nachhaltigkeit eines Geschäftsmodells. Diese Studie untersucht den Einfluss von ESG-Bewertungen und Offenlegungen auf die Liquiditäts- und Risikoeigenschaften europäischer Aktien. Zur Analyse dieses Zusammenhangs wurden OLS-Regressionsmodelle auf Basis einer Stichprobe von 1.146 europäischen Unternehmen aus verschiedenen Branchen und unter Verwendung mehrerer Liquiditäts- und Risikokennzahlen angewendet. Die verwendeten Daten sind öffentlich zugänglich und stammen aus der Thomson-Reuters-Datenbank für das Jahr 2019.v Die Ergebnisse deuten darauf hin, dass eine Korrelation zwischen Liquiditätskennzahlen und ESG-Leistung besteht: Unternehmen mit einer besseren ESG-Performance weisen tendenziell engere Geld-/Brief-Spannen auf. Dagegen konnte keine signifikante Beziehung zwischen Risikokennzahlen und ESG-Leistung bzw. Offenlegung festgestellt werden. Darüber hinaus zeigt die Analyse, dass ESG-Bewertungen zwischen verschiedenen Rating-Agenturen nicht harmonisiert sind. Dies erschwert die Vergleichbarkeit der Ergebnisse unterschiedlicher Studien und führt dazu, dass die Resultate stark vom jeweils verwendeten ESG-Rating-Anbieter abhängen.

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III. List of abbreviations

AuM	Assets under Management
CAPM	Capital Asset Pricing Model
CSR	Corporate Social Responsibility
DCF	Discounted Cash Flow
ESG	Environmental, Social & Corporate Governance
EU	European Union
ETF	Exchange Traded Fund
GIIN	Global Impact Investing Network
MSCI	Morgan Stanley Capital International
OLS	Ordinary Least Squares regression
S&P	Standard & Poor's
SRI	Socially Responsible Investments

1. Introduction

Over the last several decades, the topic of ESG has gained increasing attention among both companies and investors. Sustainable investments have become an integral part of most strategies among major institutional investors. Thus, if we compare 2016 and 2020, the share of sustainable investments in the total AUM worldwide accounted for 28% and was valued at around USD 23 trillion (Global Sustainable Investment Alliance, 2016), while in 2020 the share of sustainable investments reached 36% amounting to approximately USD 35 trillion (Global Sustainable Investment Alliance, 2020).

Moreover, the inflow of funds into sustainable investments accelerated significantly over the last three years, since investors are seeking social gains while maintaining profitability. Additionally, due to changing consumer preferences, retail investors are increasingly focused on contributing to solutions for global problems such as climate change, poverty, and inequality. All these factors contribute significantly into the increased demand for the sustainable investments.

Given the increasing interest in sustainable investing, academia has begun examining the impact of ESG ratings on stock market and company performance. Chapter 2 of this Master's thesis is dedicated to the theoretical background regarding ESG investing, as well as a literature overview of studies on the impact of ESG on performance, liquidity, and stock riskiness. Most studies examine the correlation between ESG and stock performance, showing mixed results (von Wallis and Klein, 2015), which can be caused by high degree of variability within the methodology for ESG performance assessment.

Thus, Verheyden *et al*. (2016) found that ESG-screened portfolios using the exclusion method outperformed by 0.16% on average in three out of four portfolios. However, at the same time the authors introduced a trade-off between diversification and exclusion, finding out that the best combination is exclusion of 10% worst performing stocks. Consolandi *et al*. (2020) adopted a dynamic approach and showed that changes in ESG scores affect stock prices differently across industries.

However, some studies also documented underperformance of ESG-based investment approaches. Rudd (1981) found that additional costs and higher investment risk arise from limitations in asset allocation, which was later supported by Luther *et al*. (1992). As an explanation for ESG stocks underperformance Derwall *et al*. (2011) used investors' readiness to pay higher price for the ESG stocks, which leads to the overpricing reducing the realized return of investors.

The impact of ESG performance or disclosure on liquidity metric and riskiness of the stocks is studied only in limited number of research showing controversial results. There are mainly two channels through which ESG has impact on liquidity characteristics, specifically asymmetric information and demand for ESG investments. Cho *et al*. (2013) made two observations: 1) ESG disclosure decreases bid-ask spread with stronger effect for negative performance (due to reduction of asymmetric information); 2) higher level of presence of institutional investors reduces effect from disclosure, which is consistent with Kyle (1985). Egginton and McBrayer (2017) found that more transparent firms in terms of ESG tend to have narrower bid-ask spread with stronger effect for companies with lower analyst coverage.

As for the second channel it can be generally explained through rising interest of investors towards ESG in the recent years, and thus increased inflow of funds into high ESG rating stocks reflecting that demand for the sustainable equity is expected to be reflected in the increased trading activity and thus volume. Lace (2020) using CEE companies for research found that companies with available ESG rating

do have liquidity benefit due to the higher trading volume compared to peers that do not have ESG rating.

As for the riskiness of the stocks Lööf and Stephan (2016) showed that better ESG performance is associated with the lower downside risk, which can be explained by higher quality of the cash flow and also tendency to exhibit lower volatility. Verheyden *et al*. (2016) also found that "ESG-friendly" stocks exhibit lower volatility, drawdown risk, conditional value-at-risk, and tail risk. Study of MSCI (2019) also showed that stocks with better ESG performance tend to have lower systematic volatility, lower beta and variation in net income; lower beta consequently implies lower cost of equity, which drives the value of the company.

The limited number of studies examining the impact of ESG performance and disclosure on liquidity and riskiness motivated the present research. Thus my main contribution is to detect whether ESG rating, and disclosure have any impact on the liquidity and riskiness of the European stocks, as well as identify possible reasons for presence or absence of such an impact.

The research is based on the sample of 1146 European companies across various industries. It is presumed that the impact of ESG performance on stock characteristics should be most observable in the European market compared to other geographies given rising legislation in the area of environmental, social and governmental topics.

The further outline of this Master's thesis is as follows, Chapter 3 introduces empirical methodology for the research introducing the data sample and providing details on the data collection process, as well as presenting dependent and independent variables, including calculation methodology. To determine the correlation between ESG performance/disclosure and various liquidity and riskiness metrics, the OLS regression method was applied. The Chapter 4 is dedicated to the analysis and interpretation of the results of the OLS regressions. The overall summary of the research is presented in the Chapter 5.

2. Literature overview and theoretical background

2.1 ESG investing

ESG investing is defined by Boffo and Patalano (2020) as "an approach that seeks to incorporate environmental, social and governance factors into asset allocation and risk decisions, so as to generate sustainable, long-term financial returns".Therefore such an approach is aimed at ensuring not only financial gain but also social gain. Boffo and Patalano (2020) also defined three sources that encourage higher demand for ESG investing: firstly, demand from non-investors encouraging better corporate practices, more environmentally friendly business model, and ethical behavior enhanced by the shift from shareholder to stakeholder theory; secondly, demand from social impact investors focusing more on social return; thirdly, demand from conventional investors with long-term investing horizon seeing ESG investing as the source of a long-term sustainable return due to better risk management.

The following section is aimed to review the methods of ESG incorporation into the investment decision-making process and their main characteristics, as well as an overview of key rating providers and their main issues in further detail.

2.1.1 ESG incorporation into investment decision

According to the survey of Morgan Stanley (2018), 70% of asset managers already incorporated ESG themes into their decision-making process, while 14% of the rest were considering doing so in the near future. BNP Paribas (2019) asked investors about the reason for ESG incorporation into the decision-making process and found that more than 50% believe that ESG investments will provide higher long-term returns, 47% of respondents incorporated ESG to improve or maintain brand image and reputation and only 27% stated that they pursued moral goals.

Demographic factors also contribute to the incorporation of ESG into the decision-making process. According to the survey of MSCI (2020) 90% of millennials planned to increase the allocation to responsible investments in their portfolios, and 67% believed that this is the way to show their social, environmental, and political commitment (Giese *et al*, 2019).

Hayat and Orsagh (2015) defined six common methods of incorporation of ESG into the investing decision-process: exclusionary screening, best-in-class method, thematic investing, active ownership, impact investing, and ESG integration. Moreover, the methods can be used in different combinations.

The oldest method of ESG incorporation is the *exclusion*, i.e. avoiding "sin stocks" (companies operating in tobacco, gambling, and alcohol) as well as companies that violate important societal standards such as human rights or fighting climate change (Hayat and Orsagh, 2015). In such a way investors align their portfolios with the moral norms and influence the companies' decisions. Such a method may lead to tracking error (if "sin stocks" are included in the benchmarks) and a reduction in returns. However, normally such stocks represent a small part of the index (for example 3% in MSCI World), which will lead only to a small deviation in the returns (Kumar *et al*, 2018). Globally exclusion was applied to 17% of assets under management which amounted to 15 trillion USD (Global Sustainable Investment Alliance, 2016).

The next method is *"best-in-class" or positive screening*, which is an inclusion of the companies with better ESG performance in comparison to peers from the same industry or the companies with higher ESG momentum (dynamic approach of investing in companies with improving ESG rating). The idea behind such an approach is that companies with higher ESG scores are less risky and therefore have lower environmental costs leading to better efficiency and consequently higher value (Hayat and Orsagh, 2015). The goal of such a method is to incentivize companies to improve their ESG rating in order to be included in the portfolio. This approach relies significantly on the ESG assessment, which can be conducted in-house by the investment firm directly or outsourced to external ESG rating providers. This leads to higher costs of implementation, which ultimately affect the returns of the portfolio (Hayat and Orsagh, 2015).

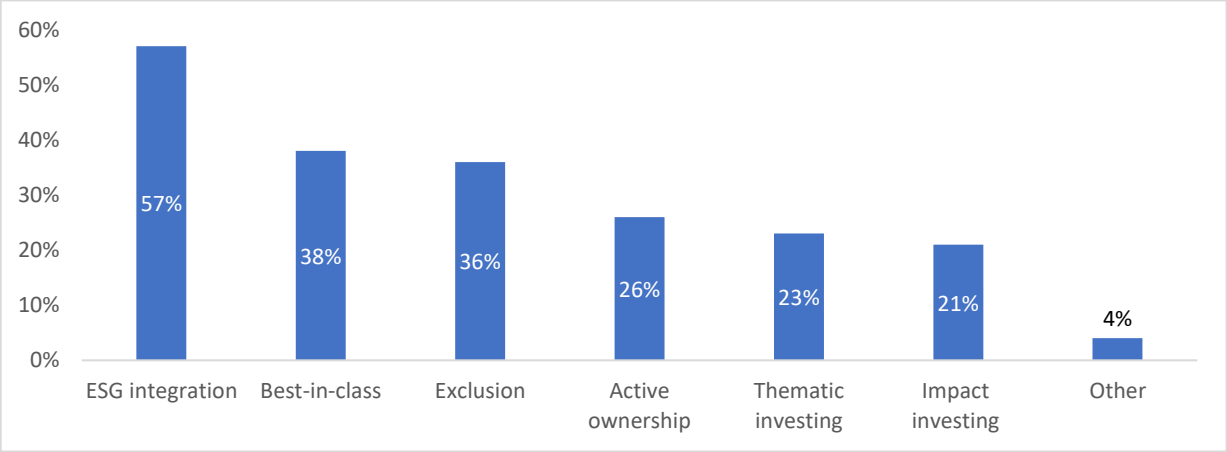
The *active ownership approach* involves direct interaction and communication with the management of the company. This way investors can directly impact the decision-making process of the management through exercising their voting rights, writing letters to the management board, communicating with company representatives, adding ESG issues to the shareholders' meeting agenda, etc. (Hayat and Orsagh, 2015).

Thematic investing relies on investing in current environmental and social trends. For example, some funds using such a strategy can be focused on e-mobility, sustainable forestry, renewable energy, and clean technologies (Hayat and Orsagh, 2015). Such a method is focused on the companies that can directly contribute to the ESG topics through their products and services.

Impact investing incorporates environmental gains directly alongside financial gains in the decision-making process. Global Impact Investing Network (GIIN) defined 4 key features of impact investing: intention to create environmental or/and social impact, financial gains on an investment are expected, returns are expected to be lower than market risk-adjusted returns (so-called compensation through the environmental/social returns); commitment to measure and report social and environmental impact.

ESG integration refers to the direct inclusion of ESG issues and risks in the analysis of the investment. It does not use any pre-specified criteria for the inclusion or exclusion of the investment instruments, but directly incorporates risks in the calculation of the return on investment. The example of such an approach is factoring in the ESG risks into the valuation process for instance, incorporating ESG risks directly into valuation models such as DCF. The way to incorporate it can be in the nominator (increasing environmental costs) impacting the cash flows or adjusting the discount factor (reflecting the higher risk of the companies with low ESG commitment) (Hayat and Orsagh, 2015).

Figure 1. The methods of ESG incorporation into investing



Source: Hayat and Orsagh, 2015

As depicted on the Figure 1, ESG integration is used by 57% of respondents, which is defined as the most popular method and represents good balance between financial and environmental/social returns. Best-in-class and exclusion strategies were applied by 38% and 36% of respondents. The strategies requiring higher additional costs were used only by 20-26% of respondents.

2.1.2 ESG ratings and data providers

ESG rating is considered to be one of the tools for the incorporation of ESG into the investment decision process. Asset managers can use their in-house facilities for the ESG assessment or outsource the evaluation to the third-party providers. Thus, ESG rating providers play an important role in the ESG investment ecosystem. The rating is based on the implicit or explicit sustainability data that companies disclose to the public. Rating providers normally use quantitative models, qualitative analysis, or a combination of both to define ESG rating.

The largest and most popular ESG ratings are: MSCI, S&P Global, Sustainalytics, Bloomberg, and Thomson Reuters.

MSCI ESG rating. Provides ESG scores for more than 8,500 companies worldwide. The assessment is conducted by research analysts across 35 ESG issues taking into account companies' business models and industry-specific factors. Rating ranging from AAA (best) to CCC (worst) is assigned to each company on a relative basis, i.e. relative to the performance of the peers from the same industry. ESG rating is assigned based on the company disclosure (for example, annual reports, quarterly filings), specialized data sets and media sources for monitoring news (MSCI, 2020).

S&P Global. S&P Global entered the ESG rating market by acquiring RobecoSAM in January 2020. RobecoSAM provides ratings to 3,400 companies and is based on Corporate Sustainability Assessment questionaries comprising 80-120 questions and filled in by professional analysts. Each criterion can be valued up to 100 and then individual scores are weighed to derive the overall score (S&P Global).

Sustainalytics. The provider covers more than 6,500 companies worldwide. ESG rating from 0 to 100 is based on the management of ESG risk, disclosure of metrics, and ESG performance. Sustainalytics provides scores for the separate pillars and overall weighted ESG rating using industry peer comparison (Sustainalytics, 2021)

Bloomberg. ESG rating is provided for more than 10,000 companies worldwide. In addition to the performance score, Bloomberg also provides a disclosure score. The data is gathered from the public sources, Sustainalytics, RobecoSAM (Bloomberg does not provide its own ESG rating assessment, but rather the ratings from other providers), however based on these data ESG disclosure in the range of 0-100 is derived by comparing disclosure level of the specific company to the disclosure of the peers (Bloomberg, 2020).

Thomson Reuters. The platform provides ESG ratings for more than 6,000 companies worldwide. The individual score for each company is derived in relative terms, that is in comparison to the performance of companies from the same industries. Overall, 400 ESG data points are considered for the different pillars. The weighting of the individual pillars to derive the overall score is industry specific (Thomson Reuters, 2017).

However, currently there are some critical issues with ESG ratings. As described above different ESG rating providers use different methodologies, which leads to the low correlation of ESG ratings provided by different agencies.

Various researchers tested the correlation of ESG scores between different data providers (Chatterji *et al*., 2016; Berg *et al.*, 2019). The studies show mainly low correlation, suggesting a low degree of consolidation in the ESG assessment process. Thus, after checking the correlation of ESG scores provided by Bloomberg, Thomson Reuters, and MSCI using a sample of 8,500 companies worldwide Dorfleitner *et al*. (2015) found that the correlation between scores is low. Berg *et al*. (2019) made a comparison of credit rating correlation and ESG rating between different rating providers. The outcome for the ESG rating was significantly lower amounting to 0.61 compared to the credit rating correlation of 0.99.

Lopez and Bendix (2020) discovered similar results comparing the ESG rating of 3 main rating providers: Thomson Reuters, RobecoSAM and Sustainalytics.

Figure 2. Correlation matrix of ESG scores for different ESG rating providers and industries

	Energy	Basic Materials	Industrials	Cyclicyl Consumer	Non-Cyclical Consumer	Financials	Healthcare	Technology	Telecom	Utilities
Thompson Reuters & RobecoSAM	0,48	0,57	0,64	0,72	0,5	0,71	0,74	0,72	0,62	0,56
Thompson Reuters & Sustainalytics	0,32	0,64	0,58	0,7	0,48	0,71	0,65	0,79	0,79	0,62
RobecoSAM & Sustainalytics	0,7	0,64	0,72	0,8	0,58	0,79	0,72	0,79	0,66	0,62

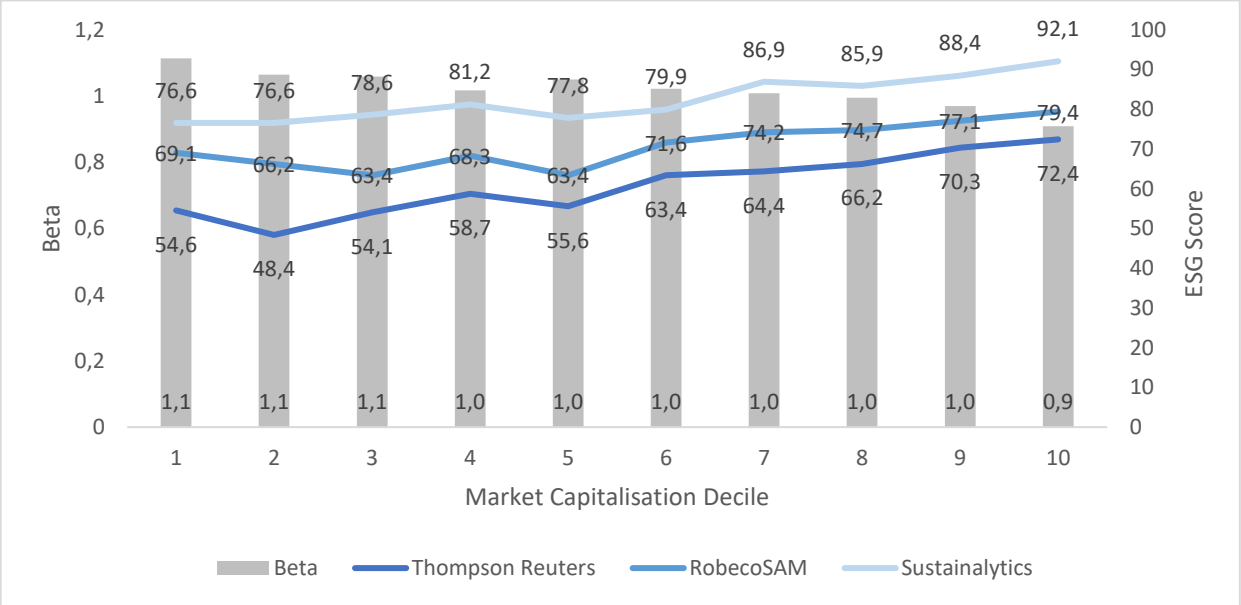
Source: Lopez and Bendix, 2020

As summarized in the figure above, the authors found that the correlation of the ESG scores varies across the industry. Thus, the lowest average correlation is observed in energy and non-cyclical consumer goods industries, where environmental and social considerations play the most important role, while the highest correlation is observed in the technology and financials, where ESG issues are considered to be less impactful. The highest average correlation of 0.7 is observed for the pair RobecoSAM & Sustainalytics (Lopez and Bendix, 2020). Based on this observation, we can conclude that the methodology of ESG assessment implemented by Thomson Reuters differs more significantly from Robeco SAM and Sustainalytics compared to the pair Robeco SAM and Sustainalytics.

Although providers use similar criteria for environmental, governance, and social pillars, different weightings and methods of evaluation might lead to deviations in the assigned ESG rating across the different providers. Kotsantonis and Serafeim (2019) checked the disclosure of 50 companies regarding safety and health information and found that the firms used 20 different ways to report the same metrics. Thus, they defined three main reasons for the rating divergence: scope (different attributes used by providers), weighting, and measurement.

Additionally, due to the fact that larger companies have more resources for ESG disclosure, firm size may also affect the correlation of scores between data providers. Indeed, Drempetic *et al*. (2020) found empirical evidence of the existence of such a bias, thus correlation of the scores for larger firms was higher than for the smaller.

Figure 3. ESG scores and beta for different market capitalisation deciles



Source: Lopez and Bendix, 2020

Moreover, as depicted on the figure above Lopez and Bendix (2020) additionally found that bigger companies are awarded by higher ESG ratings compared to the score assigned to the smaller companies and the result is consistent across several ESG rating providers.

The divergence across different ESG score providers leads to lower attribution of ESG performance to the price of the stock, ambiguity for investors regarding the ESG-related information and creates barriers in empirical research (Zumente and Lace, 2021). The issue with the low level of correlation between the ESG rating providers is critical for both investors and companies, since it affects the investment decisions and portfolio construction processes, making portfolio returns dependent on the choice of ESG rating provider. Supporting evidence can be found in the study of Li and Polychronopoulos (2020), where they constructed portfolios of stocks with the same methodology but using different ESG rating providers. The results show a difference of 10% in Europe and 24.1% in US within the 8 years period, which also reveals that there is regional divergence in ESG ratings (Li and Polychronopoulos, 2020).

2.2 Impact of ESG performance on stock characteristics

The following section is aimed at reviewing the impact of ESG performance and disclosure on the price performance, the liquidity characteristics, as well as on the riskiness of the stocks.

2.2.1 The impact of ESG rating and price performance

The results of studies of the impact of ESG rating on the price performance of stocks are mixed. Evidence of mixed results can be found in the research of von Wallis and Klein (2015), where the authors summarized the results of 53 studies on socially responsible investing from 1986 to 2012. As an indicator of share price performance, authors of the examined articles used Jensen alpha (31 articles), average returns (14 articles), Treynor ratio (6 articles), Sharpe ratio (14 articles), excess standard deviation adjusted returns (3 articles), Tobin's Q (3 articles), other indicators (5 articles). 35 papers out of 53 compared the performance of socially responsible investments (SRI) to the conventional benchmark. As a result, 14 articles provided evidence on the outperformance of SRI, 15 showed that there is no significant difference between the financial performance of conventional investment and SRI, 6 studies found that SRI underperforms the benchmark. Additionally, based on 18 remaining articles, which examined the impact of socially responsible behaviour of the companies on the financial performance, it was found that the majority of studies suggest a positive impact of socially responsible behaviour on the financial performance of the company (Wallis and Klein, 2015).

Cummings (2000) compared the financial performance of two portfolios: one with an applied ethical screen and one with a broader investment spectrum. Based on the results he claimed that ethical investing provides non-negative performance, thus investors can make ethical decisions without a negative impact on the portfolio returns. Mallin, Saadouni and Briston (1995) also support sustainable investing in their research showing that UK funds focused on ethical investments had superior performance compared to the conventional funds within the period of 1986-1993.

Another meta study of Fulton, Kahn and Sharples (2013) distinguished between different types of sustainable investing: SRI, CSR and ESG. Overall authors analysed 100 papers and derived their findings based on 62 articles. They found that ESG and CSR factors are positively correlated to the risk-adjusted return in the majority of studies. SRI was frequently based on the exclusion strategies and failed to outperform the same funds where no exclusions took place (mainly the same results) resulting in 88% of articles showing neutral or mixed results. All academic papers within the meta study showed that superior ESG performance leads to a lower cost of capital implying lower riskiness of the companies. Around 90% of researchers found that higher ESG rating firms do outperform the market. 85% of papers provided evidence that such companies have better accounting-based performance compared to the peers with worse rating.

Verheyden *et al*. (2016) compared the stock performance of portfolios with ESG screening and without for four different universes applying different thresholds for the screening. They found that ESG screening improves the risk-adjusted performance of the portfolio in three constructed universes out of four improving performance by 0.16% annually. Furthermore, for three out of four stock universes authors found that ESG screening does not harm the diversification effect. For the portfolios with applied ESG-screening exclusion of 10% and 25% of worst ESG-performing stocks were applied. One stock universe (with 25% threshold) showed the same riskiness metrics and slightly lower performance than an unscreened portfolio. Additionally, the authors concluded that 10% threshold provides the best benefit in terms of risk-adjusted performance without a significant reduction in the diversification effect.

Consolandi *et al*. (2020), after the analysis of US companies included in Russell 3000 index, concluded that changes in ESG performance do influence the stock prices. Moreover, companies within the industries characterised by a higher concentration of ESG materiality have larger increase in price than the ones operating within industries with lower concentration.

Derwall *et al*. (2011) provided an argument on the underperformance of the high ESG rating stocks, which can be explained by the specific preferences of the investors, specifically readiness to pay a higher price for the ESG stocks, which leads to the overpricing of such stocks reducing the realized return of investors. Hamilton *et al*. (1993) argues that social responsibility is not priced by the market, which is consistent with studies, where a non-significant effect of ESG performance on the stock performance was found.

Rudd (1981) explains the underperformance of the SRI portfolio comparing to the conventional portfolio with the additional costs and higher investment risk arising from the limitations in the asset allocation. Luther *et al*. (1992) supported the argument of Rudd by pointing out limited diversification and higher monitoring costs for socially responsible portfolios. Kahn *et al*. (1997) examined exclusion investing by comparing tobacco-free portfolio (since tobacco is generally seen as sin stock) and portfolio with tobacco companies, he found that portfolio with tobacco exclusion underperformed portfolio where tobacco stocks were included.

During the last years the discussion on ESG and valuation has been further expanded by new studies. Ferriani and Pericoli (2025) conducted the analysis of the European non-financial corporations and showed that higher ESG scores are connected to a lower default probability over the medium and long time periods. Their results imply that markets reward ESG with lower credit risk, which directly influences prices and valuation through narrower credit spreads. Magnani *et al*. (2024) added additional angle by conducting research on the ESG momentum and stability. Instead of focusing on the values of the ESG ratings, he discovered that investors significantly react to the ESG rating improvements as well as to the companies with consistently stable ESG performance. Those characteristics are also priced into returns, demonstrating that changes and stability matter as much as overall scores. Mandas (2024) focused his research on reputational risk, emphasizing that negative ESG controversies can substantially reduce market valuation, while high ESG eliminates these effects. To summarize the most recent studies, they suggest that ESG is not only a static characteristic but also a dynamic signal impacting market pricing through default expectations, stability, and reputation.

2.2.2 The relation of ESG performance and disclosure to liquidity

One channel through which ESG ratings can affect overall price performance is the liquidity channel. There are numerous empirical research findings that stock liquidity is positively related to stock performance (Amihud and Mendelson, 1986). This is also consistent with the existence of a liquidity risk premium, which is priced into stock returns (Hur *et al*. 2018).

At the moment, there is no significant number of studies examining the impact of ESG rating score on the liquidity of the stocks. Cho *et al*. (2013) conducted the research on the relation between CSR performance disclosure and information asymmetry, using bid-ask spread as a proxy. They found that CSR performance decreases information asymmetry for both directions – positive and negative, with a stronger effect for the negative scores. This is consistent with the prior empirical studies, which provided evidence that asymmetric information has a significant effect on the liquidity of the equity (Grossman and Stiglitz, 1980; Kyle, 1985; Easley and O'Hara 1987; Glosten and Harris, 1988).

Additionally, the research of Cho *et al*. (2013) provided evidence that higher level of the institutional investors involvement reduces the magnitude of negative relation of information asymmetry and CSR performance. This is explained by the fact that institutional investors have the possibility to exploit their private information on CSR performance. This result is consistent with the studies of Kyle (1985)

and Glosten and Milgrom (1985), showing that informed investors trade against uninformed traders leading to the deterioration of transparency and liquidity.

The recent empirical research of Egginton and McBrayer (2017) using Bloomberg ESG data showed similar results. Relying on the prior findings that transparent disclosure policy positively affects liquidity, consequently reducing transaction costs (Diamond and Verrechia, 1991; Welker, 1995), the authors found that firms with more transparent CSR disclosure tend to have narrower bid-ask spreads. Additionally, the effect of disclosure was tested conditionally on the degree of the opaqueness of the firms, showing that the effect of CSR disclosure on liquidity is stronger for firms with lower analyst coverage (Egginton and McBrayer, 2017). Additionally, they also confirmed the study of Boffo and Patalano (2020), that there is a bias in ESG rating availability towards large market capitalisation companies.

Given the rising interest of investors towards ESG in recent years, and thus increased inflow of funds into high ESG-rating stocks, reflecting the demand for sustainable equity, the expectation is that trading activity and thus volume will further rise in the future. An especially significant inflow of funds was directed into ETFs, which are widely used by retail investors. Furthermore, dollar volume is positively related to liquidity according to Stoll (1978), meaning that increased volume should positively impact the liquidity characteristics of ESG stocks. Additionally, Brennan and Subrahmanyam (1995) found significant evidence for the trading volume being considered a liquidity determinant. Chordia *et al.* (2000) also suggest that bid-ask spread is affected by the dollar trading volume. Zumente and Lace (2021) using CEE companies for their research indeed found that companies with available ESG rating do have liquidity benefits (higher trading volume) compared to peers that do not have ESG ratings.

Additional evidence on the impact of ESG on liquidity has been shown in the latest empirical studies. Luo (2022), using UK equities, discovered that companies with higher ESG scores also demonstrate higher liquidity, showing narrower spreads and higher turnover, as well as the fact that better liquidity partly justifies higher returns for the high ESG rating companies. Vasiu (2023) focused his study on the companies in emerging EU markets and similarly concluded that ESG performance has a positive relation to the liquidity ratios. These two research papers demonstrate that the liquidity channel is considered to be one of the most robust outcomes in ESG research, since transparency and disclosure reduce information asymmetry, attract investor demand, and consequently improve marketability of stocks.

2.2.3 Impact of ESG rating on riskiness

The idea that ESG performance can influence the risk characteristics of the stocks from the idea that it increases the value of the firm through improved corporate financial performance and through lower cost of capital (Plemlee *et al*., 2015). Due to the fact that cost of equity, which is a part of cost of capital, is significantly influenced by the beta (a proxy of systematic risk), there should be also relation between the riskiness and ESG performance of the stocks.

Lööf and Stephan (2016) based their analysis on the sample of 887 European stocks and examined the impact of ESG score on the drawdown risk of the companies, which consequently can reduce the cost of equity and cost of debt. They found that companies with the better ESG performance are associated

with the lower downside risk, which can be explained by higher quality of the cash flow and also the tendency to exhibit lower volatility.

Apart from examining impact of ESG screening on overall performance of the stocks, Verheyden *et al.*, (2016) also had closer look at the risk characteristics of the ESG-screened portfolios. Thus, they found that portfolios with applied ESG screening exhibit lower volatility, drawdown risk and conditional value-at-risk. Additionally, ESG screening decreases tail risk particularly exhibiting less frequent extreme negative return days.

MSCI (2019) defined 3 channels leading to better performance of stocks with higher ESG rating, one of the channels is idiosyncratic risk channel, reflecting the ability of the company to manage business and operational risk. The idea behind is connected to better risk management, which leads to lower probability of non-ethical events (frauds, corruption cases, etc.) avoiding negative impact on the share price performance (Hong and Kacperczyk, 2009). This hypothesis is supported by the empirical study of Hoepner *et al.* (2017), who found that stocks with higher ESG rating tend to have lower volatility and value at risk. Additionally, MSCI (2019) study also examines the relation of ESG score and systematic risk. Thus, the results suggest that stocks with better ESG performance tend to have lower systematic volatility, lower beta and variation in net income. Lower beta consequently implies lower cost of equity, which drives the value of the company.

The impact of ESG performance on the different types of risks was studied by Sassen *et al.* (2016) using the sample of 8752 observation gathered for the period 2002-2014 and covering Europe. As a result they found evidence that ESG performance generally decreases idiosyncratic and total risk. At the same time environmental score showed a negative relation to idiosyncratic risk. However, systematic risk was affected only for the industries, which are environmentally sensitive. According to the results of the research social performance decreases all three types of risks while there was no significant effect of governance score on any type of risk found.

Although most studies provide evidence of an indirect relationship between ESG performance and risk characteristics, Bouslah *et al.* (2013) found a positive relationship for some dimensions and samples (particularly corporate governance, employee relations, and human rights), which is a counterintuitive result.

Additionally, it is also difficult to compare the papers due to the fact that researchers quite frequently use different risk metrics as proxies. This is also related to the ESG data as explanatory variables, since in some papers aggregated ESG performance is used (for example, Bassen *et al.*, 2006), while in others ESG measures are broken down into separate dimensions.

The link between ESG performance and risk has become a central topic in the latest empirical studies as well. While earlier papers often demonstrated contradictory results, recent studies have focused on the issue with more robust data, sector-specific analyses, and crisis-period observations. Especially influential in this regard are series of empirical studies published by CEPR, which focus on the banking sector and provide detailed conclusions on how ESG influences refinancing risk, systemic vulnerability, and crisis resilience. The detailed discussion of the papers is presented below, alongside additional, latest empirical papers that broaden the view on the topic.

Gehrig *et al.* (2021; 2022) examined European banks and investigated whether ESG scores impact refinancing risk and funding costs. The authors base their research on a broad sample of banks and define the indicators of funding stability, differentiating between short-term wholesale finance and

more stable sources. The key finding is that banks with better ESG performance can access funding on better terms: their funding structures are less dependent on volatile instruments, and their bond issues are priced at lower spreads. This result shows that markets see ESG-oriented banks as more reliable, assigning them a lower cost of capital. The 2022 revision confirms these findings with a longer sample and alternative estimation strategies. It should be pointed out that it also demonstrates that investors require a smaller risk premium from ESG-friendly banks, indicating that ESG is not only a reputational factor but also directly priced into credit markets. This provides a clear mechanism linking ESG to bank riskiness, since by reducing refinancing risk and enhancing confidence, ESG strengthens the resilience of the financial system.

Gehrig *et al.* (2022) broaden the topic through a comparison of European and U.S. banks. The authors found a difference in the composition of ESG scores: European banks tend to have higher scores on the Environmental and Social pillars, while U.S. banks are more focused and show better performance in Governance. Despite better overall ESG ratings, European banks tend to be more vulnerable to systemic risk than their U.S. peers. These findings demonstrate that aggregate ESG scores can be misleading if the underlying pillars differ in importance for financial stability. Particularly, governance weaknesses appear to offset environmental and social strengths. The research thus emphasizes the need to break down ESG into its separate components.

Dursun-de Neef *et al.* (2023) provided evidence from a crisis perspective by focusing on the data during COVID-19 pandemic. Using high-frequency stock return data and bank lending information, the study shows that banks with higher ESG ratings in fact underperformed during the first phase of the crisis. The daily returns of such banks were lower, and they limited lending more significantly compared to the peers with less focus on ESG. The negative effect was the most evident in banks with large retail investor bases. This is not consistent with the idea that ESG should act as stabilizer; however, it seems that under stress, ESG is seen as costly or as limiting flexibility, causing worse market outcomes.

Summarizing all the above, the CEPR papers emphasize three important points. Firstly, in normal periods, ESG reduces refinancing risk and decreases risk premia in banks (Gehrig *et al*., 2021; 2022). Secondly, ESG has multiple dimensions, and aggregate scores can eliminate the importance of variations across pillars (Gehrig *et al*., 2022). Thirdly, ESG's role is not constant but rather dependent on the environment: in a crisis, its effects may even reverse (Dursun-de Neef *et al*., 2023). Overall, these results emphasize that ESG's effect on risk is dependent on sector characteristics, the composition of each ESG pillar, and specific market conditions. The stabilising effects identified in some contexts cannot be generalised as a universal pattern but should instead be seen as conditional outcomes that may weaken, diminish, or even react contrary under stress.

Beyond the CEPR papers, other recent studies reveal further details. Iannone *et al*. (2025) examined ESG portfolios in Germany, France, and Italy during recent turmoil and discovered that ESG investments were more resilient than traditional ones, though volatility was higher in some markets. Bouattour *et al.* (2024) showed that the relationship between ESG and stability is non-linear in European banks: risk-reducing benefits were present only when banks were already in the high ESG bucket. Curcio *et al*. (2024) discovered that ESG performance of non-financial firms decreases the systemic risk exposure of banks and insurers, demonstrating cross-sector effects. Galletta and Mazzù (2023) emphasized that ESG controversies, for example, environmental accidents, governance failures, or social misconduct, are linked to the higher bank risk-taking. This means that when banks themselves are affected by scandals or are closely related to controversial clients, the arising reputational and regulatory pressures can lead to riskier financial behaviour. These findings support the idea that the

relationship between ESG and risk is dependent on context, methodology, and the considered pillars of ESG.

2.3 Research questions and hypothesis formulation

The research questions to be studied within the Master's thesis are formulated in the following way:

- Do ESG disclosure and performance have an impact on the liquidity of the European stocks?
- Do better ESG disclosure and performance lead to the lower riskiness of the European stocks?

So far, the riskiness characteristics of the stocks in relation to the ESG performance were addressed in the empirical studies widely, however there is a limited number of studies addressing the relation between ESG rating and liquidity characteristics of the stocks.

To answer the questions stated above, empirical research will be conducted, and the following hypotheses, based on the prior literature overview, will be tested:

H1. Better ESG disclosure leads to improved liquidity of the stocks.

The hypothesis is based on the observation that better ESG disclosure increases the amount of available information about the company, enhancing transparency and reducing asymmetric information faced by investors (Akerlof, 1970). Additionally, since asymmetric information is one of the key drivers of stock liquidity (Glosten and Harris, 1988; Hasbrouck, 1991), it is expected that better disclosure reduces spread, enhancing liquidity characteristics of the stocks.

H2. Better ESG performance leads to the improved liquidity of the stocks.

The direct relation between ESG performance and liquidity of the stocks is related to the rising demand for sustainable investing stemming from investors. Thus, due to the increasing inclusion of stocks with better ESG ratings into ESG ETFs, mutual funds and portfolios of institutional and retail investors, trading volume is rising, leading to the higher liquidity of the stocks, supported by additional cash inflow directed into ESG fund.

H3. ESG performance and disclosure influence total and systematic riskiness of the stocks.

This hypothesis is formulated based on the fact that the lower riskiness of the stocks with high ESG score can be explained by to reduced probability of fraud, media controversies, corruption, scandals and litigation processes (Hong and Kacperczyk, 2006), which normally have an adverse effect on the share price.

3. Empirical methodology

3.1 Sample and data collection

The research is based on European stocks and all data points are referred to the year 2019. Financial data as well as ESG data are retrieved through Refinitiv Eikon database (Thomson Reuters). Financial data (historical price performance, bid price, ask price, volume, and the number of shares outstanding(were taken at a daily frequency for 2019. Other financial data, such as the D/A ratio and market capitalisation, were taken as annual figures as of the end of the calendar year to ensure time consistency of the data across the companies. ESG performance metrics and a detailed breakdown of pillars are represented annually as well.

Since ESG data availability is more problematic than financial data availability, the sample size was determined mainly by the availability of ESG data. The initial sample included 1862 companies with available ESG performance data for 2015-2019. Since some financial data were taken as the average during the year (relative bid-ask spread, illiquidity ratio, turnover), due to a limited number of historical observations for bid–ask spreads, the sample size was further reduced to 1210 data points for which matching ESG data were available.

The final reduction to 1,146 observations was due to missing pillar-level ESG detail required to compute the disclosure score. This occurred due to the differences in the financial year-end for some companies (not available at the time of data retrieval).

3.2 Measurement of variables

The following section describes the derivation of the dependent, independent and control variables, as well as explains their meaning and underlying intuition.

3.2.1 Dependent variables

Relative bid-ask spread

Bid-ask spread is one of the determinants of liquidity characteristics of the stock (Garbade, 1982; Stoll, 1985). Demsetz (1968) first linked the bid–ask spread to transaction costs, through which dealers are compensated for providing liquidity. The relative bid-ask spread is calculated based on the following formula:

$$s = \frac{a-b}{m},$$

where *a* is the ask price for the stock, *b* is the bid price for the stock and *m* represent the mid price which is calculated as follows:

$$m = \frac{a+b}{2}$$

The relative bid-ask spread was calculated for each trading day for each stock in the sample. After that, the average of the relative bid-ask spread during the whole year was calculated and used in the regression analysis.

Amihud illiquidity ratio

The ratio was first introduced by Amihud (2002) as a measurement of stock illiquidity. The ratio is calculated as follows:

$$I_t = \frac{|r_t|}{Vol_t},$$

where r_t represents the absolute return of the stock and Vol_t stands for the trading volume over the given period. The measure approximates price impact per unit of trading volume; therefore, it is considered a good proxy for the measurement of price impact (Amihud, 2002). The ratio is also consistent with the definition of illiquidity provided by Kyle (1985).

For this research, the Amihud illiquidity ratio was calculated daily for each stock, with further calculation of the average Amihud illiquidity ratio during the whole year, which was then used in the regression analysis. Returns were calculated from the retrieved historical price performance; dollar volume was calculated as the closing price multiplied by trading volume.

Turnover

Share turnover is considered one of the liquidity measures and is calculated as follows:

$$share\ turnover = \frac{number\ of\ shares\ traded}{total\ shares\ outstanding}$$

Higher share turnover indicates liquid stock, showing how easy it is to sell the shares of the particular company in the given period.

For this research, share turnover was calculated daily to eliminate the effect of changes in shares outstanding. For the regression analysis, the average share turnover for the whole year was calculated.

Beta

Beta as a proxy of systematic risk is used as it is defined in CAPM model (Treynor, 1961; Sharpe, 1964; Lintner, 1965):

$$E(R_i) = R_f + \beta(E(R_m) - R_f),$$

where $E(R_i)$ corresponds to the expected return of the asset, R_f is the risk-free rate, $E(R_m)$ is the expected return of the market and β is the risk factor, i. e., sensitivity of the expected return of the risky asset to the expected excess return of the market.

Beta for the securities in the sample used for the linear regression is retrieved directly through Thomson Reuters database. It is calculated based on monthly returns of the stock and the market index of the corresponding country (country of incorporation) within the period of 5 years.

Volatility

Standard deviation (volatility) is frequently used as a risk measurement of the stock (Markowitz, 1952). Volatility is seen as a total risk, thus it incorporates idiosyncratic (firm-specific) and systematic risk (market risk) of the stocks. The volatility of the stock is calculated as follows:

$$SD_i = \sqrt{Var(R_i)},$$

where R_i represents return of individual stock and variance is calculated as follows:

$$Var(R_i) = \sum_{n=1}^{n} \frac{(R_i - \overline{R_i})}{n-1},$$

where n represents number of observations, $\overline{R_i}$ is the mean return across all observations, R_i is return of each single data point.

The volatility for the stocks in the sample was calculated based on daily return observations during 2019.

Semideviation

In contrast to overall volatility, semideviation captures only downward price movements, representing investors' exposure to loss rather than total variability. The metric was first introduced by Markowitz and Roy (1952). The semideviation is calculated based on the following formula:

$$Semideviation = \sqrt{\frac{1}{n} \times \sum_{r_{t<\mu}}^{n} (\mu - r_t)^2}$$

The semideviation for the stocks in the sample was calculated in the same way as volatility based on daily return observations during 2019.

3.2.2 Independent variables

ESG rating

The ESG rating is retrieved directly from Thomson Reuters. The rating is based on the information disclosed by the companies. Refinitiv's ESG assessment relies on publicly disclosed corporate information and evaluates firms across ten thematic areas: human rights, workforce, community, product responsibility, management, shareholders, CSR strategy, resource use, emissions, and environmental innovations. The environmental and social scores provided by Thomson Reuters are based on the relative performance of the company within its industry, while governance score is based on the relative performance within the company's country.

ESG metrics are represented as qualitative (boolean values answering the questions with yes or no) and quantitative (i.e. numerical values). A subcategory score is defined from the number of companies with a worse score, the same score, and the total number of companies reporting the metric. Thus, the percentile rank is not sensitive to the outliers since it is calculated based on the formula below:

$$percentile = \frac{amount\ of\ stocks\ with\ worse\ value + \frac{amount\ of\ stocks\ with\ the\ same\ value}{2}}{number\ of\ stocks\ reporting\ value}$$

Additionally, weights for pillars used to calculate overall ESG rating score can be different depending on relevancy for the industry. Thus, as independent variables, the overall ESG score (with Refinitiv's industry weights applied) and the separate pillar scores were used (Thomson Reuters, 2017).

ESG disclosure

Given Refinitiv does not publish a standalone disclosure score, it was calculated for this study as the ratio of disclosed indicators to all relevant indicators reported under the Refinitiv framework:

$$ESG\ disclosure = \frac{number\ of\ disclosed\ relevant\ metrics}{number\ of\ relevant\ metric}$$

For the calculation only metrics contributing to the performance score are taken into account, while 'voluntary' metrics are ignored. The disclosure score is calculated for each of the three pillars separately (environmental, social and governance). To derive the overall ESG disclosure score, the average of the three pillars is taken for each company.

Market capitalisation

Market capitalisation was retrieved directly from Thomson Reuters for each stock as of last trading day of 2019. Market capitalisation is represented in euros, thus for the stocks traded in the non-euro countries the historical exchange rate provided by ECB was used for the conversion to enable comparability across the stocks in the sample.

3.3 Empirical methods

The key method used in the research of the correlation between ESG rating and liquidity/riskiness metrics is OLS regression. In this section all the models used for research are described in more detail. Models can be divided into two groups:

1. Liquidity metrics as dependent variables
2. Riskiness metrics as dependent variables

Liquidity metrics models are listed in the table below

Table 1. OLS models definition for liquidity metrics as dependent variables

Relative bid-ask spread	
Model 1	$Spread_t = \alpha + \beta_1 Turnover_t + \beta_2 Volatility + \beta_3 Marketcap + \beta_4 Beta$
Model 2	$Spread_t = \alpha + \beta_1 Turnover_t + \beta_2 Volatility + \beta_3 Marketcap + \beta_4 Beta + \beta_5 ESG$
Model 3	$Spread_t = \alpha + \beta_1 Turnover_t + \beta_2 Volatility + \beta_3 Marketcap + \beta_4 Beta + \beta_5 Social + \beta_6 GOvernance + \beta_7 Environment$
Model 4	$Spread_t = \alpha + \beta_1 Turnover_t + \beta_2 Volatility + \beta_3 Marketcap + \beta_4 Beta + \beta_5 ESG\_disc$
Model 5	$Spread_t = \alpha + \beta_1 Turnover_t + \beta_2 Volatility + \beta_3 Marketcap + \beta_4 Beta + \beta_5 Social\_disc + \beta_6 Governance\_disc + \beta_7 Environment\_disc$
Illiquidity ratio	
Model 1	$Illiquidity_t = \alpha + \beta_1 Spread_t + \beta_2 Volatility + \beta_3 Marketcap + \beta_4 Beta$
Model 2	$Illiquidity_t = \alpha + \beta_1 Spread_t + \beta_2 Volatility + \beta_3 Marketcap + \beta_4 Beta + \beta_5 ESG$
Model 3	$Illiquidity_t = \alpha + \beta_1 Spread_t + \beta_2 Volatility + \beta_3 Marketcap + \beta_4 Beta + \beta_5 Social + \beta_6 GOvernance + \beta_7 Environment$
Model 4	$Illiquidity_t = \alpha + \beta_1 Spread_t + \beta_2 Volatility + \beta_3 Marketcap + \beta_4 Beta + \beta_5 ESG\_disc$
Model 5	$Illiquidity_t = \alpha + \beta_1 Spread_t + \beta_2 Volatility + \beta_3 Marketcap + \beta_4 Beta + \beta_5 Social\_disc + \beta_6 Governance\_disc + \beta_7 Environment\_disc$
Turnover	
Model 1	$Turnover_t = \alpha + \beta_1 Spread_t + \beta_2 Volatility + \beta_3 Marketcap + \beta_4 Beta$
Model 2	$Turnover_t = \alpha + \beta_1 Spread_t + \beta_2 Volatility + \beta_3 Marketcap + \beta_4 Beta + \beta_5 ESG$
Model 3	$Turnover_t = \alpha + \beta_1 Spread_t + \beta_2 Volatility + \beta_3 Marketcap + \beta_4 Beta + \beta_5 Social + \beta_6 GOvernance + \beta_7 Environment$
Model 4	$Turnover_t = \alpha + \beta_1 Spread_t + \beta_2 Volatility + \beta_3 Marketcap + \beta_4 Beta + \beta_5 ESG\_disc$
Model 5	$\alpha + \beta_1 Spread_t + \beta_2 Volatility + \beta_3 Marketcap + \beta_4 Beta + \beta_5 Social\_disc + \beta_6 Governance\_disc + \beta_7 Environment\_disc$

Model 1 includes only control variables for each liquidity metric to find a correlation between predefined financial metrics. Model 2 adds ESG rating variable to the Model 1 to test for the correlation between liquidity metric and ESG performance. Model 3 adds the breakdown of ESG rating into three pillars: governance, environmental, social scores to Model 1 to test the relation between liquidity metric and each pillar separately.

Model 4 adds ESG disclosure score to the Model 1 to test for the correlation between the liquidity metrics and the ESG disclosure score. Model 5 includes a breakdown of ESG disclosure metric on three pillars: environmental, social and governance to test for the relation between liquidity metric and pillars disclosure score.

The hypotheses related to the liquidity metrics are stated as follows:

- $H1_0$. There is no significant positive correlation between ESG disclosure and liquidity of the stocks (negative correlation for bid-ask spread, negative correlation for illiquidity ratio and positive correlation for turnover).
- $H1_a$. There is a significant positive correlation between ESG disclosure and liquidity of the stocks (negative correlation for bid-ask spread, negative correlation for illiquidity ratio and positive correlation for turnover).
- $H2_0$. There is no significant positive correlation between ESG performance and liquidity of the stocks (negative correlation for bid-ask spread, negative correlation for illiquidity ratio and positive correlation for turnover).
- $H2_a$. There is a significant positive correlation between ESG performance and liquidity of the stocks (negative correlation for bid-ask spread, negative correlation for illiquidity ratio and positive correlation for turnover).

Riskiness metrics models are listed in the table below.

Table 2. OLS models definition for risk metrics as dependent variables

Beta	
Model 1	$Beta_t = \alpha + \beta_1 D/A_t + \beta_2 Spread_t + \beta_3 Volatility + \beta_4 Marketcap$
Model 2	$Beta_t = \alpha + \beta_1 D/A_t + \beta_2 Spread_t + \beta_3 Volatility + \beta_4 Marketcap + \beta_5 ESG$
Model 3	$Beta_t = \alpha + \beta_1 D/A_t + \beta_2 Spread_t + \beta_3 Volatility + \beta_4 Marketcap + \beta_5 Social + \beta_6 Governance + \beta_7 Environment$
Volatility	
Model 1	$Volatility_t = \alpha + \beta_1 D/A_t + \beta_2 Spread_t + \beta_3 Beta + \beta_4 Marketcap$
Model 2	$Volatility_t = \alpha + \beta_1 D/A_t + \beta_2 Spread_t + \beta_3 Beta + \beta_4 Marketcap + \beta_5 ESG$
Model 3	$Volatility_t = \alpha + \beta_1 D/A_t + \beta_2 Spread_t + \beta_3 Beta + \beta_4 Marketcap + \beta_5 Social + \beta_6 Governance + \beta_7 Environment$
Semideviation	
Model 1	$Semideviation_t = \alpha + \beta_1 D/A_t + \beta_2 Spread_t + \beta_3 Beta + \beta_4 Marketcap$
Model 2	$Semideviation_t = \alpha + \beta_1 D/A_t + \beta_2 Spread_t + \beta_3 Beta + \beta_4 Marketcap + \beta_5 ESG$
Model 3	$Semideviation_t = \alpha + \beta_1 D/A_t + \beta_2 Spread_t + \beta_3 Beta + \beta_4 Marketcap + \beta_5 Social + \beta_6 Governance + \beta_7 Environment$

Model 1 as in the models for the liquidity metrics includes control variables to define correlation between riskiness metrics and key financial characteristics of the stocks. Model 2 adds to the Model 1 ESG performance as independent variable to test for the correlation between riskiness metrics and ESG rating. Model 3 includes the breakdown of ESG rating into three pillars: environmental, social and governance score to determine correlation of the riskiness characteristics and performance related to the specific pillar.

The hypotheses related to the riskiness metrics are stated as follows:

- $H1_0$. There is no significant negative correlation between ESG performance and riskiness of the stock (negative correlation for beta, negative correlation for volatility, negative correlation for semidevation).
- $H1_a$. There is a significant negative correlation between ESG performance and riskiness of the stock (negative relation for beta, negative relation for volatility, negative relation for semi deviation).

4. Empirical results

4.1 Descriptive statistics

Table 3 provides descriptive statistics on the financial data used in the sample. Relative bid-ask spread averages to 0.3% across the sample ranging from 0.08% (1st quartile) to 0.36% (3rd quartile). The Illiquidity ratio varies quite significantly across the sample, showing that the data contain very liquid as well as illiquid stocks. Turnover ratio averages 6.58%, while beta averages 0.92, which is rather close to the market beta of 1 according to CAPM. The sample includes stocks with various market capitalisation with an average of EUR 9,446 million. The volatility and semideviation of the stocks in the sample do not show a significant difference with averages of 6.61% and 6.40% respectively.

Table 3. Descriptive statistics for the variable in OLS models

Variable	*n*	*M*	*SD*	1st quartile	3rd quartile
spread	1146	0.30%	0.38%	0.08%	0.36%
illiquidity	1146	0.001058	0.024137	0.000010	0.000136
Turnover ratio	1146	6.58%	10.46%	1.06%	7.23%
beta	1146	0.92	0.44	0.64	1.17
D/A	1146	66.17%	25.73%	58.18%	83.51%
market_cap	1146	9,446	22,514	903	7,843
volatility	1146	6.61%	0.31%	6.45%	6.67%
semi_deviation	1146	6.40%	0.17%	6.32%	6.42%

Note: spread is represented in the percentage; illiquidity ratio is multiplied by 1000; turnover ratio is represented in percentage; D/A ratio is represented in percentage; market_cap is represented in EURm;

Table 4 shows the summary statistics for the ESG performance metrics as well as for the ESG disclosure metrics. The average ESG score across 1146 stocks in 2019 amounted to 56.07 with a minimum score of 7.53 and a maximum score of 99.98. The breakdown of ESG score into the separate pillars shows that social score has the highest average across the pillars (60.86 versus 51.41 for environmental score and 53.10 for governance score). Additionally, we can observe that social score distribution is more skewed to the left-hand side compared to the other scores. However, the lowest score is observed in the environmental category (0.30), where also the largest range between the first and third quartiles is observed.

Average ESG disclosure metric is relatively high, amounting to 82.5. The most disclosed pillar in the sample is the Governance pillar averaging 90.2 (versus 77.5 for social disclosure metric and 77.5 for environmental disclosure metric). This can be related to the fact that corporate governance issues

were incorporated into investment-decision process earlier than social and environmental considerations.

Table 4. Descriptive statistics for ESG metrics

Variable	*n*	*M*	*SD*	Min	1st quartile	3rd quartile	Max
ESG score	1146	56.07	18.98	7.53	41.76	70.81	99.98
environment score	1146	51.41	25.93	0.30	30.79	74.00	98.88
social score	1146	60.86	20.97	4.17	45.38	77.69	96.98
governance score	1146	53.10	22.73	2.30	35.44	71.37	97.82
ESG disclosure	1146	82.5	7.6	62.2	77.0	87.7	100
env_disclosure	1146	77.5	12.3	54.5	66.7	87.9	100
soc_disclosure	1146	79.9	8.7	53.5	74.4	83.7	100
gov_disclosure	1146	90.2	5.9	69.8	86.0	94.6	100

Note: ESG score, environment score, social score and governance score are represented as nominal score values; ESG disclosure, env_disclosure, soc_disclosure, gov_disclosure are represented in %

Figure 4 provides an overview of ESG score with further breakdown of ESG score into environmental, social and governance pillars. Overall, all four distributions are close to the normal distribution with slight skewness to the left (except for the environmental score).

Figure 4. Distribution of ESG scores

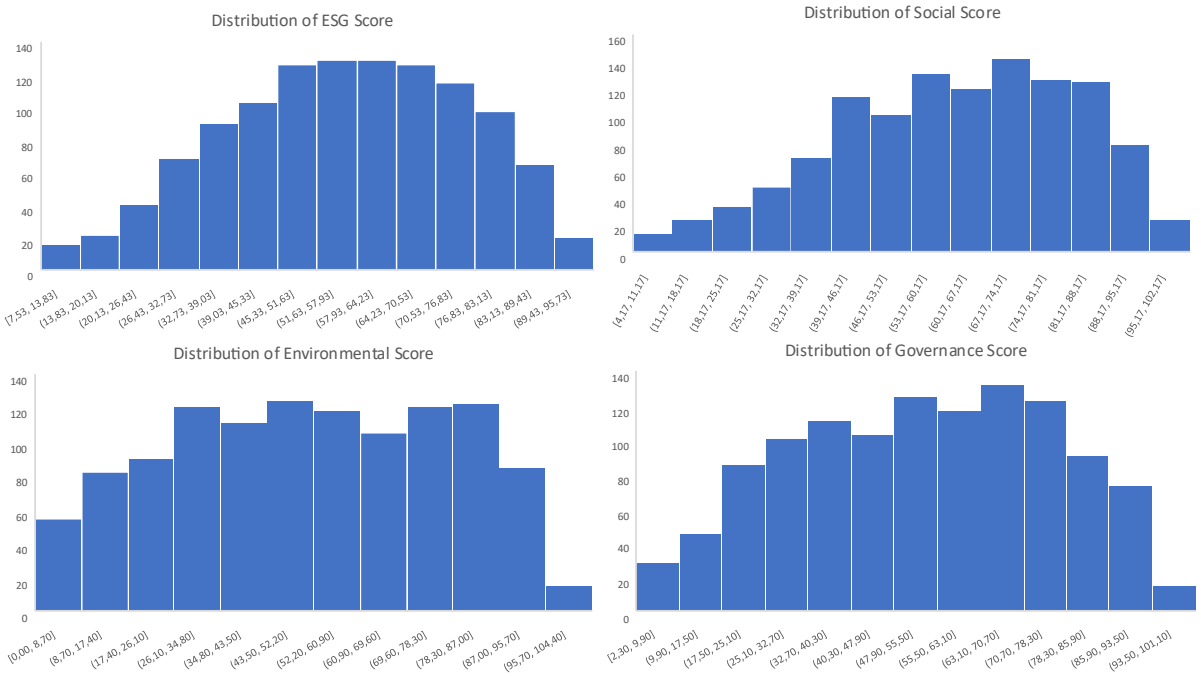


Table 5 shows summary statistics on ESG score categorized by the capitalisation. Thus, the sample comprises 239 large-cap, 519 mid-cap, and 388 small-cap stocks. Overall, based on the data analyzed stocks with larger market capitalisation tend to have higher ESG ratings, which is consistent with the results of previous studies presented in the literature overview section. As stated above this can be since larger companies have more available resources to ensure focus on ESG issues and ESG disclosure.

Table 5. ESG score categorized by capitalisation

Category	*n*	*M*	Min	1st quartile	3rd quartile	Max
Large cap	239	73.16	10.36	66.30	83.55	94.51
Mid cap	519	59.52	9.87	49.56	70.89	92.17
Small cap	388	45.83	7.53	33.38	57.67	88.00

Table 6 provides information on ESG disclosure categorized by market capitalisation. ESG disclosure shows the same result as ESG rating indicating that large capitalisation stocks disclose the largest amount of information (average of 86.12%) followed by mid capitalisation (82.55%) and small capitalisation stocks (79.41%).

Table 6. ESG disclosure categorized by capitalisation

Category	*n*	*M*	Min	1st quartile	3rd quartile	Max
Large cap	239	86.12	67.50	82.51	90.00	98.39
Mid cap	519	82.55	65.60	77.96	88.00	97.80
Small cap	388	79.41	62.20	74.74	85.86	97.80

Table 7 represents the descriptive statistics on the ESG rating and pillars scores categorized by industry. Overall mean scores across ESG rating, environmental, social and governance scores are centered in the range 50-60. The highest average score is observed in the utilities industry (62.5), however this is also industry with the largest range between minimum and maximum score. Other industries with the best average scores are basic materials and healthcare. The worst scores are observed for financials, energy and real estate. Education industry is not taken into account due to poor representation in the sample (1 company with available financial and ESG data). The average across mean scores of industries for ESG rating is 59.99.

Environmental score overall is lower than ESG rating with the mean of 52.86. The industries with the lowest average environmental score are financials, healthcare and technology, while the best scores are observed for utilities, basic materials and real estate. Social score represents the highest average across the ESG pillars amounting to 61.54. The industries with the worst scores are financials, energy and real estate, while the best scores are in the healthcare, technology and basic materials industries. The governance score is characterised by a lower average score across industries (53.84) than overall ESG rating score. Among the industries with the worst score are real estate, financials, industrials, while the best scores are observed in utilities, basic materials and energy.

Table 7. ESG performance categorized by industry

Category	*n*	*Min*	1st quartile	Mean	Median	3rd quartile	Max
			ESG score				
Energy	73	7.86	40.08	55.12	57.68	72,94	92.17
Basic Materials	120	9.23	46.26	59.69	59.79	75.64	90.65
Consumer Cyclicals	212	8.93	45.36	57.47	58.18	70.92	93.05
Consumer Non-cyclical	92	17.31	43.36	57.19	57.33	69.80	90.48

Education	1	31.94	31.94	31.94	31.94	31.94	31.94
Financials	207	9.87	36.13	51.73	51.48	66.08	92.13
Healthcare	90	15.02	43.46	58.01	58.22	71.70	94.51
Industrials	223	10.96	39.90	55.39	55.70	70.29	91.71
Real estate	73	10.22	42.87	55.44	57.01	69.88	86.93
Technology	34	11.15	43.67	57.36	55.86	69.89	93.57
Utilities	21	7.53	58.28	62.50	70.95	76.35	88.59
			Environment Score				
Energy	73	0.30	35.56	50.56	48.51	66.93	92.12
Basic Materials	120	1.54	38.93	56.74	55.49	78.36	95.71
Consumer Cyclicals	212	0.35	33.96	53.15	52.49	73.51	98.88
Consumer Noncyclical	92	2.60	36.28	56.91	56.91	78.54	97.94
Education	1	25.00	25.00	25.00	25.00	25.00	25.00
Financials	207	0.68	15.98	43.58	37.53	73.66	98.75
Healthcare	90	1.66	28.84	48.28	51.42	65.78	93.78
Industrials	223	2.32	31.49	51.19	54.21	71.13	98.59
Real estate	73	2.73	32.91	56.80	60.37	82.02	96.73
Technology	34	6.11	33.41	47.95	46.09	65.61	92.34
Utilities	21	8.56	50.30	63.39	65.67	86.75	93.06
			Social Score				
Energy	73	9.27	39.66	59.26	65.88	78.86	94.68
Basic Materials	120	8.41	52.40	63.50	65.83	78.38	95.31
Consumer Cyclicals	212	5.56	45.31	61.64	62.16	77.87	96.91
Consumer Non-cyclical	92	16.00	43.82	60.22	60.22	79.35	96.58
Education	1	44.04	44.04	44.04	44.04	44.04	44.04
Financials	207	9.25	40.83	55.91	55.84	71.40	96.98
Healthcare	90	5.54	53.57	66.59	69.93	84.49	96.98
Industrials	223	9.56	46.46	61.68	63.90	78.82	96.44
Real estate	73	11.21	45.50	59.34	61.75	73.95	93.14
Technology	34	10.89	51.73	63.60	60.39	79.84	96.44
Utilities	21	4.17	53.73	63.63	68.11	80.90	95.76

			Governance Score				
Energy	73	9.13	32.09	55.79	62.69	77.38	97.77
Basic Materials	120	6.38	41.44	58.24	59.17	76.08	97.82
Consumer Cyclicals	212	6.08	37.75	54.50	56.73	72.11	94.81
Consumer Non-cyclical	92	11.30	36.83	52.37	50.56	67.93	94.90
Education	1	27.55	27.55	27.55	27.55	27.55	27.55
Financials	207	2.30	33.23	50.82	52.63	72.02	95.77
Healthcare	90	6.83	33.37	52.82	52.63	72.02	95.77
Industrials	223	3.90	35.03	51.25	53.88	67.38	94.22
Real estate	73	5.72	31.64	49.21	45.90	68.64	87.08
Technology	34	11.10	36.01	54.92	59.51	75.84	96.35
Utilities	21	10.13	44.04	58.53	64.35	75.51	87.38

Table 8 shows similarly to Table 7 the descriptive statistics for ESG disclosure score based on the industry categorization. Overall disclosure scores range from 50 to 100 with the highest scores observed for the governance score. The highest average ESG disclosure is observed in technology (85.70), while the lowest is observed in financials (80.40).

Table 8. ESG disclosure categorized by industry

Category	*n*	*Min*	1st quartile	Mean	Median	3rd quartile	Max
			ESG score				
Energy	73	66.13	77.26	82.19	81.55	88.68	93.87
Basic Materials	120	66.71	78.33	83.68	83.36	87.84	97.98
Consumer Cyclicals	212	66.13	77.37	82.81	83.54	87.74	97.98
Consumer Noncyclical	92	70.48	77.94	83.89	83.99	89.03	96.01
Education	1	69.47	69.47	69.47	69.47	69.47	69.47
Financials	207	62.20	75.90	80.40	80.96	85.65	97.62
Healthcare	90	65.48	74.77	81.01	80.69	87.06	98.39
Industrials	223	66.31	77.29	83.22	82.55	94.88	97.80
Real estate	73	65.48	76.38	83.35	82.33	94.88	97.80

Technology	34	70.60	81.11	85.70	83.13	95.37	98.21
Utilities	21	71.85	79.59	81.78	81.50	84.24	97.02
			Environment Score				
Energy	73	60.61	66.67	78.54	78.79	87.88	100
Basic Materials	120	60.61	78.79	84.39	87.88	90.91	100
Consumer Cyclicals	212	54.54	66.67	76.83	75.76	87.88	96.97
Consumer Noncyclical	92	57.58	68.94	78.66	78.79	87.88	96.97
Education	1	57.58	57.58	57.58	57.58	57.58	57.58
Financials	207	54.55	63.64	72.80	72.73	80.30	96.97
Healthcare	90	54.55	61.36	74.07	72.73	84.85	96.97
Industrials	223	60.61	69.70	79.86	78.79	90.91	96.97
Real estate	73	54.55	66.67	76.59	75.77	93.94	96.97
Technology	34	54.54	73.31	81.91	81.70	93.94	96.97
Utilities	21	60.60	63.64	70.19	69.70	72.73	96.97
			Social Score				
Energy	73	62.79	72.09	79.03	79.07	86.05	95.35
Basic Materials	120	62.79	76.74	81.34	81.40	86.05	100.00
Consumer Cyclicals	212	60.47	74.42	79.21	79.07	83.72	100.00
Consumer Noncyclical	92	65.12	74.42	80.33	81.40	86.05	97.67
Education	1	65.11	65.11	65.11	65.11	65.11	65.11
Financials	207	53.49	74.42	77.56	79.07	83.72	97.67
Healthcare	90	65.48	74.77	81.01	80.69	87.06	98.39
Industrials	223	66.31	77.30	83.22	82.55	89.23	97.44
Real estate	73	65.48	76.38	83.35	82.33	94.88	97.80
Technology	34	70.60	81.11	85.70	83.13	95.37	98.21
Utilities	21	71.85	79.59	81.78	81.50	84.24	97.02
			Governance Score				
Energy	73	71.43	85.71	88.99	88.37	92.86	100.00
Basic Materials	120	69.77	79.07	85.30	83.82	91.07	100.00
Consumer Cyclicals	212	76.79	91.07	92.39	92.86	94.64	100.00
Consumer Noncyclical	92	76.79	89.29	92.68	92.86	94.43	100.00
Education	1	85.71	85.71	85.71	85.71	85.71	85.71
Financials	207	75.00	87.50	90.83	91.07	94.64	98.21

Healthcare	90	76.79	89.29	91.25	91.07	94.64	100.00
Industrials	223	69.77	83.93	88.77	91.07	93.02	100.00
Real estate	73	73.21	87.50	90.56	91.07	94.64	98.21
Technology	34	80.36	89.73	92.02	92.86	94.64	98.21
Utilities	21	80.36	87.50	89.88	91.07	94.64	96.43

Figure 5 shows quartile analysis of the key financial metrics with relation to the ESG rating. Figure 5.1 depicts relative bid-ask spread distribution based on ESG rating quintile. It shows that companies with better ESG rating tend to have lower relative bid-ask spread on average.

Figure 5.2 depicts Debt/Assets ratio distribution based on ESG quintile. According to the figure there is no clear tendency in terms of dependency of ESG rating and Debt/Assets ratio.

Figure 5.3 shows volatility distribution based on the quintiles. The difference between average volatility for 1st, 2nd, 3rd and 4th quintiles is insignificant, however for the 5th quintile (higher ESG rating companies) there is significant reduction in the average volatility as well as in the range between 1st and 3rd quartiles.

Figure 5.4 shows beta distribution based on ESG performance quintiles. Overall, the sample shows the tendency for stocks with higher ESG rating to have higher beta, which is contradicting to the results found in the previous empirical studies.

The Figure 5.5 shows the ESG performance based on market capitalisation quintiles. There is a clear trend for larger stocks to have better ESG rating, which is consistent with size effect described in the previous empirical studies.

Figure 5. Distribution of key metrics based on quintiles

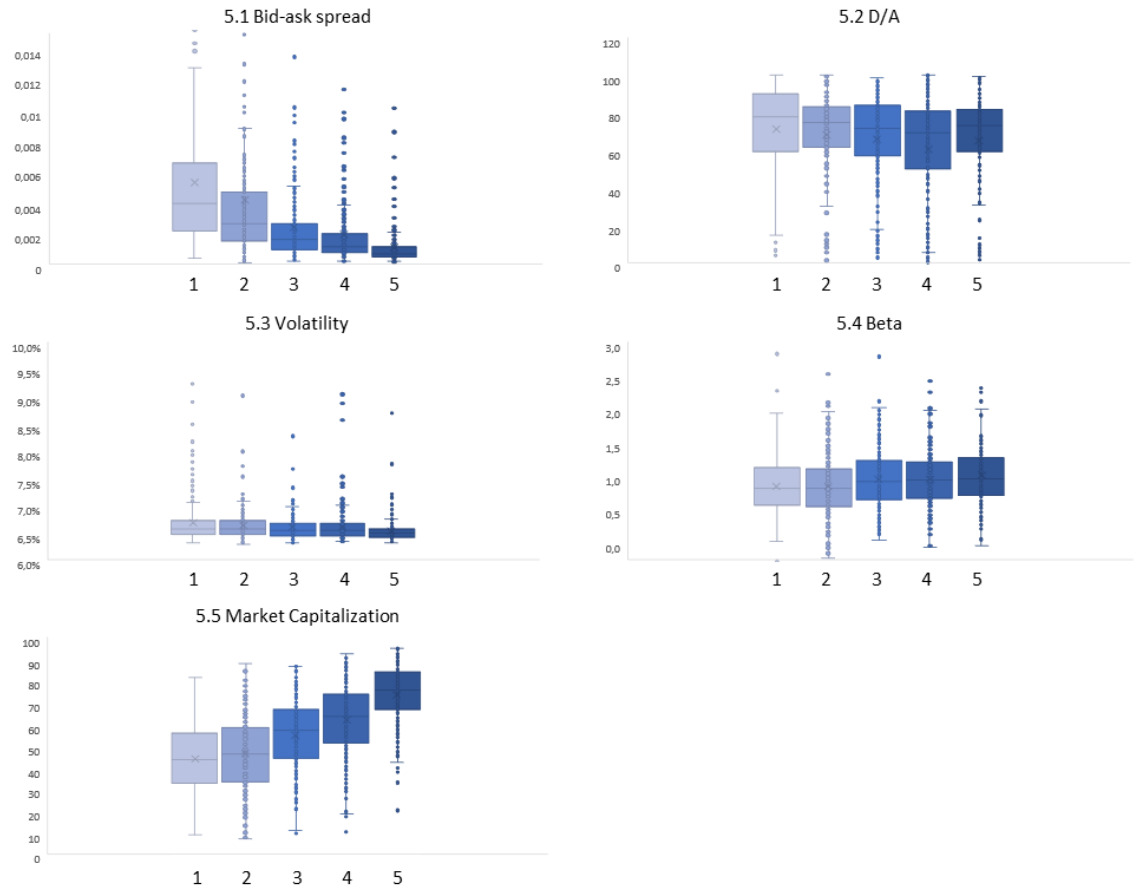


Table 9 presents correlation matrix across all used variables. It shows that there is relatively strong negative correlation of relative bid-ask spread with overall ESG performance and separate ESG pillars. Additionally, according to the correlation matrix there is a weak negative relation of volatility and semideviation with ESG performance and separate ESG pillars. ESG performance and disclosure are strongly correlated with the positive sign, additionally there is strong positive correlation of market capitalisation with overall ESG rating and separate ESG pillars.

Table 9. Correlation matrix across variables

	Spread	illiquidity	Volume	Beta	D/A	ESG	Social	Environmental	Governance	marketcap	volatility	semideviation	Disclosure env	Disclosure soc	Disclosure gov	Disclosure ESG
Spread	1.00	0.19	0.04	-0.13	0.07	-0.39	-0.33	´-0.33	-0.29	-0.23	0.26	0.20	-0.15	-0,13	-0.15	-0.17
Illiquidity	0.19	1.00	0.04	-0.04	-0.05	-0.05	-0.02	-0.05	-0.05	-0.02	0.18	0.22	-0.04	-0.06	-0.07	-0.07
Volume	0.04	0.04	1.00	-0.05	0.04	-0.09	-0.04	-0.08	-0.11	-0.05	-0.01	-0.00	0.01	-0.02	-0.02	-0.01
Beta	-0.13	-0.04	-0.05	1.00	-0.12	0.13	0.13	0.10	0.11	0.05	0.21	0.16	0.08	0.01	-0.01	0.05
D/A	0.07	-0.05	0.04	-0,12	1.00	-0.12	-0.08	-0.11	-0.09	-0.03	0.00	0.00	0.04	-0.02	-0.05	0.00
ESG	-0.39	-0.05	-0.09	0.13	-0.12	1.00	0.88	0.84	0.72	0.39	-0.15	-0.12	0.45	0.46	0.33	0.50
Social	-0.33	-0.02	-0.04	0.13	-0.08	0.88	1.00	0.72	0.43	0.35	-0.13	-0.10	0.40	0.44	0.25	0.45
Environmental	-0.33	-0.05	-0.08	0.10	-0.11	0.84	0.72	1.00	0.39	0.34	-0.18	-0.16	0.48	0.42	0.23	0.48
Governance	-0.29	-0.05	-0.11	0.11	-0.09	0.72	0.43	0.39	1.00	0.28	-0.06	-0.05	0.23	0.26	0.32	0.31
marketcap	-0.23	-0.02	-0.05	0.05	-0.03	0.39	0.35	0.34	0.28	1.00	-0.19	-0.15	0.21	0.18	0.22	0.24
volatility	0.26	0.18	-0.01	0.21	0.00	-0.15	-0.13	-0.18	-0.06	-0.19	1.00	0.93	-0.08	-0.11	-0.08	-0.10
semideviation	0.20	0.22	0.00	0.16	0.00	-0.12	-0.10	-0.16	-0.05	-0.15	0.93	1.00	-0.05	-0.09	-0.06	-0.08
Disclosure Env	-0.15	-0.04	0.01	0.08	0.04	0.45	0.40	0.48	0.23	0.21	-0.08	-0.05	1.00	0.74	0.34	0.91
Disclosure Soc	-0.13	-0.06	-0.02	0.01	-0.02	0.46	0.44	0.42	0.26	0.18	-0.11	-0.09	0.74	1.00	0.47	0.90
Disclosure Gov	-0.15	-0.07	-0.02	-0.01	-0.05	0.33	0.25	0.23	0.32	0.22	-0.08	-0.06	0.34	0.47	1.00	0.62
Disclosure ESG	-0.17	-0.07	-0.01	0.05	0.00	0.50	0.45	0.48	0.31	0.24	-0.10	-0.08	0.91	0.90	0.62	1.00

Note: spread is represented in the percentage; illiquidity ratio is multiplied by 1000; turnover ratio is represented in percentage; D/A ratio is represented in percentage; market_cap is represented in EURm; ESG score, environment score, social score and governance score are represented as nominal score values; ESG disclosure, env_disclosure, soc_disclosure, gov_disclosure are represented in %

Key takeaways and learnings from the descriptive statistics show that ESG characteristics in the sample vary. The Governance pillar is disclosed the most, whereas Environmental scores vary widely and Social scores are generally skewed toward lower values. Larger firms and the ones with better disclosure are characterised by higher ESG ratings, confirming the size-related reporting bias. In regard to sectors, utilities, basic materials, and healthcare have the best ESG performance, while financials, energy, and real estate tend to have the weaker scores.

The quartile analysis (Figure 5) further shows several clear patterns. Companies in higher ESG quintiles are characterised by narrower bid–ask spreads, implying better liquidity and lower information asymmetry. Leverage appears not showing a consistent link to ESG, while volatility declines only in the top ESG quintile. Surprisingly, companies with higher ESG scores tend to have slightly higher betas, deviating from many earlier studies. Additionally, there is a strong relationship between size and ESG rating within the sample, that is larger firms systematically are in higher ESG quintiles.

The correlation matrix (Table 9) further substantiates findings. Within the data sample bid–ask spread is negatively correlated with ESG and its pillars, while volatility and semideviation show weak negative relations.

Generally, the descriptive analysis suggests that high ESG rating is linked to better liquidity, while its connection to risk metrics remains weak and potentially driven by size. Descriptive analysis provides

the empirical foundation for the regression analysis, which investigate whether these relations remain significant after controls variables are introduced.

4.2 Empirical results of OLS

In the following section, the detailed results of empirical research will be represented.

Table 10. OLS regression models with bid-ask spread as dependent variable

Variable	*Model 1*	*Model 2*	*Model 3*	*Model 4*	*Model 5*
Intercept	-1.956e-02***	1.311e-02***	-1.340e-02***	-1.290e-02***	-1.096e-02***
Turnover	1.118e-04	4.031e-05	3.054e-05	1.023e-04	1.021e-04
Volatility	3.663e-01***	3.162e-01***	3.195e-01***	3.25-e-01***	3.276e-04***
market_cap	-3.001e-14***	-9.256e-15°	-9.898e-15*	-2.575e-14**	-2.456e-14***
Beta	-1.472e-03***	-1.087e-03***	-1.085e-03***	-1.452e-03***	-1.457e-03***
ESG		-6.629e-05***			
environment score			-1.692e-05**		
social score			-2.132e-05**		
governance score			-2.749e-05***		
ESG disclosure				-4.972e-03***	
env_disclosure					-2.173e-03°
soc_disclosure					9.319e-04
gov_disclosure					5.791e-03**
F-value	49.43	70.23	57.78	37.8	21.72
R-squared	0.1431	0.2289	0.1963	0.1422	0.1457
N	1184	1184	1184	1184	1184

*** significant at 0.001; ** significant at 0.01; * significant at 0.05; ° significant at 0.1

Note: spread is represented in the percentage; illiquidity ratio is multiplied by 1000; turnover ratio is represented in percentage; D/A ratio is represented in percentage; market_cap is represented in EURm; ESG score, environment score, social score and governance score are represented as nominal score values; ESG disclosure, env_disclosure, soc_disclosure, gov_disclosure are represented in %

Table 10 presents empirical results for the regression models with bid-ask spread as dependent variable. The first model (Model 1) does not include the variables of interest (ESG performance and ESG disclosure) and consists of solely control variables. Thus, it shows that volatility has a positive

effect on the relative bid-ask spread, meaning that higher volatility leads to wider spread and consequently lower liquidity of stocks. This result is consistent across all 5 models after adding variables of interest and is significant at a 0.1% level. Market capitalisation shows mixed results across the models. Within all the models market capitalisation is negatively related to the spread, suggesting that large cap stocks have lower bid-ask spread. However, in the Model 2 (after adding ESG performance to the control variables) the result is significant only at the 10% level. Beta shows significant negative correlation with the bid-ask spread across all the models. However, turnover did not result in significant relation with dependent variables. ESG performance score produced a negative coefficient, which is significant at 0.1%. The result is also consistent after the breakdown of ESG score into environment, social and governance pillars, showing the largest impact of the Governance score on the relative bid-ask spread. These findings support the hypothesis stated previously. The result for variable ESG disclosure is significant with a negative sign for the overall ESG disclosure (Model 4) at the 0.01% level. However, after splitting disclosure into pillars the sign appears to be mixed, and results are statistically significant at 1% only for governance disclosure.

Table 11. OLS regression models with turnover as dependent variable

Variable	*Model 1*	*Model 2*	*Model 3*	*Model 4*	*Model 5*
intercept	5.949e-01	8.792e-01	7.878e-01	4.032e-01	7.120e-01
spread	1.069e+01	4.269e+00	3.199e+00	7.269e+00	7.271e+00
volatility	-5.392e+00	-6.224e+00	-4.929e+00	-3.757e+00	-4.158e+00
market_cap	-1.842e-12	-7.033e-13	-6.767e-13	-1.725e+00	-1.740e-12
beta	-9.554e-02	-8.001e-02	-8.281e-02	-8.036e-02	-8.930e-02
ESG		-4.227e-03*			
environment score			-2.062e-03		
social score			2.445e-03		
governance score			-5.054e-03**		
ESG disclosure				7.613e-02	
env_disclosure					4.976e-01
soc_disclosure					-5.550e-01
gov_disclosure					-1.699e-01
F-value	1.546	2.153	2.153	1.087	1.104
R-squared	0.005196	0.009018	0.009018	0.004743	0.006744
N	1184	1184	1184	1184	1184

*** significant at 0.001; ** significant at 0.01; * significant at 0.05; ° significant at 0.1

Note: spread is represented in the percentage; illiquidity ratio is multiplied by 1000; turnover ratio is represented in percentage; D/A ratio is represented in percentage; market_cap is represented in EURm; ESG score, environment score, social score and governance score are represented as nominal score values; ESG disclosure, env_disclosure, soc_disclosure, gov_disclosure are represented in %

The results of the models depicted in Table 11 with turnover as dependent variables show extremely low R^2. However, ESG score coefficient is significant at 5% level with the negative sign, which is consistent with the hypothesis stated. After the breakdown of the ESG rating into pillars (Model 3) only governance score is statistically significant at 1% and is consistent with the results of the Model 2. Given the findings we can come to the conclusion that disclosure score does not have any explanatory power on the dependent variable. Overall, the results of the models with turnover as dependent variables show extremely low R^2.

Table 12. OLS regression models with illiquidity ratio as dependent variable

Variable	*Model 1*	*Model 2*	*Model 3*	*Model 4*	*Model 5*
intercept	-7.116e-06***	-7.050e-06***	-7.149e-06***	-7.291e-06***	-6.242e-06**
spread	8.683e-05***	8.533e-05***	8.391e-05***	9.634e-05***	9.530e-05***
volatility	1.134e-04***	1.132e-04***	1.149e-04***	1.245e-04***	1.246e-04***
market_cap	4.477e-18	4.743e-18	4.800e-18	6.472e-18	6.729e-18*
beta	-5.826e-07**	-5.790e-07**	-5.815e-07**	-2.780e-07°	-2.970e-07°
ESG		-9.860e-10			
environment score			-4.380e-10		
social score			2.938e-09		
governance score			-4.176e-09		
ESG disclosure				-1.126e-06	
env_disclosure					3.455e-07
soc_disclosure					-7.568e-07
gov_disclosure					-1.805e-06
F-value	13.3	10.64	7.765	14.9	10.92
R-squared	0.04301	0.04304	0.044	0.06136	0.06293
N	1184	1184	1184	1184	1184

*** significant at 0.001; ** significant at 0.01; * significant at 0.05; ° significant at 0.1

Note: spread is represented in the percentage; illiquidity ratio is multiplied by 1000; turnover ratio is represented in percentage; D/A ratio is represented in percentage; market_cap is represented in EURm;

ESG score, environment score, social score and governance score are represented as nominal score values; ESG disclosure, env_disclosure, soc_disclosure, gov_disclosure are represented in %

Table 12 presents empirical findings from the OLS models with illiquidity ratio as dependent variable. The correlation between illiquidity ratio and such independent variables as volatility and beta are consistent with the OLS regressed on the relative bid-ask spread. The relation between the relative bid-ask spread and illiquidity ratio is statistically and economically significant with the positive sign. However, both ESG performance and ESG disclosure do not have significant impact on the illiquidity ratio.

The regression results for liquidity measures show that ESG performance is correlated with narrower bid-ask spreads, which is in line with the hypothesis that better sustainability disclosure and performance enhance stock marketability. This finding is consistent with prior evidence in the literature. For example, Luo (2022) discovered that UK firms with better ESG profiles are associated with both higher liquidity and better stock returns, while Vasiu (2023) found that companies located in the emerging EU markets have a positive relationship between ESG scores and liquidity ratios.

It is important to mention that these results are also consistent with the research conducted at CEPR. Gehrig *et al*. (2022) emphasise that differences in ESG pillar composition, particularly the stronger Environmental and Social focus of European banks, are linked to market outcomes that imply improved transparency and liquidity, although systemic risk is still present. It is worth mentioning that both my study and Gehrig *et al*. (2022) highlight that ESG affects the way markets perceive and trade stocks. Whereas Gehrig *et al*. (2022) focuses on the banks and demonstrates that ESG performance affects funding and stability, my study demonstrates complementary evidence that in the corporate sector, ESG is associated with narrower spreads and better liquidity in secondary equity markets.

Table 13. OLS regression models with beta as dependent variable

Variable	*Model 1*	*Model 2*	*Model 3*
Intercept	-1.556e+00***	-1.701e+00***	-1.717e+00***
D/A	-1.837e-03***	-1.683e-03***	-1.725e-03***
Spread	-1.988e+01***	-1.646e+01***	1.622e+01***
Volatility	4.007e+01***	4.021e+01***	4.007e+01***
market_cap	1.080e-12°	4.853e-13	4.115e-13
ESG		2.188e-03**	
environment score			-3.495e-05
social score			2.058e-03*
governance score			5.193e-04
F-value	31.3	26.89	19.8
R-squared	0.09563	0.1021	0.105
N	1184	1184	1184

*** significant at 0.001; ** significant at 0.01; * significant at 0.05; ° significant at 0.1

Note: spread is represented in the percentage; illiquidity ratio is multiplied by 1000; turnover ratio is represented in percentage; D/A ratio is represented in percentage; market_cap is represented in EURm; ESG score, environment score, social score and governance score are represented as nominal score values; ESG disclosure, env_disclosure, soc_disclosure, gov_disclosure are represented in %

Based on the results of Table 13, spread appears to be negatively correlated with beta which is the result consistent with the previous OLS model (with liquidity measures as dependent variables and risk proxies as independent variables). Volatility has a significant negative relation to beta, which is consistent with the existing literature defining that volatility is a proxy of the total risk, incorporating systematic and idiosyncratic risk. Overall ESG performance shows statistically significant result, however the sign is opposite to expected, meaning that higher ESG rating leads to higher beta. After the breakdown only social score is significant at 5% with the positive sign as well. These findings lead to rejection of the hypothesis stating that better ESG performance is associated with lower systematic risk.

Table 14. OLS regression models with volatility as dependent variable

Variable	*Model 1*	*Model 2*	*Model 3*
Intercept	6.391e-02***	6.426e-02***	6.412e-02***
D/A	9.024e-07	5.255e-07	3.187e-07
Spread	2.253e-01***	2.163e-01***	2.153e-01***
Beta	1.789e-03***	1.806e-03***	1.787e-03***
market_cap	-1.812e-14***	-1.654e-14***	-1.601e-14***
ESG		-5.816e-06	
environment score			-1.374e-05**
social score			1.786e-06
governance score			8.222e-06*
F-value	56.79	45.71	34.71
R-squared	0.161	0.1619	0.1706
N	1184	1184	1184

*** significant at 0.001; ** significant at 0.01; * significant at 0.05; ° significant at 0.1

Note: spread is represented in the percentage; illiquidity ratio is multiplied by 1000; turnover ratio is represented in percentage; D/A ratio is represented in percentage; market_cap is represented in EURm; ESG score, environment score, social score and governance score are represented as nominal score values; ESG disclosure, env_disclosure, soc_disclosure, gov_disclosure are represented in %

As depicted in Table 14 stocks volatility resulted in positive significant correlation to the bid-ask spread across all the models (the results in Table 10 are consistent with this finding). Additionally, according to the regression results in Table 14 volatility is positively correlated with beta (consistent with the regression in Table 13). Market capitalisation shows a negative relation across all three models, implying that large-cap stocks are less volatile than small-cap stocks. The overall ESG score appears to have no impact, since the coefficient is not significant. However, after the breakdown of the ESG rating the environmental score shows statistically significant negative relation at the 1% significance level supporting the hypothesis stated previously. Governance score shows statistical significance at 5%, but the positive sign of the coefficient is not economically justified, since higher governance score should theoretically lead to lower risk and thus lower volatility.

Table 15. OLS regression models with semideviation as dependent variable

Variable	*Model 1*	*Model 2*	*Model 3*
Intercept	6.309e-02***	6.326e-02***	6.317e-02***
D/A	2.254e-08	-1.633e-07	-3.605e-07
Spread	9.742e-02***	9.300e-02***	9.215e-02***
Beta	7.541e-04***	7.624e-04***	7.489e-04***
market_cap	-8.324e-15***	-7.545e-15**	-7.261e-15**
ESG		-2.868e-06	
environment score			-8.560e-06**
social score			3.386e-06
governance score			3.509e-06
F-value	31.1	25.06	19.61
R-squared	0.09507	0.09579	0.1041
N	1184	1184	1184

*** significant at 0.001; ** significant at 0.01; * significant at 0.05; ° significant at 0.1

Note: spread is represented in the percentage; illiquidity ratio is multiplied by 1000; turnover ratio is represented in percentage; D/A ratio is represented in percentage; market_cap is represented in EURm; ESG score, environment score, social score and governance score are represented as nominal score values; ESG disclosure, env_disclosure, soc_disclosure, gov_disclosure are represented in %

The results of the regression with the semideviation as dependent variable as presented in Table 15 are the same for the control variables as for the regression with the volatility as the dependent variable (Table 14). The overall ESG score does not show significant relation with the semideviation. However, the environmental score is negatively related to the semideviation, implying that companies with better environmental scores have lower downside volatility. This finding supports the hypothesis stated previously.

In contrast to liquidity, the regression results for risk metrics (beta, volatility, and downside risk) demonstrate no significant relation with ESG scores or disclosure. This finding differs from several CEPR studies focusing on banks. Gehrig *et al*. (2021; 2022) showed that better ESG performance in banks decreases refinancing risk and results in lower funding costs, with the 2022 version demonstrating that investors explicitly require lower risk premia from ESG-compliant banks. My results do not reflect this effect in the corporate sector, suggesting that the funding-cost channel that drives risk reduction in banks may be less relevant for non-financial firms.

Moreover, Dursun-de Neef *et al*. (2023) showed that the relationship between ESG and risk is dynamic across environments. During the COVID-19 crisis, banks with stronger ESG commitments in fact underperformed, demonstrating lower stock returns and decreasing lending more aggressively than their peers. This finding implies that ESG may even have an adverse effect in particular crisis situations, whereas my analysis, limited to the pre-crisis year 2019, captures only a stable period without such stress effects.

4.3 Key takeaways and learnings from the empirical regressions

Key takeaways and learnings from the empirical regressions show that the relation between ESG performance and financial metrics differ across various dimensions. The results indicate strong support for the hypothesis that ESG performance positively influences market liquidity, while the evidence for the risk reduction effect is weak and dependent on the context.

The regression analysis shows that larger companies are characterised by narrower bid–ask spreads, while companies with higher volatility tend to have wider spreads, both in line with theoretical expectations. Furthermore, ESG performance is associated with lower bid–ask spreads, supporting Hypothesis 2 that ESG performance leads to better liquidity and lower information asymmetry. This relationship is statistically and economically significant even after decomposing ESG into its pillars, with Governance having the strongest impact. ESG disclosure also shows a significant negative coefficient, indicating that transparency facilitates trading efficiency, though the effect is not significant once disclosure is split by pillar.

For further liquidity metrics, the evidence is mixed. Turnover models are characterised by limited explanatory power, with preliminary expected relation between ESG and trading activity disappearing after pillars are analysed separately. Similarly, the Amihud illiquidity ratio shows no relation with ESG or its sub-components. These results imply that ESG's liquidity benefits are most prominent in direct trading-cost measures such as bid–ask spreads.

Regarding Hypothesis 1, testing the effect of ESG disclosure and individual pillars, the results show only partial support. While overall ESG disclosure is significant and negatively related to bid–ask spread, its explanatory power weakens after pillars are separated. Neither of E, S, or G components consistently explain variation in liquidity or risk. The specifically constructed ESG disclosure variable may also have weaker explanatory power since it examines the availability of information and not performance itself. Additionally, the pillars are composed of various sub-indicators of different importance to investors, which is likely to influence their independent explanatory strength.

Regarding Hypothesis 3, stating that higher ESG performance is expected to reduce market-based risk, the data do not support this assumption. None of the specified risk metrics show a consistent negative relation between ESG and beta, volatility, or semideviation. In several cases, the coefficients even turn positive, which would mean that companies with strong ESG performance can be more sensitive to systematic factors. After splitting ESG score into pillars, only the Social pillar remains significant at the 5 % level, and with a positive sign, which counterintuitively implies that socially oriented firms may be exposed to slightly higher systematic risk. Volatility and semideviation are impacted weakly only by the Environmental pillar, while the overall ESG score remains insignificant. These results lead to the rejection of Hypothesis 3 for the selected data sample.

To summarise, the findings indicate that Hypothesis 1 is only partly supported, Hypothesis 2 is confirmed, and Hypothesis 3 is rejected for the selected data sample. ESG's performance relevance is strongest on the liquidity side, whereas its impact on risk is limited.

5. Conclusion

After empirical investigation of the sample consisting of 1,146 European companies from various industries, we can conclude that there is indeed an impact of ESG rating on the liquidity characteristics of stocks. However, the study showed that ESG performance have no significant effect on riskiness metrics.

After testing the impact of ESG performance and disclosure, particular liquidity metrics displayed a clear pattern. While bid–ask spreads were narrower for companies with higher ESG performance and stronger disclosure, the Amihud illiquidity ratio and turnover were not impacted by ESG scores, either before or after breaking them down into their constituent pillars. The narrower bid–ask spreads for better-performing ESG stocks can be attributed to lower information asymmetry and the increased investor demand for ESG-aligned firms.

These findings align closely with recent empirical research. Luo (2022) found that ESG performance improves liquidity in UK equities, while Vasiu (2023) reported a similar relationship for firms in emerging EU markets. Both studies show that transparency and disclosure reduce information asymmetry, consistent with the liquidity effect observed in this thesis. In a related context, Gehrig *et al.* (2022) demonstrated that European banks with stronger Environmental and Social scores exhibit market outcomes consistent with greater transparency, even though their systemic risk remains higher than that of their U.S. peers. Taken together, these studies reinforce the interpretation that ESG consistently enhances liquidity across markets and sectors.

It is also worth noting that this research confirms prior evidence that larger companies tend to have better liquidity, i.e., narrower bid–ask spreads. Combined with the finding that larger firms generally achieve higher ESG ratings, it is possible that the observed liquidity advantages partly reflect firm size effects rather than ESG performance alone. Future research should therefore consider clustered or size-segmented analyses, dividing the sample into groups by market capitalisation to isolate size-related impacts.

In contrast, the study finds no significant impact of ESG performance on risk characteristics, consistent with the mixed evidence in previous literature. The estimated positive relationship between ESG and beta suggests that high-ESG firms may even be more exposed to systematic risk, an outcome that is opposite to initial expectations.

Recent CEPR research further illustrates this conditional nature of ESG's stabilising role. Gehrig *et al*. (2021; 2022) showed that European banks with higher ESG scores benefit from more stable funding structures and lower refinancing costs, while Gehrig *et al*. (2022) demonstrated that the relevance of ESG depends on pillar composition, with Governance being the key stabilising component. Dursun-de Neef et al. (2023) found that ESG's effects can even reverse during crises, as high-ESG banks underperformed and curtailed lending more sharply in the early COVID-19 period. Complementary evidence from Iannone *et al*. (2025), Bouattour *et al*. (2024), Curcio *et al*. (2024), and Galletta and Mazzù (2023) further shows that ESG's effects on risk are non-linear, sector-dependent, and sensitive to market stress and reputation events. Overall, these studies indicate that ESG's stabilising effect is conditional—it varies by sector, market environment, and the relative weight of ESG pillars—and should not be assumed to hold universally.

Additionally, this study highlights the lack of harmonisation among ESG rating providers. Divergent methodologies, weightings, and assessment criteria lead to low correlation across providers,

significantly affecting the comparability of results. This heterogeneity represents a central limitation in ESG research and underscores the importance of developing a more standardised rating framework to ensure consistent empirical findings.

Building on these findings, further research could study ESG's impact on various financial metrics over longer and more volatile periods, particularly during crisis periods, and across different geographic markets to enable cross-country comparison. Extending the analysis dynamically by tracking changes in ESG ratings over time could investigate whether improvements in ESG performance translate into changes in liquidity or risk.

Furthermore, future research could also split the individual ESG pillars into further subcategories, as various sub-factors have different importance to investors. Less important subcategories may contribute noise to the data, distorting true relationships between ESG dimensions and financial metrics. Such granularity would help to understand which specific environmental, social, or governance components drive the observed liquidity advantages.

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