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Do ESG Factors Influence Investment Attractiveness of the Public Companies?

Varvara Nazarova ✉

hD in Economics, Researcher, Associate Professor,

National Research University Higher School of Economics, Saint Petersburg, Russia,

nvarvara@list.ru, [ORCID](#)**Victoria Lavrova**

PJSC Gazpromneft, Chief Specialist of Investor Relations Department

v_lavrova@inbox.ru, [ORCID](#)

Abstract

Even though there are numerous papers on the impact of ESG disclosure or performance on company performance, the topic remains disputable and controversial. The growing importance of ESG scores in investment decision-making has raised a question of whether the ESG score and its pillars influence the investment attractiveness of public companies. Using a sample of S&P 500 American and S&P 350 European companies in the period between 2010 and 2020, we examine the relationship between ESG performance and investment attractiveness, expressed by Tobin's Q, ROE, cost of capital and probability of paying dividends. We use the difference in means, panel regression and propensity score matching analysis and conclude that higher ESG performance positively influences Tobin's Q for both markets, while also providing evidence that ESG score transition to the above-median level may lead to a fairer valuation, higher probability of paying dividends and lower cost of capital, while return on equity is not subject to change. While previous research mainly focuses on one indicator, such as company value or cost of debt, this paper develops a set of investment attractiveness indicators and covers not only composite ESG performance, but also its environmental, social and governance pillars separately; it also emphasizes the influence on the industrial sector. Overall, our results suggest that managers pay close attention to ESG performance if it falls below median, although good ESG performance does not guarantee investment attractiveness.

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Introduction

ESG (Environmental, Social, Governance) is a set of indicators that allows evaluating companies and deciding whether these companies are sustainable enough to operate in the long run and to create value not only for shareholders, but also for society. Environmental factors mainly include companies' actions to prevent climate change by reducing greenhouse emissions, as well as by decreasing waste and increasing resource restoration. The social pillar comprises labour protection and safety and integration with local communities, ensuring the quality of products and supporting human rights and diversity. The governance pillar incorporates metrics associated with responsibilities and rights of companies' management, as well as balancing the interests of the management and the shareholders. Excellence in one pillar does not guarantee good performance in others; therefore, companies should pay attention to all these aspects to receive a good ESG composite score.

ESG issues play a major role in investment decision-making, moreover, it is a fiduciary duty, meaning that investors should integrate ESG factors into their investment analysis [1]. The majority of investors believe that ESG is highly relevant to investment performance and fully integrate ESG issues into their trading strategies [2]. Despite the fact that ESG is a broad term that includes different metrics (from carbon emissions to the number of women on the board of directors), more and more investors are sensitive to the ESG agenda. While USA investors tend to choose the inclusion strategy, which implies that they incorporate ESG factors into their investment analysis, rather than refuse to invest in specific companies or industries, many institutional investors in other countries are not allowed to invest in certain sectors, especially in industrial and energy companies, since high environmental exposure makes these companies toxic and risky in the wake of renewable energy development [3; 4].

The spread of ecological and other human-oriented initiatives convinced investors that in order to generate profits in the future, companies should be sustainable from the ecological, social and governance points of view. According to McKinsey [5], about a quarter of assets under management of the US investment institutes is related to companies with ESG scores. Results are similar for European institutions – according to Forbes, in 2018 ESG investing made up \$20 trillion in assets under management in the world, which is around a quarter of total professionally managed assets [6]. Moreover, Bloomberg [7] reports that investments in ESG funds were three times higher in 2020 than in 2019. PwC [8] states that among 162 large firms, 91% have already adopted or are developing a responsible investment policy, while 72% are developing their own KPIs.

It is important to mention that not only investors, but also consumers, regulators and policymakers are interested in ESG development. But do ESG factors positively influence company value and investment attractiveness? This is the research question posed in this paper.

Not all researchers or company executives support the idea that ESG significantly influences company performance. Moreover, some believe that ESG creates value only in the long term, meaning that in the short term “anti-ESG” companies may be more profitable than ESG ones [9]. Motivated by the importance and relevance of ESG, the paper aims to examine the relationship between ESG performance and investment attractiveness of public companies, expressed by Tobin's Q, ROE, cost of capital and probability of paying dividends.

Even though there are papers that discuss the impact of ESG factors on financial performance, these papers mainly focus on one metric, while in this paper we attempt to develop a complex investment attractiveness indicator, which consists of several accounting and market performance metrics. Secondly, the majority of studies concentrate on the ESG composite score, while we also distinguish between its E, S and G components to conclude which specific pillar contributes more to the result and can affect performance. Moreover, quite a few articles differentiate between the industries, while in this study we believe that industrial companies may exhibit more pronounced effects. As for the empirical study, in order to exclude the potential influence of other events on companies' results and the possible causality problem, we employ propensity score matching models that allow separating companies with above-median and below-median ESG ratings and analysing the difference in performance, as well as judging whether a transition from a below-median ESG score to an above-median ESG score influences investment attractiveness. Finally, this paper relies on recent data from 2010 to 2020. The paper is similar to others in its attempt to reveal whether ESG indicators improve finance-related indicators and in using panel regression methodology. However, our research employs different measures of financial performance, uses more statistical methods for analysis, and concentrates on separate ESG pillars and industrial companies. These distinctions make the subject of research highly relevant.

Literature Review

ESG and companies' performance

It is a well-known fact that investors are interested in the future growth of company value, as higher prices brings returns on their investments. Most of the research concentrates on ESG disclosure or performance in relation to firm value, due to the belief that ESG can improve sustainability, which is the main driver of long-term value creation. Followed by this paradigm, a lot of authors examine whether ESG creates value for different companies in different countries and discover that in most cases this link is positive and significant [10–13]. Moreover, the link between company value and ESG might be substantial because consumers became more aware of sustainable practices and responsible consumption. If a company invests in ESG issues, the consumers are willing to buy its products, driving

the sales and net profit up. In turn, the assurance of seamless sales processes and adequate operating income, along with cost optimization ensures future growth and makes it easier to reliably forecast a company's cash flows, leading to a fairer valuation.

Secondly, ESG performance is believed to have a positive influence on company performance indicators, such as return on assets and equity, because responsible consumers require responsible company actions, and company sales demonstrate stable growth only if companies behave in a responsible manner. Higher sales and income, as well as cost reduction, employee motivation and asset optimization, in turn, can increase returns on equity and assets [5]. However, the results in this field can be controversial since ESG investing may be about being sustainable and profitable in the future, rather than about receiving higher returns now.

Risk reduction is another sphere in which ESG is usually thought to bring a positive impact. There are many papers stating that reporting on sustainability and ESG issues increases information transparency and reduces information asymmetry and associated risks. Risk reduction can bring benefits for companies, since many papers provide evidence that ESG disclosure leads to reductions in debt and equity costs [13–15]. Credit agencies and potential shareholders include ESG scores in their risk assessment models while assigning credit ratings affirmation or making lending decisions. For example, S&P Global considers ESG factors during business, financial and management risk assessment [16], while Moody's and Fitch also include ESG performance assessments in their reports to provide transparent information to its customers, who use the reports to assess risks and make investment decisions.

Finally, the relationship between dividends and ESG indicators is questionable. According to the Financial Times, the COVID-19 recession has shown that responsibility to staff and society nowadays outweighs dividend payments. During preceding market downsides, dividend payments were protected, as companies cut capital expenditures to ensure positive free cash flow. Today, however, the emphasis is placed on the society, employees, and their welfare [26]. Hence, some companies may lower or refuse to pay dividends to implement social projects.

ESG and Tobin's Q

A significant number of papers is related to ESG and company value. Usually, the authors hypothesize that ESG disclosure and performance positively affect company value, meaning that Tobin's Q increases. Li et al. [12] provide four reasons for the positive relationship between ESG disclosure and a company's value. First, ESG disclosure provides important information about financials, which improves price informativeness. Secondly, ESG disclosure strengthens the incentives for internal control, since ESG practices force to comply with regulations. Moreover, the availability of ESG information reduces information asymmetry between the company and related parties, strengthening the relationship with shareholders. Finally, many institutional managers assess company risks and use ESG factors.

Thus, more transparent ESG information promotes better investment decisions. In addition, according to the stakeholder theory [10], ESG (especially social responsibility) concerns increase shareholders' wealth or company value, since concentrating on stakeholders' interests in some way guarantees that these stakeholders are interested in company's operations.

Many papers provided evidence that Tobin's Q increases in response to ESG. For example, Fatemi et al. [11] find that strong ESG indicators increase company value. The authors considered both ESG performance and ESG disclosure (the dummy variable that indicates whether a company discloses ESG metrics). They also found that ESG disclosure itself does not affect valuation, thus, it is important not only to disclose information, but also to succeed in being ESG-oriented. Li et al. [12], who similarly conclude that higher CEO power strengthens the influence of ESG disclosure on firm value, also support this idea. On the other hand, Wong et al. [13] doubt that disclosure influences firm value, while the score does not. Thus, the results differ between countries and different types of markets. In developed markets, investors are ready to pay attention to the scores, while in developing markets the mere fact of disclosure can be sufficient.

Bardos et al. [10] examine how CSR can affect company value. The authors find that there is an indirect relationship between CSR and company value, as CSR influences market perception, which in turn increases market value. Rjiba et al. [18] also find that corporate financial performance, measured by Tobin's Q, is positively affected by corporate social responsibility, and this connection is more pronounced during periods of high economic uncertainty.

There was also research discussing how ESG controversies affect firm value and corporate performance [19], where the authors found that negative events in the ESG sphere can significantly and negatively affect Tobin's Q.

ESG and financial performance

Investment in ESG can reduce risks associated with a company's sustainability and information asymmetry, which in turn can drive profits up [20]. A lot of studies have been dedicated to exploring the relationship between ESG or CSR concepts and financial results.

Alonso-Almeida et al. [21], who study the influence of quality management systems on hotel business, note that there is a strong and positive relationship between social responsibility and financial results for industrial companies in Mexico, measured by return on assets, return on equity, price to book ratio and earnings per share.

On the other hand, evidence from Germany [22] shows that the governance component positively and significantly affects return on assets and Tobin's Q, while environmental and social components are less significant. These results are explained by the fact that corporate governance in Germany has been reported for a long time.

Alareeni and Hamdan [23] offer complex research and investigate the influence of ESG composite score and E, S

and G components separately on financial performance, measured as ROE, ROA, and Tobin's Q. The overall results state that a composite ESG score positively affects all these metrics, while environmental and social components negatively influence ROE and ROA, which is explained by the fact that company profits may decrease due to higher ESG spending, while the positive influence on Tobin's Q is associated with a positive market perception of ESG investments. Ortas et al. [24] agree that environmental and social pillars have a significant influence on Tobin's Q, but the authors doubt that influence on ROA is positive as well. Landi and Sciarelli [25] study whether socially responsible investors can outperform the market and gain excess profits, discovering no significant impact of ESG on stock returns. Thus, there are some more controversial results, and the topic remains interesting.

Zhou et al. [26] believe that return on capital employed is also a good measure of financial performance, and the authors conclude that ESG factors have a positive influ-

ence on ROCE, implying that Chinese power generation companies should pay more attention to ESG, albeit their sample is too small.

According to Benlemlih [27], corporate social responsibility can affect dividend payments from different points of view. First, dividend policy can serve as a disciplinary mechanism and prevent a company from overinvestment (including ESG areas). Hence, higher investment in CSR should be associated with lower dividend payments. On the other hand, Samet and Jarboui [28] provide evidence that higher CSR investments do not usually reduce dividends for shareholders. Moreover, CSR investment leads to increased profits through lower risks and better shareholder relations, which ensures higher dividends [20]. However, the authors also think this question is controversial since CSR activities may reduce the cost of capital and lead to more investment rather than dividend payouts.

The key conclusions from the literature review are presented in Table 1.

Table 1. Literature review summary on ESG and investment attractiveness

	Positive impact	Negative impact	No impact
Firm value	Environmental, social, and corporate governance components positively affect Tobin's Q [23]	Negative events in ESG area can significantly and negatively affect Tobin's Q [19]	No significant influence of ESG on Tobin's Q [22]
	Positive relationship between social pillar and Tobin's Q [24; 18]		Only ESG disclosure (not score) affects valuation [13]
	Positive ESG score influence on firm value [11; 12]		Indirect relationship between CSR and firm value [10]
Financial performance	Significant and positive relationship between CSR and ROE, ROA, EPS, P/B [21]	ESG does not provide excess returns on stocks [25]	The influence of ESG on financial performance (P/B, ROE, ROA, ROI) is not significant [8]
	Corporate governance is positively associated with ROA [23]	Environmental and social components negatively affect ROA and ROE, while corporate governance negatively influences ROE [23]	
	ESG positively influences ROA, G has the most significant effect [22]		
	The impact of ESG factors on ROCE in power-generating Chinese companies is positive [26]		
	Positive relation between social and environmental pillar and ROA [24]		

	Positive impact	Negative impact	No impact
Cost of capital		Negative relationship between cost of equity and CSR [14]	ESG certification lowers cost of capital; ESG performance does not [13]
		Lower cost of debt with ESG disclosure [15]	
Dividends	Higher CSR does not usually reduce dividends [28]		No significant influence of ESG on dividend payments [30]
	CSR investment leads to profit increase and higher dividends [20]		
	Higher CSR increases dividends [27]		

Considering that the above-mentioned indicators can be closely connected with investment attractiveness and may be affected by ESG performance, we propose our first hypothesis.

H1. Better ESG performance has a positive influence on investment attractiveness indicators, measured by Tobin's Q, return on equity, cost of capital and probability of paying dividends.

ESG indicators in different industries

In this paper, we assume that the effect of ESG performance on investment attractiveness indicators may be more pronounced for the industrial companies (including industrial, energy and materials sectors) due to several reasons. First, in 2018, 985 investors from 37 countries have already declined to invest in oil companies, which left the industry with \$6.25 trillion less in assets; this number is growing by 25% annually [3]. Another example of industrial companies' incentives to improve ESG (especially en-

vironmental concerns) is the fact that the World Bank has announced that it would no longer invest in oil and gas starting in 2019 [4]. Thus, we suppose that industrial companies, being more exposed to risks associated with environmental damage, tough working conditions and further underinvestment, are expected to invest more in ESG and receive a more pronounced response from the investment community, which means better investment attractiveness.

For example, Taliento et al. [29] find that ESG is different across industries, and when ESG exceeds the industry average, it can significantly and positively influence financial performance. While studying the UN Global Compact participants' results and ESG, Ortas et al. [24] found that the positive relationship is more pronounced for companies in the energy and healthcare industries. Alonso-Almeida et al. [21] note the strong and positive relationship between social responsibility and financial results industrial companies. The summary of the key prior studies' results is presented in Table 2.

Table 2. Literature review summary on ESG and industries

	Positive impact	Negative impact	No impact
ESG in industries	ESG affects financial ratios in different industries [29]		ESG mostly affects financial ratios in industrial companies, but not significantly [31]
	Energy and healthcare sectors show higher ESG impact on performance [24]		
	Industrial companies have strong ESG influence on results [21]		

Accordingly, we postulate our second hypothesis:

H2. The impact of ESG performance on investment attractiveness is stronger for industrial companies.

To sum up, it is important to note that the knowledge base in regard to the relationship between ESG concepts and financial or market performance is developing. Most studies find a positive link between ESG disclosure and market performance, mainly measured by Tobin's Q. Moreover, ESG can positively influence ROE and ROA, as well as lower cost of capital and increase the probability of paying dividends. There was also evidence that some ESG pillars can have a greater influence in some industries. Thus, we would like to expand the existing knowledge in this sphere and consider different types of financial performance indicators: accounting (ROE), market (Tobin's Q), investment (cost of capital) and corporate governance (dividend payments), contributing to the creation of a more comprehensive picture of investment attractiveness.

Research Design

Data

As ESG topics are usually more relevant for big public companies, we are analysing the companies included in the S&P 500 index in 2010–2020. The S&P 500 index consists of 500 public companies traded on the US stock market with the largest capitalization, and includes 11 sectors: Communication services, Consumer discretionary, Con-

sumer staples, Energy, Finance, Health care, Industrials, Information technology, Materials, Real estate, and Utilities. However, we excluded the financial sector from our analysis, as the metrics used to assess the performance of financial companies are different from the metrics we have selected. Our choice of the S&P 500 index allows taking into consideration different industries and at least a 10-year period of ESG performance reporting. Moreover, this index covers approximately 80% of the US equity market capitalization, which is why the results of this study can be extrapolated to the general population. We also compare our results with the results received for the European market by performing the same analysis on the S&P 350 index of European companies with the largest capitalization. This analysis will allow us to suggest that influence of ESG scores on investment attractiveness may be different in the US and European markets. To minimize the influence of outliers on the results, we use winsorization at a 1% level. Due to the missing data, the number of S&P 500 companies was decreased to an average of 250, while S&P350 comprises an average of 177 companies. Table 3 shows the number of companies in our sample for each year, as well as their industry distribution.

The data is noticeably unbalanced, and 2020 contains the least observations, since not every company has reported its results yet. Moreover, industrial companies make up 20% of all observations, followed by health care and consumer discretionary sectors.

Table 3. Distribution of observations by year and industry

Year	S&P 500 Obs.	S&P 350 Obs.	Industry	S&P 500 Obs.	S&P 350 Obs.
2010	242	168	Communication Services	55	157
2011	255	171	Consumer Discretionary	369	227
2012	260	171	Consumer Staples	243	193
2013	250	171	Energy	180	60
2014	255	175	Health care	424	217
2015	259	175	Industrials	551	502
2016	249	180	Information Technology	196	113
2017	250	184	Materials	257	318
2018	259	187	Real estate	228	52
2019	256	187	Utilities	264	111
2020	232	181			

We retrieve financial and ESG data from the Thomson Reuters database yearly in 2010–2020.

Dependent variables

We designed different models for four dependent variables. The first measure of investment attractiveness is Tobin's Q, calculated as the market value of equity plus the book value of debt over total assets. Tobin's Q is used as a proxy for firm value in many papers [10; 12; 13; 18; 19; 32; 33]. Thus, we also use this proxy for firm value and investment attractiveness indicator.

The second variable is return on equity (ROE), defined as net income to total equity ratio, measuring company's accounting performance.

Moreover, we will also estimate the probability of paying dividends, measured by a binary variable – 1 if a company pays dividends, 0 otherwise [30]. Some authors [27] concentrate on dividend payout rather than probability. However, in this paper, we focus on the probability of payments, since this indicator is more appropriate for investors in regard to investments in different industries.

Finally, we also think that the cost of capital may be a measure of investment attractiveness. Dhaliwal et al. [14] state that there is no “best” proxy for the cost of capital, using the average of the three metrics proposed in the previous research. Wong et al. [13] used the standard WACC calculation as the cost of capital indicator while estimating the cost of equity through the CAPM model. As the calculation of the cost of capital is not the objective of this paper, we will use the weighted average cost of capital, calculated in the Thomson Reuters database.

Independent variables

As for the independent variables, we began with the main variable of interest – ESG score. Different agencies provide ESG scores using different methodologies. For example, MSCI ESG research uses 35 key indicators selected annually for each industry and weighted to combine the overall ESG rating and pillars [1]. Bloomberg, one of the main financial providers, also covers ESG data, but mostly concentrates on ESG disclosure and industry-specific scores. An independent global provider of ESG research to investors, Sustainalytics, offers ESG risk scores based on 300 indicators [34]. There are many more other agencies and ratings, but to ensure that financial and ESG data are available for the same sets of companies and to avoid measurement errors, we would like to use the Thomson Reuters ESG score. The score considers 178 ESG indicators for each company, grouped by 10 categories: resource use, emissions, innovation, management, shareholders, CSR strategy, workforce, human rights, community and product responsibility. These categories are grouped and weighted to generate the ESG score. Some of the categories have larger weights in the total score. For example, management (34 indicators) is the principal marker for governance, while workforce (29 indicators) is the most valuable in social pillar, and emissions (22 indicators) is of primary importance in the environmental category. The data is based on com-

pany reports and news with independent audits and management review. S&P500 companies have been included in this ESG score database since 2003. Moreover, we would also like to analyse the influence of separate environmental, social and governance scores (pillars) on investment attractiveness. Since Thomson Reuters also provides scores by pillars, we included them in our models. It is also important to highlight that these scores measure companies' ESG performance, rather than just disclosure. Many researchers rely on these scores while studying ESG concerns [15; 19; 30; 35]. The score scale ranges from 0 to 100, where 100 is a maximum score.

Control variables

To ensure that the results are robust, control variables are included. We use different sets of control variables for each dependent variable; a pivot table can be found in Table 4. Since the influence of ESG on investment attractiveness may have become more intense since 2015, when the Paris agreement was adopted to limit global warming through economic and social transformation and involving all the countries and companies in that process, we include a dummy variable 2015, which allows to analyse whether the ESG performance after 2015 affects investment attractiveness more than before.

Table 4. Model components

Dependent	Tobin's Q	ROE	Cost of capital	Dividend payment
Independent variables	ESG score	ESG score	ESG score	ESG score
	E (environmental score)	E (environmental score)	E (environmental score)	E (environmental score)
	S (social score)	S (social score)	S (social score)	S (social score)
	G (governance score)	G (governance score)	G (governance score)	G (governance score)
Control variables	Size = ln(total assets)	Size = ln(total assets)	Size = ln(total assets)	Size = ln(total assets)
	Leverage = total debt/total assets	Leverage = total debt/total assets	Leverage = total debt/total assets	Capex/total assets
		Asset turnover = sales/total assets	ROA	ROA
	Liquidity = current assets/current liabilities	Profit margin = net profit/sales	Interest coverage ratio = operating income/interest paid	Leverage = total debt/total assets
	Growth = ln(Sales _{t-1} /Sales _{t-2})	Life cycle = retained earnings/equity	Beta	Growth = ln(Sales _{t-1} /Sales _{t-2})
	ROA	2015 (dummy variable, 1 – after 2015, 0 – otherwise)	Dividend payout (dividends/earnings)	Market-to-book ratio
	Capex/total assets		Capex/total assets	Life cycle = retained earnings/equity
	Dividend payout (dividends/earnings)		2015 (dummy variable, 1 – after 2015, 0 – otherwise)	Liquidity = current assets/current liabilities
			Cash from operating activities/total assets	
	2015 (dummy variable, 1 – after 2015, 0 – otherwise)		2015 (dummy variable, 1 – after 2015, 0 – otherwise)	

Difference in means analysis

Before carrying out econometric modelling, we performed the statistical tests that compare the means of the variables of interest within the two groups.

First, the sample was divided into companies with above-median ESG score and companies with lower than median ESG scores. T-test for differences in means was carried out to analyse whether the differences of means in investment attractiveness factors and firm characteristics between the two groups are significant. Moreover, we carried out this analysis for each industry.

We are also interested not only in how indicators in companies with or without ESG scores are different, but also in whether ESG scores (as well as E, S and G pillars) are different across industries, for which we used a multivariate test.

Panel regression analysis

Next, regression analysis was carried out. As there are a lot of models (different investments attractiveness measures), the common model forms are as follows:

$$DepVar_{it} = \alpha_0 + \alpha_1 ESG_{it-1} + \beta Control_{it-1} + \varepsilon_{it}, \quad (1)$$

$$DepVar_{it} = \alpha_0 + \alpha_1 E_{it-1} + \alpha_2 S_{it-1} + \alpha_3 G_{it-1} + \beta Control_{it-1} + \varepsilon_{it}, \quad (2)$$

$$DepVar_{it} = \alpha_0 + \alpha_1 ESG_{it-1} + \alpha_2 ESG_{it-1} * industrial + \beta Control_{it-1} + \varepsilon_{it}, \quad (3)$$

where DepVar are Tobin's Q, ROE, cost of capital, probability of paying dividends. ESG – ESG score for the overall model. E, S and G in equation 2 are the separate ESG pillars. Control variables are size, leverage, liquidity, capex, and others presented in Appendix 1, as well as time effects, and ε_{it} – error term. 'Industrial' in the third model is a dummy variable that equals 1 if a company is from the energy, industrial or materials industries, 0 – otherwise.

It is important to note that dividend payout probability is estimated by the logistic regression that models a binary dependent variable by using a logistic function.

To mitigate potential endogeneity problems caused by the simultaneity of dependent and independent variables, independent variables (ESG and control variables) are taken as lag values. There is also a logical reason for using lag values from the financial point of view: assets, equity and capex of the current year are unlikely to have any influence on the results of this year – these numbers will have more influence on the following year's results. In addition, investors first review ESG scores and sustainability reports and only make their investment decisions later on. Moreover, it also makes sense for new investors who examine previous reports and data before investing.

Pooled OLS, fixed effects and random effects models are applied. According to previous research, the fixed effect model was the most popular in estimating the relationship between financial data and ESG scores [12; 13; 15]. The best specification for each model is determined by using Breusch-Pagan and Hausman tests. A cluster-robust variance estimator allows to capture the potential problem

of heteroscedasticity, while a correlation matrix allows to avoid multicollinearity. We use RESET-tests for panel data to ensure that there is no endogeneity caused by omitted variable bias. Our research design in the panel regression analysis differs from other research in its attempt to find a cross-effect relationship to confirm the second hypothesis about industrial companies (model 3).

Propensity score matching modelling

Come to think about ESG as a policy that companies incorporate in their strategies and operations nowadays, it is also interesting to estimate the treatment effect of the ESG score. Thus, we are interested in whether the investment attractiveness of companies with above-median ESG score (treatment group) is different from the companies with below-median ESG scores (control group). It might seem that this question has been already put forward while performing the difference in means analysis. However, there are some factors that can affect receiving an ESG score – for example, larger companies may have ESG scores just because they are large and well-known, which leads to selection bias.

As the problem of selection bias may appear, it can be useful to implement propensity score matching that assigns the sample to control and treatment groups regardless of their characteristics. A propensity score is a probability that a company with certain characteristics will be assigned to the group where the companies have above-median ESG scores (as opposed to the control group). The selection bias is eliminated by balancing covariates (the characteristics of participants) between treatment and control groups [36]. The advantage of this approach is that this is a non-parametric method, which does not require to develop functional dependencies.

There are six steps in propensity score matching. First, following Shipman et al. [37] and Rjiba et al. [18], we assigned scores to treatment and control groups. Since there are quite a few companies with a zero ESG score, we assume that observations with an ESG score lower than the sample median are assigned to the control group, while those with an ESG score higher than the sample median – to the treatment group. Secondly, covariates should be selected (the variables that can be included in the logit model to predict the probability of receiving a treatment effect). In this paper, covariates are selected specifically for each model and explained in the control variables' description. Afterwards, propensity scores (probabilities of treatment) are calculated. Despite the existence of various methods, we implemented logistic regression due to its widespread use. Hence, in the second step, we calculated the probability that a firm will have above-median ESG scores based on its characteristics.

After propensity scores are calculated, the control and treatment groups are matched based on similar characteristics. There are several ways to match the groups: nearest neighbor, exact matching, optimal matching, and some others. Exact matching requires certain categorical data such as age or gender, which is why it is not best-suited for

our study, since exact financial indicators rarely exist. Following prior research, we use the nearest neighbor method for matching within a caliper distance of 0.001, since it searches for the closest nearest value rather than for an exact match [18]. After creating the matches, a quality assessment is provided to ensure that participants and non-participants are balanced. Finally, the treatment effect can be evaluated by calculating the differences between treatment and control groups. Our propensity score model does not differ from the models in the previous research, but it should be noted that very few papers implement treatment effects to evaluate the influence of the ESG scores, therefore our paper differs from others in the research design.

Results

Descriptive analysis

We begin our analysis with summary statistics (Table 5). It is apparent that the companies in this sample are typically overvalued since their Tobin's Qs are more than 1. Moreover, the companies show relatively high returns on equity,

while cost of capital is moderate and the majority of companies pay dividends.

As for the ESG indicators, none of the companies have the highest 100-degree score. The average score in US companies is around 55, which equals a B- on the scale from A+ to D-. Thus, this score is in the middle and we cannot claim that S&P500 companies on average show excellent ESG performance. Governance shows the highest average pillar score, which may imply that the idea of governance improvement was popular a long time ago, and by now, companies are demonstrating above-average governance practices. The poorest-scoring average pillar is environmental, meaning that on average companies have a below-median environmental score that requires improvement.

On the other hand, the European S&P 350 companies on average show better ESG performance at around 68, which equals a B+. This result is mainly achieved by a stronger social pillar, followed by environmental. Unlike S&P 500 companies, S&P 350 companies show the lowest score in the governance pillar, which can be explained by the fact that the USA and Europe have different governance models.

Table 5. Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Dependent variables					
<i>S&P 500</i>					
Tobin's Q	2,767	3.47	3.74	0.52	23.74
ROE	2,767	24.15	24.00	2.48	162.89
Cost of capital	2,767	6.39	3.49	2.35	23.01
Dividends	2,767	0.91	0.29	0.00	1.00
<i>S&P 350</i>					
Tobin's Q	2,108	3.43	4.79	0.42	31.12
ROE	2,108	19.94	14.20	2.23	82.27
Cost of capital	2,108	7.06	2.97	1.22	18.32
Dividends	2,108	0.94	0.24	0	1
Explanatory variables					
<i>S&P 500</i>					
ESG score	2,767	54.09	21.36	0.00	88.38
E pillar	2,767	48.92	28.27	0.00	91.97
S pillar	2,767	55.61	23.59	0.00	94.92
G pillar	2,767	56.69	23.65	0.00	93.87
<i>S&P 350</i>					

Variable	Obs	Mean	Std. Dev.	Min	Max
ESG score	2,084	67.96	15.54	22.24	92.77
E pillar	2,084	67.70	20.78	6.42	96.79
S pillar	2,084	71.18	18.41	18.50	96.52
G pillar	2,084	62.62	20.41	11.24	95.48
Control variables					
S&P 350					
Size	2,108	23.47	1.32	18.50	27.13
Leverage	2,108	0.25	0.13	0.01	0.58
ROA	2,023	7.40	5.20	0.78	32.00
Liquidity	2,108	1.39	0.61	0.42	3.73
Capex	2,078	0.04	0.03	0.00	0.15
Growth	1,867	0.03	0.17	-1.57	2.28
Dividend payout	2,108	61.75	220.09	-1754	4350
Profit margin	2,096	11.59	15.89	0.33	127.42
Asset turnover	2,051	0.80	0.45	0.05	2.46
Interest coverage	2,108	30.45	84.14	0.44	631.30
Beta	2,108	0.97	0.44	0.06	2.14
Market-to-book	2,108	7.86	10.27	0.47	57.43
Cash from OA	2,107	0.10	0.06	0.01	0.34
Life cycle	2,079	0.79	0.32	0.04	1.74
2015	2,108	0.44	0.50	0	1
S&P 500					
Size	2,767	23.50	1.18	19.39	27.38
Leverage	2,767	0.29	0.15	0.00	0.67
ROA	2,767	7.14	3.57	2.57	13.42
Liquidity	2,767	1.42	0.90	0.00	4.41
Capex	2,767	0.04	0.03	0.00	0.17
Growth	2,767	0.14	0.34	-2.17	2.49
Dividend payout	2,767	38.82	59.10	-104.85	341.02
Profit margin	2,767	10.85	9.60	-8.87	50.98
Asset turnover	2,767	0.80	0.68	0.00	3.56
Interest coverage	2,767	16.61	38.95	-2.07	302.50

Variable	Obs	Mean	Std. Dev.	Min	Max
Beta	2,767	0.62	0.42	0.00	1.84
Market-to-book	2,767	10.37	14.13	0.49	90.91
Cash from OA	2,767	0.10	0.05	-0.02	0.27
Life cycle	2,767	1.02	1.32	0.20	8.44
2015	2,767	0.45	0.98	0.00	1.00

Difference in means analysis

First, we divided our sample into the group with above-median ESG, E, S and G scores, and the group with below-median scores. By doing so, we suggest that companies with above-median ESG (and E, S, G pillars) have significantly better investment attractiveness indicators.

After the sample was divided into the companies with above-median ESG scores and the companies with below-median scores, we examined the differences between the means of the dependent and control variables (Table 6 and Table 7). First, Tobin's Q of the companies with higher ESG scores is significantly smaller for both American and European companies, meaning that these companies are relatively undervalued and potentially reflecting the future growth potential of undervalued companies, which is good for investors. This result is robust for every pillar. As for the return on equity, there is also strong evidence that firms with above-median ESG and pillar scores reveal higher returns on equity, which is a

measure of higher efficiency. There is also a significant difference in the cost of capital, and companies with higher ESG scores have lower costs of capital, which is in line with our assumptions and reveals lower risks. As for the dividends, there is a significant difference in probability of payment, and companies with higher ESG scores are more likely to pay dividends.

It can be also claimed that companies with better ESG performance have greater assets and are more leveraged. Moreover, they report higher capital expenditures, have sufficient retained earnings and a lower market-to-book ratio - a sign of undervaluation. American companies with above-median ESG scores also exhibit higher return on assets, asset turnover, and more cash from operating activities and interest coverage ratio, while European companies demonstrate the opposite dynamics. On the other hand, these companies are riskier as they have higher betas. There is no significant difference in the means of growth, dividend payout or profit margin.

Table 6. Difference in means analysis for S&P 500 companies

	<i>ESG score</i>	<i>E score</i>	<i>S score</i>	<i>G score</i>
	<i>Above median</i>	<i>Above median</i>	<i>Above median</i>	<i>Above median</i>
Tobin's Q	<***	<***	<***	<***
ROE	>***	>***	>***	>***
Cost of capital	<***	<***	<***	<***
Dividends	>***	>***	>***	>***
Size	>***	>***	>***	>***
Leverage	>***	>***	>*	>***
ROA	>***	>*	>***	<***
Liquidity	<***	<***	<***	<***
Capex	>***	>***	>***	>***
Growth	-	-	<**	<**
Dividend payout	-	-	-	-
Profit margin	-	-	>*	-

	<i>ESG score</i>	<i>E score</i>	<i>S score</i>	<i>G score</i>
	<i>Above median</i>	<i>Above median</i>	<i>Above median</i>	<i>Above median</i>
Asset turnover	>***	>*	>**	–
Interest coverage	>*	–	>***	–
Beta	>**	–	>**	>***
Market-to-book	<***	<***	<***	<***
Cash from OA	>**	>***	>***	–
Life cycle	>***	>***	>***	>***

The table presents the results of the difference in means analysis. > denotes the fact that the indicator is higher for companies with above-median ESG performance. < denotes the fact that the indicator is lower for companies with above-median ESG performance. * denotes $p < 0.10$; ** denotes $p < 0.05$; and *** denotes $p < 0.01$.

Table 7. Difference in means analysis for S&P 350 European companies

	<i>ESG score</i>	<i>E score</i>	<i>S score</i>	<i>G score</i>
	<i>Above median</i>	<i>Above median</i>	<i>Above median</i>	<i>Above median</i>
Tobin's Q	<***	<***	<***	<***
ROE	<***	<***	–	<***
Cost of capital	<***	<***	<**	<**
Dividends	>***	>***	>***	–
Size	>***	>***	>***	>***
Leverage	>***	>***	–	>***
ROA	<***	<***	–	<***
Liquidity	<***	<*	–	–
Capex	>***	>***	>***	>**
Growth	<***	<***	<***	<**
Dividend payout	>***	>***	>**	>***
Profit margin	<***	<***	–	<**
Asset turnover	<**	–	–	<**
Interest coverage	<***	<***	–	<***
Beta	>***	>**	–	>**
Market-to-book	<***	<***	<***	<***
Cash from OA	<***	<***	–	<**
Life cycle	>**	–	>***	>***

The table presents the results of the difference in means analysis. > denotes the fact that the indicator is higher for companies with above-median ESG performance. < denotes the fact that the indicator is lower for companies with above-median ESG performance. * denotes $p < 0.10$; ** denotes $p < 0.05$; and *** denotes $p < 0.01$.

Since firm characteristics and control variables are not the main variables of interest, we shortened our industry-based analysis and examined whether there are differences in investment attractiveness indicators across industries between companies with high and low ESG scores (Table 7).

As for industry-based analysis, it is important that Tobin's Q in companies with higher ESG scores is significantly lower in all industries, except for health care, industrials, and utilities, meaning that these three industries are often overvalued, while others are undervalued. It might be the case because overvaluation may reflect the fact that investors overreact to higher ESG scores in these industries, pushing share prices up. Significantly higher return on equity is attributable to communication services, consumer discretionary, consumer staples, energy,

IT, and materials industries, while the difference in ROE of the industrial, health care and real estate companies is not sufficient. It is statistically significant that the cost of capital in the communication and consumer services, as well as in health care, real estate and utilities industries is lower when the ESG score is higher. However, companies with higher ESG scores show higher cost of capital in IT industry. The difference across other industries is not significant, thus, higher ESG transparency does not mean lower cost of capital for them. Finally, better ESG performance increases the probability of paying dividends in communication services, consumer, energy, industrials, and real estate industries. In other industries, companies with different ESG scores pay dividends with the same probability.

Table 8. Difference in means analysis. Industry breakdown for S&P 500 companies

	<i>ESG score</i>	<i>E score</i>	<i>S score</i>	<i>G score</i>
	<i>Above median</i>	<i>Above median</i>	<i>Above median</i>	<i>Above median</i>
<i>Communication Services</i>				
Tobin's Q	<***	<***	<***	<***
ROE	>***	>**	>***	>***
Cost of capital	<**	<**	<**	–
Dividends	>***	>***	>***	>***
<i>Consumer Discretionary</i>				
Tobin's Q	<***	<***	<***	<***
ROE	>***	>***	–	>***
Cost of capital	<**	<**	<**	<**
Dividends	>***	>***	>***	>***
<i>Consumer Staples</i>				
Tobin's Q	<***	<***	<***	<***
ROE	>***	–	>**	>***
Cost of capital	–	–	–	–
Dividends	>***	>**	>***	>***
<i>Health care</i>				
Tobin's Q	>***	>**	>**	>*
ROE	–	<**	–	–
Cost of capital	<*	–	<*	<*
Dividends	–	–	–	–

	<i>ESG score</i>	<i>E score</i>	<i>S score</i>	<i>G score</i>
	<i>Above median</i>	<i>Above median</i>	<i>Above median</i>	<i>Above median</i>
<i>Energy</i>				
Tobin's Q	<**	<**	<***	<*
ROE	>***	>***	>***	>***
Cost of capital	-	-	-	-
Dividends	>***	>***	>***	>***
<i>Industrials</i>				
Tobin's Q	>***	>***	>***	-
ROE	-	-	<**	-
Cost of capital	-	-	-	-
Dividends	>**	>*	>**	>**
<i>Information Technology</i>				
Tobin's Q	<***	<***	<***	<**
ROE	>***	>***	>***	-
Cost of capital	>***	>**	>***	-
Dividends	-	-	<*	-
<i>Materials</i>				
Tobin's Q	<***	-	<***	<***
ROE	>***	>***	>***	>*
Cost of capital	-	<***	<**	-
Dividends	-	-	-	-
<i>Real estate</i>				
Tobin's Q	<***	<***	<***	-
ROE	-	-	-	-
Cost of capital	<*	<**	<*	-
Dividends	>*	>**	>*	>**
<i>Utilities</i>				
Tobin's Q	>***	>***	>***	<**
ROE	<**	<**	<***	-
Cost of capital	<**	<**	<***	-
Dividends	-	-	-	-

The table presents the results of the difference in means analysis. > denotes the fact that the indicator is higher for companies with above-median ESG performance. < denotes the fact that the indicator is lower for companies with above-median ESG performance. * denotes $p < 0.10$; ** denotes $p < 0.05$; and *** denotes $p < 0.01$.

European companies demonstrate a negative relationship between ESG performance and Tobin's Q for all industries except real estate, while ROE is lower for almost every industry except for health care. Effect on cost of capital

is controversial in different industries, but mostly lower with better ESG performance. Only in consumer staples and health care can higher ESG scores lead to dividend payouts.

Table 9. Difference in means analysis. Industry breakdown for S&P 350 companies

	ESG score Above median	E score Above median	S score Above median	G score Above median
Communication Services				
Tobin's Q	<***	<***	<***	<***
ROE	<***	<***	<***	<**
Cost of capital	<***	<***	<***	<*
Dividends	-	>**	-	-
Consumer Discretionary				
Tobin's Q	<***	<***	<***	<***
ROE	<***	<***	<**	<*
Cost of capital	<***	<***	<***	-
Dividends	-	-	>**	<**
Consumer Staples				
Tobin's Q	<***	<*	<***	-
ROE	>***	>***	-	>***
Cost of capital	>**	>***	-	-
Dividends	>***	>***	>**	-
Health care				
Tobin's Q	<***	<***	-	<***
ROE	>**	>***	>***	-
Cost of capital	-	>***	>***	-
Dividends	>***	>***	>***	-
Energy				
Tobin's Q	<**	-	<***	<***
ROE	-	-	-	-
Cost of capital	>*	<**	<**	>**
Dividends	-	-	-	-
Industrials				
Tobin's Q	<**	<**	<**	<***
ROE	-	-	>**	<*

	ESG score	E score	S score	G score
	Above median	Above median	Above median	Above median
Cost of capital	–	–	–	–
Dividends	–	–	>***	–
Information Technology				
Tobin's Q	<***	<***	<*	<*
ROE	–	<***	–	–
Cost of capital	–	–	–	–
Dividends	–	–	>*	<*
Materials				
Tobin's Q	<***	<*	<***	<***
ROE	<***	–	<***	<***
Cost of capital	<***	<*	<*	<***
Dividends	–	<***	<*	–
Real estate				
Tobin's Q	>***	>***	–	–
ROE	<***	<***	<***	<***
Cost of capital	<***	<*	–	–
Dividends	–	–	–	–
Utilities				
Tobin's Q	<***	<***	–	–
ROE	<***	<***	–	>*
Cost of capital	–	<***	<***	>***
Dividends	–	–	–	–

Panel regression analysis

While building panel regressions, we chose between pooled OLS, fixed effects and random effects models' specifications. Breusch-Pagan Lagrange multiplier test allowed us to conclude that the difference across units is significant, and the panel effect is present. After that, we ran a Hausman test and concluded that random effects models are not consistent in our case, which is why we implemented fixed effects models. To ensure that our models do not suffer from omitted variable bias, we used a RESET-test for panel data, which confirmed that our models are specified. Finally, we noted the fact that all models show joint significance, measured by F statistics.

Table 10 demonstrates fixed effects regression results on the S&P 500 companies' sample, exploring the relationship between ESG scores and investment attractiveness measured by Tobin's Q, ROE, cost of capital and dividend payment probability for the American market. We hypoth-

esized that higher ESG scores will lead to higher Tobin's Q, ROE, and dividend payout probability, while the cost of capital should be reduced. We revealed that only after 2015 better ESG performance positively affects Tobin's Q and dividend payment probability, which is supported by [11; 12; 18;23;24]. However, we discovered that ESG scores do not significantly affect ROE and cost of capital, which is in line with [13; 29;30]. Such a result may be explained by the fact that ESG scores send good investment signals to markets, increasing Tobin's Q and dividend payout probability because of sustainable governance practices. However, better ESG performance might not affect internal efficiency indicators and cost of capital, since credit agencies are not prone to immediately and significantly change their outlooks in response to a better ESG performance. Moreover, according to some research, sometimes the absence of ESG disclosure can affect metrics such as cost of capital, but ESG disclosure itself can lower the cost of capital [13].

Table 10. Fixed effect regression. ESG score influence on investments attractiveness for S&P 500 companies

	Tobin's Q	ROE	Cost of capital	Dividend payment
ESG score*2015	0.054*	-0.081	0.011	0.600***
Std. dev	0.031	0.060	0.073	0.225
ESG score	-0.019	-0.039	0.041	0.235
Std. dev	0.025	0.042	0.073	0.772
Size	-0.655***	-0.134**	-0.108	7.220***
Std. dev	0.032	0.067	0.073	2.182
Leverage	0.027*	0.086***	-0.148**	1.656**
Std. dev	0.016	0.033	0.069	0.655
Liquidity	-0.022			2.747**
Std. dev	0.025			1.374
ROA	-0.038**		0.184**	4.032***
Std. dev	0.018		0.090	1.426
Growth	-0.003			-1.658**
Std. dev	0.018			0.838
Div. payments	-0.001		-0.012	
Std. dev	0.003		0.010	
Capex	-0.009		0.002	-4.493***
Std. dev	0.017		0.024	1.504
Profit margin		0.073***		
Std. dev		0.025		
Asset turnover		0.411***		
Std. dev		0.081		
Life cycle		0.117***		0.908
Std. dev		0.03		1.421
Interest coverage			-0.212***	
Std. Dev			0.066	
Beta			0.327***	
Std. dev			0.038	
Market to book				-2.616*
Std. dev				1.367
CFO				-2.284**

	Tobin's Q	ROE	Cost of capital	Dividend payment
Std. dev				1.042
Constant	16.429***	6.109***	4.189**	
Std. dev	0.739	1.5559	1.861	
Year effect	Yes	Yes	Yes	No
N	1635	2160	1672	
F	81.26	12.70	34.46	
R (within)	0.73	0.18	0.49	

The table presents the results of the fixed effects regression analysis. * denotes $p < 0.10$; ** denotes $p < 0.05$; and *** denotes $p < 0.01$.

As for European companies (Table 11), there is evidence that better ESG performance overall and specifically after 2015 also has a positive influence on Tobin's Q, albeit the effect on other indicators is not significant. The weak effect of ESG performance on investment attractiveness indicators for the European market may be explained by the fact

that the European companies' ESG results on average outperform the American companies' scores, which may mean that the investment community in Europe positively reacts to ESG performance in terms of valuation, but this performance does not guarantee that European companies will pay dividends, exhibit higher ROE or lower cost of capital.

Table 11. Fixed effect regression. ESG score influence on investments attractiveness for S&P 350 companies

	Tobin's Q	ROE	Cost of capital	Dividend payment
ESG score*2015	0.045*	-0.083	-0.018	-0.087
Std. dev	0.023	0.102	0.070	0.100
ESG score	0.059***	0.019	0.098	0.668
Std. dev	-0.021	0.099	0.061	1.440
Size	-0.804***	0.035	0.015	1.662
Std. dev	0.028	0.082	0.055	1.808
Leverage	0.035***	0.093***	-0.057**	-0.668
Std. dev	0.010	0.028	0.026	0.546
Liquidity	0.013			-1.505
Std. dev	0.012			1.137
ROA	-0.017***		0.462***	2.286***
Std. dev	0.006		0.042	0.528
Growth	-0.011			0.437
Std. dev	0.012			1.287
Div. payments	0.006		-0.022	
Std. dev	0.004		0.019	
Capex	-0.015**		-0.003	-0.073

	Tobin's Q	ROE	Cost of capital	Dividend payment
Std. dev	0.007		0.022	0.435
Profit margin		0.215***		
Std. dev		0.025		
Asset turnover		0.894***		
Std. dev		0.095		
Life cycle		0.03		1.085**
Std. dev		0.039		0.517
Interest coverage			-0.039	
Std. dev			0.024	
Beta			0	
Std. dev				
Market to book				2.627*
Std. dev				1.459
CFO				-0.004
Std. dev				0.464
Constant	19.624***	1.907	0.776	
Std. dev	0.678	1.909	1.323	
Year effect	Yes	Yes	Yes	No
N	1614	2048	1729	
F	177.42	14.76	13.04	
R (within)	0.91	0.28	0.27	

The table presents the results of the fixed effects regression analysis. * denotes $p < 0.10$; ** denotes $p < 0.05$; and *** denotes $p < 0.01$.

According to regression results presented in Table 12, we are unable to confirm the second hypothesis that ESG scores' influence on investment attractiveness is more pronounced for industrial, materials and energy US compa-

nies either overall or after 2015. This implies that industrial, materials and energy companies in the S&P500 index do not demonstrate greater investment attractiveness indicators because of their ESG scores.

Table 12. Fixed effect regression. Influence of ESG scores in industrial S&P 500 companies

	Tobin's Q	ROE	Cost of capital	Dividend payment
Esg*industrial*2015	0.007	-0.014	-0.091	3.394
Std. dev	0.005	0.014	-0.108	2.839
Esg*industrial	0.024	-0.045	-0.091	-1.353
Std. dev	-0.048	-0.084	-0.108	-1.954
ESG score*2015	0.056	-0.081	0.066	0.512**

	Tobin's Q	ROE	Cost of capital	Dividend payment
Std. dev	0.031	0.061	-0.083	0.237
Year effect	Yes	Yes	Yes	No
N	1635	2160	1672	
F	80.75	11.91	34.11	
R (within)	0.73	0.18	0.50	

The table presents the results of the fixed effects regression analysis. * denotes $p < 0.10$; ** denotes $p < 0.05$; and *** denotes $p < 0.01$.

Unlike the US market, there is evidence for European companies that ESG performance in industrial companies decreases Tobin's Q, which may be a sign of a fairer valuation of industrial companies due to higher transparency. Following 2015, cost of capital of indus-

trial companies was slightly reduced in response to an increase in ESG scores. Probability of paying dividends decreased as well, which may imply that industrial companies prefer to invest in ESG issues rather than pay dividends.

Table 13. Fixed effect regression. Influence of ESG scores in industrial S&P 350 companies

	Tobin's Q	ROE	Cost of capital	Dividend payment
Esg*industrial*2015	0.002	-0.01	-0.014**	-0.424**
Std. dev	0.003	0.013	-0.006	0.208
Esg*industrial	-0.077***	-0.045	-0.091	-1.353
Std. dev	0.027	-0.084	-0.108	-1.954
ESG score*2015	0.048*	-0.096	-0.003	0.064
Std. dev	0.024	0.105	0.067	0.123
Year effect	Yes	Yes	Yes	No
N	1614	2048	1729	
F	171.0003	14.00123	12.96319	
R (within)	0.91	0.28	0.27	

The table presents the results of the fixed effects regression analysis. * denotes $p < 0.10$; ** denotes $p < 0.05$; and *** denotes $p < 0.01$.

Despite the fact that the overall ESG score does not improve investment attractiveness indicators in energy, materials, and industrial companies, it can benefit the separate pillars. For example, an increase in environmental score is expected to send a positive sign to investors in ecologically unfriendly industries. The same logic can be applied to the social pillar because industrial companies usually offer less safe labour conditions than other industries. An extended analysis with a cross effect for the S&P 500 companies

shows that better performance in environment and social pillars generally decreases Tobin's Q and ROE. Meanwhile, only a negative relationship between ROE and environmental pillar was discovered for industrial companies, which may mean that higher spending on environmental projects reduces profits and ROE. For other indicators we found that the relationship between ESG scores and performance indicators in industrial, energy and materials companies is the same as in other sectors (Table 14).

Table 14. Fixed effect regression. Influence of ESG pillars in industrial S&P 500 companies

	Tobin's Q	ROE	Cost of capital	Dividend payment
E*industrial*2015	-0.036	-0.146*	0.076	-2.422
Std. dev	0.050	0.083	0.094	15.713
S*industrial*2015	0.110	0.131	0.036	15.846
Std. dev	0.070	0.129	0.159	-17.336
G*industrial*2015	-0.071	-0.007	-0.084	-10.239
Std. dev	0.048	0.107	0.131	-12.427
E score*2015	-0.040**	-0.093*	-0.001	14.173
Std. dev	0.017	0.055	0.076	15.366
S score*2015	-0.095***	-0.186*	0.014	-1.434
Std. dev	0.033	0.101	0.161	18.564
G score*2015	0.016	-0.048	0.051	7.489
Std. dev	0.025	0.082	0.080	9.778
Year effect	Yes	Yes	Yes	No
N	1552	2025	1575	
F	61.03	8.09	31.50	
R (within)	0.72	0.18	0.51	

The table presents the results of the fixed effects regression analysis. * denotes $p < 0.10$; ** denotes $p < 0.05$; and *** denotes $p < 0.01$.

The same analysis for the European S&P 350 companies indicates that the relationship between ESG scores and performance indicators in industrial, energy and materials companies is the same as in other sectors.

Table 15. Fixed effect regression. Influence of ESG pillars in industrial S&P 350 companies

	Tobin's Q	ROE	Cost of capital	Dividend payment
E*industrial*2015	0.001	0.135	0.023	0.729
Std. dev	0.026	0.161	0.095	2.880
S*industrial*2015	-0.011	-0.076	-0.053	-1.010
Std. dev	0.030	0.156	0.113	4.136
G*industrial*2015	0.010	-0.068	0.046	-0.169
Std. dev	0.019	0.093	0.067	3.424
E score*2015	0.025	-0.154	0.001	-1.543
Std. dev	0.019	0.099	0.067	2.493
S score*2015	-0.029	0.061	-0.031	0.663
Std. dev	0.029	0.127	0.100	4.044

	Tobin's Q	ROE	Cost of capital	Dividend payment
G score*2015	0.027**	0.028	0.005	1.691
Std. dev	0.013	0.066	0.054	2.394
Year effect	Yes	Yes	Yes	No
N	1614	2048	1729	
F	142.30	11.82	11.17	
R (within)	0.91	0.29	0.28	

The table presents the results of the fixed effects regression analysis. * denotes $p < 0.10$; ** denotes $p < 0.05$; and *** denotes $p < 0.01$.

Propensity score matching

The authors fail to find significant relationships between ESG scores and Tobin's Q, ROE, cost of capital and probability of paying dividends. However, there may be a potential causality effect, according to which different firm characteristics such as size, capital structure, expenditures and others may affect the ESG score (the fact that some companies have ESG scores and others do not). Since our dataset does not contain companies without ESG scores,

we divided the sample into companies with above-median ESG scores (treatment group) and below-median ESG scores (control group). We used the propensity score matching modelling to find out whether ESG scores influence investment attractiveness regardless of company characteristics. In other words, we sought to find out how much investment attractiveness factors change in companies whose ESG score increases from below-median to above-median.

Table 16. Propensity score matching estimation for S&P 500

	Tobin's Q	ROE	Cost of capital	Dividend payment
ESG score	-0.427***	2.382	-0.654**	0.046***
Std. dev	0.164	1.967	0.321	0.014
E pillar	0.142	0.748	-0.372	0.049***
Std. dev	0.222	1.21	0.302	0.017
S pillar	-0.346**	1.029	-0.804**	0.014
Std. dev	0.142	2.114	0.321	0.013
G pillar	-0.205*	-0.264	-0.442**	0.017
Std. dev	0.114	1.245	0.181	0.014

The table presents the results of propensity score matching analysis. * denotes $p < 0.10$; ** denotes $p < 0.05$; and *** denotes $p < 0.01$.

Propensity score matching estimation shows the results regardless of company characteristics that may affect ESG scores and dependent variables, thereby causing endogeneity. According to Table 16, if an American company was to increase its ESG score to the above-median level from a below-median level, its Tobin's Q will decrease by 0.43 on average, and this result is significant. Increasing the environmental pillar would not significantly decrease Tobin's Q, while working on social and governance aspects can be useful. This result complies with the difference in means analysis, which states that companies with higher ESG

scores on average show lower Tobin's Q. Moreover, ESG improvement according to the PSM model leads up to a 0.65 decrease in cost of capital. Higher contribution of the social and governance pillars supports the idea that the cost of capital decreases because debtholders and shareholders are better protected by the strong governance system, and discontinuity and sustainability of operations is supported by the fact that a company cares about its employees and society. Higher ESG scores can also improve dividend payment probability due to improvement in the environmental section, but do not significantly influence return on equity.

Table 17. Propensity score matching estimation for S&P 350

	Tobin's Q	ROE	Cost of capital	Dividend payment
ESG score	-0.719***	1.52	-0.360**	0.003
Sstd. dev	0.238	0.934	-0.162	0.011
E pillar	-0.292	0.812	-0.018	0.037
Std. dev	0.265	1.159	0.161	0.017
S pillar	0.056	4.136***	-0.100	0.021
Std. dev	0.269	0.737	0.186	0.012
G pillar	-0.275	-0.081	0.157	-0.004
Std. dev	0.191	0.862	0.162	0.012

The table presents the results of propensity score matching analysis. * denotes $p < 0.10$; ** denotes $p < 0.05$; and *** denotes $p < 0.01$.

The results retrieved for European companies are similar with the results for American companies. Transition to the above-median ESG score group will also reduce Tobin's Q and cost of capital. However, there is no evidence that transition to the higher ESG score group will affect dividend payout probability or that better performance in separate pillars will significantly affect investment attractiveness. Considering that European companies on average show better median ESG performance, a transition to a higher level will not lead to a change in investment attractiveness, while American companies comparatively underperform, and investors may positively react to transition even to median levels.

Discussion and Conclusions

In this paper, we sought to find an answer to the question of whether ESG scores affect the investment attractiveness of public companies, measured by Tobin's Q, cost of capital, return on equity and dividend payout probability. Another relevant question was whether this influence was more pronounced for industrial, energy and materials companies included in S&P 500 index and S&P 350 Europe index between 2010 and 2020. These questions have arisen due to the growing importance of ESG issues, followed by higher pressure from the investment community on the companies that now need to incorporate ESG performance indicators into their long-run strategies to ensure future sustainability.

Two main hypotheses were put forward in this research. The first one states that companies with better ESG performance tend to have higher investment attractiveness indicators, expressed by higher Tobin's Q (thus, being more valued), higher return on equity (being more profitable) and a higher probability of paying dividends (thus, ensuring stable returns to shareholders). On the other hand, higher ESG scores should lower the cost of capital due to information asymmetry reduction and lowered risks. The

provided difference in means analysis has shown that companies with above-median ESG scores have significantly lower Tobin's Q and cost of debt, and probability of paying dividends is significantly higher for both American and European companies. However, S&P 350 Europe companies have lower return on equity in response to better ESG performance, while S&P 500 US companies show higher profitability. These results were also robust for the industry-based analysis.

Panel regression analysis did not reveal any significant influence of the ESG score or its pillars on the investment attractiveness indicators, however, under the assumption that the result might be influenced by the Paris agreement, which was signed in 2015, we found that after 2015 investors became more responsive to changes in ESG scores. Thus, for US companies we can confirm that ESG performance positively affects Tobin's Q and probability of paying dividends after 2015, while for European companies there is also evidence that higher ESG scores lead to a higher Tobin's Q. Thus, these results partly allow us to confirm our first hypotheses. The results support the opinion that ESG performance may be more influential in the long-term, rather than in the present [9].

The Chow test was carried out to test the stability of the regression model parameters, the presence of structural shifts in the sample. This made it possible to test sample heterogeneity in the context of the regression model.

According to the results of the Chow test, after 2015 there was a structural shift, that is, the fundamental characteristics of the system in question have changed over time. According to the test results, the signing of the 2015 Paris Agreement on climate change significantly affected the state of the market. A more than 10-fold excess of the critical value was found, which confirms the hypothesis of the presence of a structural shift. According to the decision made, the reduction of greenhouse gas emissions was supposed to lead to energy security and technological

development. We can assume that this was a new reality in global energy and the creation of environmental security, which was mandatory for all participants planning future development. Thus, it is possible to find a connection between updating sustainability and increasing ESG ratings and political/legislative decisions related to environmental protection.

To mitigate the causality effect, we perform propensity score matching estimation that assesses the influence of ESG scores on investment attractiveness indicators regardless of company characteristics. For US companies, we conclude that transition from a below-median ESG score to the above-median ESG score on average decreases Tobin's Q and leads to a fairer valuation, also decreasing the cost of capital and increasing the probability of paying dividends. On the other hand, for European companies, we also found that Tobin's Q on average decreases after the transition to the above-median score groups, along with cost of capital. Other indicators may not react to higher ESG scores because S&P 350 Europe companies initially had higher average ESG scores than S&P 500 US companies.

Our results regarding Tobin's Q are in line with those of the authors who found that ESG performance increases Tobin's Q [1; 10; 12; 18; 23; 24]. However, we found that a transition to the group with above-median ESG scores decreases Tobin's Q. We explain our results by the fact that the companies in our sample are typically overvalued, and better ESG performance may increase transparency, due to which valuation of companies becomes more justified.

The influence of ESG performance on return on equity is not significant, which may provide evidence that investments in ESG may be paid back over a longer period than one year. Thus, we imply that in the short run ESG performance cannot drive profits up and significantly increase ROE, which is in line with [23].

Like [13], we believe that the cost of capital is not affected by ESG performance, which implies that ESG scores are already incorporated in the cost of capital, and a slight improvement year on year does not change the cost of capital in the following year.

Finally, the authors found a positive relationship between ESG scores and dividend payouts [20; 27; 28], which is in line with our findings regarding the US market, but we can state that in regard to the European market, we are in line with the opinion of Matos et al. [30], who found that the ESG score has no influence on the dividend dummy variable. The conclusion that the probability of paying dividends does not increase in response to better ESG performance may imply that companies direct more cash flow to ESG projects rather than to dividends.

The second hypothesis states that the influence of ESG scores is more pronounced in industrial, energy and materials industries. The difference in means analysis provided the results that ESG scores across the industries are different. Panel regression analysis made it clear that the influence of the ESG score and its pillars on investment attractiveness indicators in the industrial sector is the same as in

other industries for the US market; this is why we failed to confirm the second hypothesis in line with [31]. The intuition behind this result might be that industrial companies already have above-median ESG scores and perform better than companies from the IT industry, among others. This is why an increase in the ESG score or its pillars does not cause a positive reaction from the investment community. The research regarding industry-based ESG analysis provides evidence that contribution of ESG to the energy and industrial companies is stronger [21; 24; 29], and we were able to confirm that better ESG performance decreases cost of capital and probability of paying dividends in the European industrial companies. This implies that credit institutions in Europe may exert more pressure on industrial companies and reward them by showing better ESG performance. As for the dividends, companies may choose to realize ESG initiatives at the shareholders' expense and pay less dividends.

Even though according to our results a change in ESG scores does not imply a change in Tobin's Q, ROE, cost of capital or dividend payout probability, a transition from below-median ESG score to above-median ESG score may result in better investment attractiveness indicators.

The general conclusions of the comparative analyses for European and American companies coincided. The transition to high ESG results in a decrease in Tobin's Q and the cost of capital. However, there is no evidence that achieving higher ESG ratios affects the likelihood of paying dividends, and higher performance of some individual components will significantly affect investment attractiveness. European companies on average show the best median ESG performance, therefore, it can be assumed that high ESG ratings will not have a significant impact on the investment attractiveness of companies. At the same time, for US companies an increase in ESG ratings may have a positive impact on their investment attractiveness.

Despite some limitations, the research contributes to the existing knowledge by covering a wider time frame, taking into consideration a panel of investment attractiveness indicators, outlaying the analysis by ESG score pillars, and making an emphasis on the industrial sector. Moreover, it adds to the few papers that discuss propensity score matching model usage in the context of ESG scores.

From a practical point of view, our results suggest that managers of all companies in different industries pay strong attention to ESG performance because its role in investment decision-making is increasing, even though it is sometimes a fiduciary one. Better ESG performance allows to increase company valuation in the US and Europe, while a transition to an above-median score ensures lower cost of capital. Companies in the USA are advised to improve transparency about the social and governance projects for investors to make more accurate estimates, as well as for lenders to assess risks correctly and can help lower cost of capital.

Our study contributes to a better understanding of the impact of ESG integration on the companies' market value

in developed markets, and provides critical insight into differences in the impact of these factors as perceived by stakeholders. Even if some ESG components do not have a significant impact on increasing companies' investment attractiveness, the study can highlight certain global and individual features that should be considered by investors and analysts when making investment decisions or by managers when making decisions and implementing ESG strategies, taking into account stakeholder expectations.

In conclusion, stakeholder theory [14; 21] postulates that an increase in the ESG rating provides certain benefits to firms since it can increase their efficiency. The results of the study showed that this relationship is not fully confirmed by the behavior of market participants, since it will not sanction the overall monthly increase or decrease in ESG ratings, except during specific, contextual periods. This is an interesting result for company management, which can focus on a high ESG rating during periods of business reform or active investment activity. Results are also important for regulators and policy makers to increase the involvement of companies in pursuing an ESG strategy.

Future studies can be aimed at providing this analysis for other countries. It is interesting to examine the relationship between ESG and performance in Russia, but there is not enough data so far. Moreover, subsequent research may use more advanced methods for regression analysis and treatment effects, as well as incorporate other performance indicators.

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