


Article

ESG as a Measure of Credit Ratings

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Abstract: The aim of this study was to examine the impact of environmental, social, and governance (ESG) measures on credit ratings given to non-financial institutions by the largest credit rating agencies according to economic sector divisions. The hypotheses were as follows: a strong negative impact on non-financial institutions' credit rating changes will result from ESG risk changes, and the reaction of credit rating changes will vary in different sectors. Panel event models were used to verify these hypotheses. The study used data from the Thomson Reuters Database for the period 2010–2020. The analysis was based on the literature on credit rating determinants and on papers and reports on COVID-19, ESG factors, and their impact on credit rating changes. Linear decomposition was used for the analysis. To verify these hypotheses, long-term issuer credit ratings presented by Moody's and Fitch for European companies listed on these stock exchanges have been used. In the analyses, financial and non-financial factors were also considered. The results suggested that, within the last year, the methodology presented by credit rating agencies has changed, and ESG factors are one of the basic measures that are used to verify credit rating changes, especially those related to the pandemic.

Keywords: default risk; ESG measures; non-financial sector



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1. Introduction

The COVID-19 pandemic directed attention toward ESG (environmental, social, and governance) measures. In April 2021, the European Commission published a draft directive on non-financial reporting. The CSRD (Corporate Sustainable Reporting Directive) will replace the existing NFRD (Non-Financial Reporting Directive), and it will impose not only more reporting obligations but also expand the list of entities and areas covered by that reporting. A significant change will be the obligation for all large companies that meet certain financial and employment criteria—not only listed companies. The new directive, after its adoption by the Member States and its implementation into national legislation, will come into force in 2024 and will apply to data reporting for 2023.

The COVID-19 pandemic shows that a company's creditworthiness is not only strictly connected to its financial condition but also non-financial measures. This significant problem is also connected to the level of environmental pollution, especially with coal pollution and green energy, dry weather, rising temperature, the melting of glaciers, etc. As a result, a significant risk is the regulation risk connected to the changes in norms and the reduction in pollution. In effect, a polluted environment is a high risk, especially in, e.g., the energy and petroleum sectors. These risks are starting to be seen by credit rating agencies in the process of default risk assessment. S&P in 2021 presented the most significant ESG risks for particular sectors. As a result, the building material sector has got in the EMEA region main risk connected with CO₂ emissions. The ESG factors and regulations connected with the rapid energy transitions are especially important for the metals and mining or oil and gas sectors. The emission scrutiny risk can have got a significant impact on the transportation situation.

The presented relationship created a need to analyze the impact of ESG factors on the creditworthiness and default risk adopted by financial intermediaries. Lending policies

and the impact of credit scoring were analyzed by [Attig et al. \(2013\)](#); [Birindelli et al. \(2015\)](#), and [Zeidan et al. \(2015\)](#).

Previous research and empirical observation suggest that ESG objectives are not clearly defined and are not used in credit lending policies yet ([Zeidan et al. 2015](#)). According to [Friede et al. \(2015\)](#), the above-mentioned criteria are not used by financial institutions, even if ESG criteria are important for investment decisions. As a result, financial institutions are not ascribed potential value connected to social and environmental factors, even if they have a positive impact on their value ([Cellier and Chollet 2016](#); [Fatemi et al. 2018](#); [Gutsche et al. 2017](#); [Lins et al. 2017](#)).

ESG measures have a significant impact on credit ratings due to sector risk, the cash flow of borrowers, and the default probability of companies. Therefore, favorable ESG measures should increase the credit ratings of companies.

The presented situation created the need to analyze the impact of the ESG measures on the credit ratings by taking into account the type of the sector. Preparing analysis for the particular sector to verify the need to check the significance of the ESG measures for the credit ratings' estimations. In particular, sectors can be observed different reactions to the mentioned factors. Some of them are more sensitive, for example, to the CO₂ emission regulations like the energy sector, others to the pollution reduction, saving water, etc. The analysis for a particular sector on a large database has not been prepared. The presented paper will also reduce the lack of research about the impact of the ESG measures on credit rating estimation. It is still noticed a small number of studies about the impact of the ESG-CSR policies on the probability of default. Using credit ratings given by external credit rating agencies will help to assess the mentioned phenomenon. Credit ratings are used when investors make investment decisions and by financial institutions to estimate the credit and default risks; as a result, the knowledge about the impact of the ESG measures on the credit ratings is very important. The mentioned relationship can have a direct or indirect impact. New regulations enforce changes in credit and investment policies. More attention in the future will be put on the influence of the especially E-factors impact in the financial market. Next, the presented paper has been prepared on a large database that will help to verify the mentioned phenomenon more precisely. The dataset has been based on the data from the 1990 to 2020 period, but the final analysis has been used last ten years. It is connected with the small number of observations, that is, an effect of low pressure in older regulations on the obligation of publishing the ESG measures. In some sectors, the mentioned period is shorter even than the last ten years.

Thus, it was empirically examined the impact of ESG measures and financial conditions on foreign issuer credit ratings in a sample of European public companies. The remainder of the paper proceeds as follows. In Section 2, previous studies that investigate the relationship between ESG criteria and credit risk are reviewed. Section 3 reports the methodology by describing the features of this data sample and the model specification on which the empirical analysis is based. Section 4 provides a discussion of the findings, and Section 5 concludes by declaring limitations on the current study and consequently suggesting future developments.

2. Literature Review

2.1. Impact of ESG Measures on the Companies' Financial Condition

During the last years, the significance of non-financial factors connected with the ESG measures has been raised, and a lot of financial publications presented in media have started to give attention to the situation connected with environmental, social, and governance changes. Some of the news presented the opinion about the impact of the negative information connected with the mentioned area on the companies' financial situation, based on the losing strategic clients, reduction the business activity as an effect of environmental risk, creating a negative opinion about a company and rising the reputational risk. On the other hand, the literature review has not presented the one direct relationship between the ESG risk and the companies' financial condition. For example, [Friede et al. \(2015\)](#), in

the initial study, suggested that ESG measures do not have a significant influence on a firm's value and do not create additional financial profit. The same opinion is presented by [Orlitzky et al. \(2003\)](#). [Revelli \(2017\)](#) and [Revelli and Viviani \(2015\)](#) suggested that ESG measures are also unimportant for investors, and they have not taken them when making investment decisions. The latest studies have revised that opinion. [Miralles-Quirós and Miralles-Quirós \(2017\)](#) found that they can be significant in risk assessment. [Zeidan et al. \(2015\)](#) suggested that ESG risk can be taken into consideration in credit policies. In practice, banks, in an assessment of expected loss, analyze the probability of default, loss given default, exposure at default, and maturity. The estimated default probability only relies on the expected asset payment, the debt repayment, and the asset volatility of the borrowers. They have also started to create inside social credit ratings.

The first research on the impact of financial and non-financial factors on the probability of a default event was a study prepared by [Grunert et al. \(2005\)](#). This study initiated research about the CSR impact on credit risk estimation by banks. One of the studies from this group was research prepared by [Weber et al. \(2010\)](#) and [Weber et al. \(2014\)](#), who verified the impact of social rating announcements on stock prices to examine the relationship between CSR and firm value.

The prepared analysis of this literature review suggests that there are few studies about the impact of ESG measures on debt financing. The results of these studies are varied. Positive relationships between the above-mentioned factors have been found. A positive reaction was noticed by [Ge and Lui \(2015\)](#). Their work shows that the higher the CSR strength score is, the lower the yield spreads are in the group of new corporate bonds. They suggest that a better CSR policy can reduce the cost of debt. Similarly, Cooper and Uzur in 2015 found an inverse relationship between CSR–ESG and the cost of credit. Especially significant are ESG factors. The presented relationship suggests that ESG factors can have an indirect impact on credit ratings, with connections to the probability of debt capital repayment and the possibility of receiving bank loans. [Hoepner et al. \(2016\)](#) also found an effect between sustainability and the cost of capital. They found that social and environmental activities statistically impact loan financing; in greater detail, social issues cause a lower cost reduction in loan financing than environmental issues. These studies show a positive impact of ESG measures on internal credit ratings. The previous studies suggested differences between the significant factors taken by banks and credit rating agencies and lower quality of internal credit ratings ([Chodnicka-Jaworska 2019](#); [Chodnicka-Jaworska 2018](#); [Behn et al. 2014](#); [Bongaerts 2014](#)). In practice, this analysis should also be performed at a country-level, considering the type of sector and each subdimension of environmental, social, and governance factors.

In contrast, the second group of researchers suggest a negative relationship between ESG–CSR measures and the cost of capital. [Menz's \(2010\)](#) findings suggest that higher ESG–CSR factors lead to corporate bond spreads. This situation, in practice, indirectly can reduce credit ratings ([Chodnicka-Jaworska 2019](#)). Menz's research is based on a sample of 498 European corporate bond spreads issued during the 2004–2007 period. He suggests that a relationship can be assumed because companies with a higher risk premium try to reduce it by deciding to introduce CSR–ESG policies. [Goss and Roberts \(2011\)](#) found that CSR–ESG policies do not influence the interest rate spreads of loans. Companies with CSR policies pay more than companies without these regulations. [Stellner et al. \(2015\)](#) suggested that companies with social policies impact credit rating and zero-volatility spreads. This factor can reduce risk and increase credit ratings if it concerns environmental practices. [Jang et al. \(2020\)](#) found that, from the three ESG criteria, only the environmental scores, by taking the firm size into consideration, have a significant impact on bond returns. They found that higher environmental scores reduce the cost of debt in the case of small firms. On the other hand, they found that credit ratings cannot explain the ESG effect in predicting future bond returns. Credit rating agencies should use ESG scores in the risk estimation process to analyze which bond investors integrate with existing credit ratings. Their research also shows the pressure from large investors to develop ESG criteria. It also

compares the reliance of small businesses on external financing. ESG is not fully reflected in credit ratings.

The negative relationship between ESG and credit ratings can be the result of a few reasons. First, large investments in ESG can provoke agency conflicts between managers who may benefit from overinvestments and shareholders who would have to bear the associated costs (Goss and Roberts 2011). In addition, a high level of ESG performance requires many costly maintenance relations with stakeholders and increases in the fixed costs of companies (e.g., Luis Perez-Batres et al. 2012). In addition, managers can use ESG to distract from inappropriate company behavior or accounting inaccuracies (Kim et al. 2014). It is assumed that overinvesting in ESG binds meager (financial) resources, so poor ESG performance should be associated with lower credit risk and vice versa (Goss and Roberts 2011). Table 1 presents studies about the impact of CSR–ESG on the cost of debt.

Table 1. Literature Review.

Authors	Research Description
Anis and Utama (2016)	2011–2014, OLS regression and 2SLS with PLS, published CSR Disclosure and Corporate Governance disclosure in annual Manufacturing Industry report (Indonesia Stock Exchange). The indirect positive effect of CSR disclosure on the cost of debt was observed.
Cooper and Uzun (2015)	2006–2011, US Companies, multi-regression model, KLD Stat; Bloomberg; Mergent Fixed Income Securities Database. A lower cost of debt was noticed.
Ge and Lui (2015)	1992–2009, 4260 new bond issues, multi-regression model, RiskMetrics Group; KLD STATS database; Mergent Fixed Income Securities Database; Compustat. Bonds issued at a lower cost.
Goss and Roberts (2011)	1991–2006, 3996 loans, simultaneous equations, instrumental variable, 56 regressions, Heckman selection model, KLD Research and Analytics Inc.; Dealscan. Higher loan pricing was noticed.
Hoepner et al. (2016)	2005–2012, 470 loan agreements based in 28 different countries, Msci KLD Stats. Higher country sustainability was associated with lower costs of bank loans.
Menz (2010)	2004–2007, Merrill Lynch index system, 498 bonds, OLS—fixed and random effect model. CSR–ESG caused higher bond spreads.
Nandy and Suman (2012)	1991–2006, Kinder, Lydenberg and Domini Research and Analytics, Inc.; Compustat; Dealscan database, 3000 U.S. firms, OLS; fixed effect; Wald test to confirm. ESG–CSR factors decreased the cost of loan negotiation.
Pavelin et al. (2014)	1991–2008, by 742 different firms, KLD STATS and Datastream, 3240 bonds issued. Social posture impacts the cost of debt financing and the credit quality of its bond issues.
Zeidan et al. (2015)	Qualitative questionnaire from a subsidiary bank in Brazil to develop the sustainability credit scoring. ESG–CSR decreased default probability.
Jang et al. (2020)	2010–2015, Korean corporate bonds, panel data models. Only environmental scores have a significant impact on bond returns. They reduced the cost of debt in the case of small firms. Credit ratings cannot explain the ESG effect in predicting future bond returns.

Source: own elaboration.

A credit rating is a measure of a company’s financial obligations. In the presented paper is investigated the relationship between ESG performance and debt financing by using credit ratings as a proxy. Ratings can be downgraded or upgraded if information changes, so whether ESG performance leads to favorable credit rating issues is tested. If higher ESG performance causes a higher level of credit rating, companies can enjoy beneficial conditions in terms of the cost of debt. The analysis was structured by developing main hypotheses according to the main research question: Does ESG performance influence the credit rating evaluation of companies?

The predicted positive influence of ESG measures can be connected to the insurance function of ESG during negative events (Godfrey 2005; Shiu and Yang 2017; Godfrey et al. 2009). CSR builds the moral capital that can be used during management problems or can reduce negative reactions. It measures the ability of stakeholders to invest in a company in another way. Jang et al. (2020) suggest that ESG activity not only has an impact on moral

capital but can also create financial benefits that are especially important for companies that issue bonds. As a result, they create a positive opinion about a company as being one connected to doing something good for others. It also increases the transparency of a company's operations for stakeholders and decreases the debt cost by reducing default risk from the investor's perspective. This effect is also strictly connected to the level of asymmetrical information.

In this study, it is assumed that all ESG criteria have a significant impact on credit ratings published by agencies. English (1999) found that environmental problems, such as climate change or water pollution, are more universal and have a longer-term perspective than social and management-related risks, which are mostly limited internally. This has been confirmed by Han et al. (2016) and Jang et al. (2020). A negative relationship between environmental risk and a company's financial conditions is noticed when social measures are insignificant.

The presented research and practical knowledge suggest that ESG measures can have got a statistically significant impact on credit ratings. It can present a direct or indirect influence. They can be analyzed in the form of "adjustment factors".

2.2. Impact of Financial Condition Measures on Corporate Credit Ratings

The group of indicators that are taken to the analysis by credit rating agencies during verification of default risk are financial indicators. The impact of the mentioned variables is varied in particular sectors. Different measures are used during estimation credit ratings for banks, insurers, countries or non-financial institutions, etc. In the group of particular non-financial institutions, in subsectors, the significance of particular financial ratios is also varied. In practice, credit rating agencies publish methodologies and information about financial situations for each subsector separately. In previous studies, all companies from all sectors have been threatened as one sample. It is a mistake because each sector has got its own type of risk. In the presented paper, each sector is analyzed separately.

In this subsection, the decision was taken to verify and analyze the significance of the previous main studies about the impact of the financial indicators on corporate credit ratings. The main idea is to categorize and introduce them to estimate the final model.

One of the first models that was used by credit rating agencies was the model prepared by Altman (1968). In the presented analysis were verified factors that can influence one the corporate bankruptcy. It was a basis to prepare the next group of models by Kaplan and Urwitz (1979) and Ederington (1985). The list of variables used by then was varied. In a group of factors used by Kaplan and Urwitz (1979) we can find leverage ratios (the long-term debt to total assets ratio, the long-term debt to net worth ratio, and the interest coverage), earnings and profitability indicators (the net income to total assets ratio, the coefficient of variation of total assets, the coefficient of variation of net income) and the size of the company measured by the total assets. The significance of the impact of the size of the company was underlined by Ederington (1985). He also paid attention to the quality of the debt ratios. Kamstra et al. (2001) to the list of variables presented by Ederington (1985) included those connected with the level of profitability measured by the net income total assets ratio.

The described group of variables has also been used in other studies. In all these examples has been put attention on the negative impact of the leverage ratios, the positive influence of the profitability and earnings indicators, and higher notes received by bigger companies. On the other hand, the interest coverage has not got the statistically significant impact on corporate credit ratings.

Blume et al. (1998), by using panel data models to the list of variables presented by Kaplan and Urwitz (1979) and Ederington (1985) included operating income to sales. In their research, it was received the ambiguous relationship between leverage ratios and credit ratings, which can be an effect of using correlated debt indicators. The same problem received Amato and Craig (2004). The insignificant impact of the interest coverage has

been solved by [Blume et al. \(1998\)](#), [Kamstra et al. \(2001\)](#), and [Amato and Craig \(2004\)](#). They found the nonlinear impact of the mentioned variable on the corporate credit ratings.

Interesting findings were shown by [Mahlmann \(2011\)](#), because in his opinion if companies longer cooperate with a particular credit rating agency, it receives higher notes with the same financial condition. This opinion has been confirmed by European Commission, that effect change in European regulations connected with credit ratings. As a result, the credit ratings are unstable. It can also be connected with the methodology changes.

The main studies about the variables that have a significant impact on corporate credit ratings are presented in Table 2.

Table 2. Studies about financial factors influencing on corporate credit ratings.

Authors	Significant Variables
Kaplan and Urwitz (1979)	Interest coverage, the long-term debt to total assets ratio, the long-term debt to net worth ratio, the net income to total assets ratio, the coefficient of variation of total assets, the coefficient of variation of net income, and total assets.
Ederington (1985)	Interest coverage, the long term debt to capital ratio, and total assets.
Blume et al. (1998)	Pre-tax interest coverage, operating income to sales, long term debt to assets, total debt to assets, and total assets
Bouzouita and Young (1998)	Profitability, growth in surplus, leverage, line mix, liquidity, size, and organizational form.
Kamstra et al. (2001)	Net income plus interest expenses divided by interest expenses to represent interest coverage, a debt ratio measured by total debt divided by total assets, profitability captured by the net income total assets ratio, and firm size measured as book value of firm assets.
Bhojraj and Sengupta (2003)	Institutional ownership, the proportion of the board consisting of outsiders, concentrated ownership, debt/equity, profit margin, total assets, the market value of common equity/book of common equity.
Kim and Gu (2004)	Debt service coverage, profitability, and size.
Roje (2005)	ROA, ROE, profit, the market value of equity, tangible book value/assets, leverage, long-term Debt/total assets, projected benefit obligation-pension plan assets/total assets, volatility of earnings.
Ashbaugh-Skaife et al. (2006)	The number of outside blockholders, quality accruals, timeliness of firms' earnings, independence of the board, CEO power, percentage of shares held by officers or directors, board expertise, leverage, ROA, net income before extraordinary items, size, subordinated debt, and interest coverage
Gray et al. (2006)	Interest coverage, leverage, profitability, and industry concentration.
Sih (2006)	Industry, cash, and market value.
Bone (2010)	Interest coverage and short-term debt/total debt.

Source: own elaboration.

The prepared analysis confirms that financial indicators are basic factors that influence corporate credit ratings. The strong correlation between credit ratings and ratios estimated by using financial statements suggests that they are alternative measures to verify the default risk and can be used to measure the first signals with problems with insolvency. On the other hand, using only the financial ratios to estimate notes does not consider qualitative factors that may also be relevant in the estimation of bankruptcy risk.

The knowledge of factors influencing corporate credit ratings is very significant. It is connected for a few reasons. Credit ratings are used to verify the probability of default ([Kang and Liu 2007](#); [Matthies 2013](#)). [Choy et al. \(2006\)](#) showed that a strong correlation exists between credit ratings and the probability of later default; as a result, the higher the credit rating, the lower the default risk, and vice versa. From the company's perspective, credit ratings influence the cost of debt, the type of financing, even the possibility of staying in the market ([Gray et al. 2006](#)). From the banks' perspective, they influence the possibility of giving credit to these companies. Credit ratings can also be used to discipline CEOs as an effect of the monitoring function ([Kang and Liu 2007](#)). This constant monitoring by rating

agencies tends to influence management to act in the interests of shareholders to maximize goodwill. In other words, the credit rating performs the function of corporate governance.

External notes also play an important role during the standardized method by banks. They are useful to assess the capital adequacy indicators analysis according to regulators' rules. In fact, regulators recognize that major financial market participants use such credit ratings as a benchmark when they are calculating their capital requirements for solvency purposes or for calculating the risk in their investment activities (Papaikonomou 2010). The supervisors threaten them with good information about the solvency risk. They reduce the asymmetry of information between investors, stakeholders, regulators, supervisors, and the managers' knowledge. Credit ratings take part in the financial resources' allocation and more effective resource allocation (Papaikonomou 2010). Many professional investors can invest only in investment-grade bonds. From the investor's point of view, they help to categorize financial instruments according to the investment quality and the possibility of selling (Pinches and Singleton 1978) because agencies have access to confidential information about a company, which increases their value in the eyes of the public (Jorion et al. 2005).

A substantial literature exists that seeks to quantify the relationship between financial indicators, but most of the presented studies put attention on the one sector. Most of them are based only on the local economies. They also have not taken the non-financial indicators to the analysis. New investment products, changes in the financial situations, new regulations, or new types of risk causes credit rating agencies to try developing their assessment criteria and methodologies (Camargo 2009). The significant impact has also got the size and time of business activity of the credit rating agency (Chodnicka-Jaworska 2019; Chodnicka-Jaworska 2020). Because credit rating agencies change their standards, the assessed companies have to improve their financial indicators if they want to solve their creditability (Gray et al. 2006).

The practical analysis of the methodologies presented by credit rating agencies that they use to assess credit ratings suggests that the estimation are used financial and non-financial indicators. The presented study is different from the previous studies for a few reasons. First, the above-mentioned research does not take credit ratings presented by credit rating agencies into consideration. They have direct attention to internal notes. In practice, most internal bank notes are higher than those presented by agencies. This relates to credit reserves and loan loss provisions. Next, banks use internal credit ratings to assess default risk when making decisions about borrowing money. External credit ratings need to be analyzed when making decisions about investments in the capital market. The second difference relies on verifying the impact of ESG measures and financial factors on credit ratings. Previous studies took one of them into consideration (financial or ESG–CSR measures).

The presented findings might interest investors and researchers. For investors, models that measure credit risk and the probability of defaults are more accurate when using ESG measures, which can lead to more effective risk management and can create higher profits from investments. Investor reputation and regulatory requirements may direct investors' attention towards high ESGs (e.g., Franklin 2008). This can lead to lower capital costs for these firms and, consequently, higher asset values and lower credit spreads (e.g., Chava 2014; Chava et al., 2009).

This study can also help to investigate the risk connected to natural disasters or changes in regulations (i.e., Renneboog et al. 2008).

3. Data Description and Methodology

This analysis was prepared using credit ratings of European nonfinancial institutions proposed by Moody and Fitch. The data were collected from the Refinitiv (Thomson Reuters Database), Bankscope, and The World Bank. The analysis was prepared for 9521 companies from European countries for the period between 1990 and 2020. The final models presented in this paper relied on the database for 2010 and 2020 and a shorter period. It is connected

with the lack of data on the ESG measures. It is an effect of the less restrictive policy about the obligation to present ESG reports. According to the Non-Financial Reporting Directive, only a few groups of entities had to present the mentioned data. Previous data are also very limited. The analysis did not utilize credit ratings presented by S&P. It is an effect of the S&P's decision to prohibit the downloading of credit rating data from 2020. Their credit ratings cannot also be analyzed without acceptance of the agency. A longer period has been used for the analysis because of the small credit rating volatility. As a result, using the shorter time period can create an unbalanced panel data problem.

The data were collected quarterly—the analysis used foreign long-term issuer credit ratings proposed by Fitch and Moody, as a dependent variable. The decision for this is connected to mostly using them for taking the investment decisions and assess the credit and default risk by the financial institutions. The notes are taken as the last note at the end of the quarter. In practice, in the database, the changes of notes more the once during the quarter were not observed. As company notes are expressed in letters, the linear decomposition proposed by [Ferri et al. \(1999\)](#) was used. The effects of the decomposition are presented in [Table 3](#). For the analysis, non-linear decomposition was not used because it relies on taking CDS spreads and presented entities in only a few cases issue CDS. Additionally, using 10-year bonds to verify the mentioned phenomenon reduced and strengthened the sample.

Table 3. Decomposition of Moody's and Fitch long-term issuer credit ratings.

Moody's Long-Term Issuer Rating		Fitch Long-Term Issuer Rating	
Rating	Code	Rating	Code
Aaa	100	AAA	100
Aa1	95	AA+	94.4
Aa2	90	AA	89.47
Aa3	85	AA−	84.21
A1	80	A+	78.95
A2	75	A	73.68
A3	70	A−	68.42
Baa1	65	BBB+	63.16
Baa2	60	BBB	57.89
Baa3	55	BBB−	52.63
Ba1	50	BB+	47.37
Ba2	45	BB	42.11
Ba3	40	BB−	36.84
B1	35	B+	31.58
B2	30	B	26.32
B3	25	B−	21.05
Caa1	20	CCC	15.79
Caa2	15	CC	10.53
Caa3	10	C	5.26
Caa	5	RD	−5
C	0	D	−5
WR	−5	WD	−5
NULL	0		

Source: own elaboration.

As the ESG measures are used factors presented by Refinitiv (Thomson Reuters). To the mentioned determinants belong the ESG Combined Score, the ESG Score, the Environmental Pillar Score, the Social Pillar Score, the Corporate Governance Pillar Score, and the ESG Controversies Score. [Table 4](#) contains the description of the particular variables. Previous literature does not solve the problem of the impact of the mentioned variables on the companies' financial condition. The mentioned relationship is not obvious because in some cases, it is noticed the positive impact of the ESG measures, in others negative relationship. It is connected with using the ESG policies to improve the public opinion of the company. Big companies with large asset values sometimes receive higher ESG indexes, even if they are from a high carbon emission sector. It is connected to buying CO₂

certificates. As a result, the mentioned relationship can be varied for particular sectors and ESG factors. Because of the strong correlation between ESG measures, in some points the separate models have to be prepared.

Table 4. Description of ESG measures.

Variable Name	Description	Abbreviation
ESG Combined Score	Refinitiv ESG Combined Score is an overall company score based on the reported information in the environmental, social, and corporate governance pillars (ESG Score) with an ESG Controversies overlay.	ESGC
ESG Score	Refinitiv ESG Score is an overall company score based on the self-reported information in the environmental, social, and corporate governance pillars.	ESG
Environmental Pillar Score	The environmental pillar measures a company's impact on living and non-living natural systems, including the air, land, and water, as well as complete ecosystems. It reflects how well a company uses best management practices to avoid environmental risks and capitalize on environmental opportunities in order to generate long-term shareholder value.	ENV
Social Pillar Score	The social pillar measures a company's capacity to generate trust and loyalty with its workforce, customers, and society, through its use of best management practices. It is a reflection of the company's reputation and the health of its license to operate, which are key factors in determining its ability to generate long-term shareholder value.	SOC
Corporate Governance Pillar Score	The corporate governance pillar measures how well a company's systems and processes ensure that its board members and executives act in the best interests of its long-term shareholders. It reflects a company's capacity, through its use of best management practices, to direct and control its rights and responsibilities through the creation of incentives, as well as checks and balances, in order to generate long-term shareholder value.	GOV
ESG Controversies Score	The ESG controversies category score measures a company's exposure to environmental, social, and governance controversies and negative events reflected in global media.	CONT

Source: own elaboration based on the Refinitiv system description.

The next group of factors is determinants connected to the companies' financial stability. The mentioned factors have been divided into profitability, earnings power, liquidity, leverage, and operating measures. Their significance may be confirmed by the previous studies and the analysis of the Moody's and Fitch credit ratings' methodologies. Table 5 presents the suggested relationship between financial factors and credit ratings, taking into account the previous studies. The list of variables has also been verified with methodologies presented by particular agencies that are sent to supervisors. The description of the particular variables is presented in Appendix A.

Table 5. Description of the impact of the financial factors on credit ratings.

Variable Name	Opinion and Previous Studies	Direction
Profitability		
Gross Margin	The higher is the gross margin, the higher credit ratings are (Jiang and Packer 2017; Gray et al. 2006; Murcial et al. 2014; Poon and Chan 2008; Fink et al. 2010; Altman 1968; Altman and Herbert 2004; Logue and Merville 1972; Adams et al. 2003; Daniels et al. 2009; Galil 2003).	+
Effective Tax Rate	On the one hand, a higher value of the tax rate decreases profits and increases the business costs; on the other hand, higher taxes are connected with higher profits (Jiang and Packer 2017; Murcial et al. 2014; Fink et al. 2010).	+/-
Earning Power		
Asset Turnover	The higher the asset turnover, the higher credit ratings are (Matousek and Stewart 2009; Kumar and Bhattacharya 2006; Kim and Gu 2004).	+
Pretax ROA	The higher the pretax ROA, the higher credit ratings are (Matousek and Stewart 2009; Kim and Gu 2004; Frey 2013).	+
Earnings Retention	The retention ratio is the portion of earnings kept back in a firm to grow the business. It helps investors determine how much money a company is keeping to reinvest in the company's operations. Growing companies typically have high retention ratios as they are investing earnings back into the company to grow rapidly. The higher is the earnings retention rate, the higher credit ratings are (Kim and Sohn 2008).	+
Reinvestment Rate	The reinvestment rate is the return an investor expects to make after reinvesting the cash flows earned from a previous investment. It can be negatively affected by interest rate risk, which is the potential for investment losses resulting from changes in interest rates and the reinvestment risk, which is the potential the investor will be unable to reinvest cash flows at a rate comparable to their current rate of return (Kim and Sohn 2008; Alp 2013).	+/-
Liquidity		
Current Ratio	The current ratio from the one side measures a company's ability to pay short-term obligations. On the other hand, the high value of this factor can suggest that management may not be using its assets efficiently (Matousek and Stewart 2009; Opler et al. 1999; Baum et al. 2008; Baum et al. 2009; Shyam-Sunder and Myers 1999; Nevitt and Fabozzi 2000).	+/-
Time Interest Earned	The higher value of the time interest earned, the higher credit ratings are (Matousek and Stewart 2009; Kim and Gu 2004; Tanthanongsakkun and Treepongkaruna 2008; Frey 2013; Alp 2013).	+
Leverage		
Debt/Equity	The higher value of the debt to equity ratio, the lower credit ratings are (Anand et al. 2016; Gray et al. 2006; Kumar and Bhattacharya 2006; Kim and Gu 2004; Elayan et al. 2003; Alp 2013; Cantor and Packer 1997; Pottier and Sommer 1999; Adams et al. 2003; Poon 2003).	-
LT Debt/Capital	The higher value of the long-term debt to capital ratio, the lower the credit ratings are (Gray et al. 2006; Kumar and Bhattacharya 2006; Elayan et al. 2003; Tanthanongsakkun and Treepongkaruna 2008; Alp 2013; Cantor and Packer 1997; Pottier and Sommer 1999).	-
(Total Debt-Cash)/EBITDA	The higher value of the total debt reduced by cash to EBITDA ratio, the lower credit ratings are (Gray et al. 2006; Kumar and Bhattacharya 2006; Elayan et al. 2003; Frey 2013; Alp 2013)	-
Operating		
A/R Turnover	The higher value of the A/R Turnover ratio, the higher the credit ratings are (Kumar and Bhattacharya 2006; Elayan et al. 2003).	+
Inv Turnover	The higher value of the inventory turnover ratio, the lower the credit ratings are (Kumar and Bhattacharya 2006).	-
Fixed Assets Turnover	The higher value of the fixed assets turnover ratio, the higher the credit ratings are (Kumar and Bhattacharya 2006).	+
WC/Sales Growth	The higher value of the working capital to sales growth ratio, the higher the credit ratings are (Frey 2013).	+

Source: own elaboration.

Ordered logit panel data models in which European companies' long-term issuer credit ratings are the dependent variable were used for this analysis. Logit models rely on the verification of the probability unit, which is then transformed into its cumulative probability value from a normal distribution. The final version of the ordered logit model is:

$$y_{it}^* = \beta x'_{it} + \gamma Z_{it} + \varepsilon_{it}, \quad (1)$$

where y_{it}^* is an unobservable latent variable that measures the creditworthiness of a company i in period t ; x'_{it} is a vector of time varying explanatory variables; β is a vector of unknown parameters; Z_{it} represents time-invariant regressors that are generally dummy variables; ε_{it} is a random disturbance term that has a normal distribution.

The y_{it}^* is related to the observed variable y_i , which is a credit rating in this case, as follows:

$$\begin{aligned} y_i &= -5 \text{ if } y_i^* < \tau_0 \\ &0 \text{ if } \varepsilon_0 < y_i^* < \tau_1 \\ &5 \text{ if } \varepsilon_1 < y_i^* < \tau_2 \\ &10 \text{ if } \varepsilon_2 < y_i^* < \tau_3 \\ &15 \text{ if } \varepsilon_3 < y_i^* < \tau_4 \\ &20 \text{ if } \varepsilon_4 < y_i^* < \tau_5 \\ &\dots \\ &100 \text{ if } \varepsilon_{21} < y_i^* < 0 \end{aligned}$$

where τ_s ($\tau_0 < \tau_1 < \tau_2 < \dots < \tau_{22}$) are the known threshold parameters to be estimated. The following model can be referred to as a factor ordered probit model:

$$y_{it}^* = \alpha F'_{it} + \beta G'_{it} + \gamma Z_{it} + \delta(F * Z)_{it} + \varepsilon_{it} \quad (2)$$

where y_{it} is an observable latent variable that measures the creditworthiness of a non-financial institution i in period t (Fitch Long-Term Issuer Rating and Moody's Long-Term Issuer Rating) for European companies.

F_{it} is a vector of explanatory variables connected to the ESG measures, i.e.,

$$F_{it} = [ESGC_{it}, ESG_{it}, ENV_{it}, SOC_{it}, GOV_{it}, CONT_{it}] \quad (3)$$

where $ESGC_{it}$ is the ESG Combined Score; ESG_{it} is the ESG Score; ENV_{it} is the Environmental Pillar Score; SOC_{it} is the Social Pillar Score; GOV_{it} is the Corporate Governance Pillar Score; $CONT_{it}$ is the ESG Controversies Score; G_{it} is a vector of explanatory variables connected to the financial condition indicators estimated on first lags, i.e.,

$$G_{it-1} = [GM_{it-1}; TAX_{it-1}; ASS_{it-1}; ROA_{it-1}; RET_{it-1}; RINV_{it-1}; CUR_{it-1}; IN_{it-1}; DEB_{it-1}; LTD_{it-1}; NET_{it-1}; AR_{it-1}; INT_{it-1}; FIX_{it-1}; WC_{it-1}] \quad (4)$$

where GM_{it-1} is the Gross Margin; TAX_{it-1} is the Effective Tax Rate; ASS_{it-1} is the Asset Turnover; ROA_{it-1} is the Pretax ROA; RET_{it-1} is the Earnings Retention; $RINV_{it-1}$ is the Reinvestment Rate; CUR_{it-1} is the Current Ratio; IN_{it-1} is the Time Interest Earned Ratio; DEB_{it-1} is the Debt-to-Equity Ratio; LTD_{it-1} is the Long-Term-Debt-to-Capital Ratio; NET_{it-1} is the difference between Total Debt and Cash divided by EBITDA; AR_{it-1} is the A/R Turnover Ratio; INT_{it-1} is the Inventory Turnover Ratio; FIX_{it-1} is the Fixed Assets Turnover Ratio; WC_{it-1} is the Working-Capital-to-Sales-Growth Ratio.¹

Additionally, Z_{it} contains time-invariant regressors that are generally dummy variables; ε_{it} is a random disturbance term.

Preparing the analysis on the first lag on the financial indicators is strictly connected with publishing information about the financial statements with a quarter lag. To the analysis were used quarterly data.

The sample has been divided into subsectors because of the different reactions on ESG measures in particular groups. The description of the particular sectors and subsectors

has been prepared in Appendix B. The main sectors that were analyzed were: Energy, Basic Materials, Industrials, Consumer Cyclical, Consumer Non-Cyclical, Healthcare, Technology, and Utilities. The classification is based on the classification presented by Refinitiv (Thomson Reuters).

4. Results

4.1. Impact of ESG Measures on the Corporate Credit Ratings

The analysis of the impact of ESG measures on the Moody's and Fitch long-term issuer credit ratings has been started on the analysis of the six factors published by Thomson Reuters, i.e., the ESG Combined Score, the ESG Score, the Environmental Pillar Score, the Social Pillar Score, the Corporate Governance Pillar Score, and the ESG Controversies Score (Table 6). Because of the correlation between some of the mentioned indicators, there have to be prepared separate models. The impact of the ESG scores on the whole sample was first verified. A significant impact in Moody's and Fitch ratings is the Environmental Pillar Score. If this factor is higher, the credit rating is higher. A stronger relationship is observed in the case of Fitch ratings. These findings are similar to those of Jang et al. (2020). It is the most important factor of the above-mentioned ESG measures. As a result, environmental policy reduces default risk. It can also impact the cost of capital. Another factor that reduces default risk is the Social Pillar Score. It has a stronger influence on Moody's notes. The Corporate Governance Pillar Score is a third factor that is important in credit rating estimation. The strongest influence of the ESG Score on Moody's credit ratings suggests that Moody's directs more attention toward ESG measures. The ESG Controversies Score measures a company's exposure to environmental, social, and governance controversies and the negative events reflected in global media. The higher this index is, the lower the credit rating is. Negative events connected to ESG controversies can decrease company profits and sometimes contribute to bankruptcy. As a result, the higher the risk event is, the lower the credit ratings are, in both Moody's and Fitch's notes.

Table 6. Impact of ESG measures on Moody's long-term issuer credit ratings and Fitch long-term issuer credit ratings.

Rating	Moody's LT						Fitch LT					
	Coef.	P > z	Coef.	P > z	Coef.	P > z	Coef.	P > z	Coef.	P > z	Coef.	P > z
ENV	−0.0144	0.0000					−0.0377	0.0000				
SOC	−0.0051	0.1010					−0.0260	0.0000				
GOV	0.0052	0.0480					0.0053	0.2330				
CONT			0.0062	0.0010					0.0068	0.0020		
ESG					−0.0019	0.5200					−0.0279	0.0000
/cut1	−2.00	0.00	−5.68	0.00	−6.14	0.00	−2.11	0.00	1.54	0.00	−0.50	0.05
/cut2	−1.90	0.00	−5.23	0.00	−5.70	0.00	−1.93	0.00	1.65	0.00	−0.38	0.12
/cut3	−1.90	0.00	−4.04	0.00	−4.56	0.00	−1.91	0.00	1.66	0.00	−0.37	0.13
/cut4	−1.88	0.00	−3.13	0.00	−3.70	0.00	−1.88	0.00	1.68	0.00	−0.35	0.15
/cut5	−1.84	0.00	−2.88	0.00	−3.46	0.00	−1.86	0.00	1.69	0.00	−0.34	0.17
/cut6	−1.82	0.00	−2.70	0.00	−3.28	0.00	−1.84	0.00	1.70	0.00	−0.33	0.18
/cut7	−1.80	0.00	−2.48	0.00	−3.08	0.00	−1.78	0.00	1.74	0.00	−0.29	0.24
/cut8	−1.76	0.00	−0.72	0.01	−1.35	0.00	−1.61	0.00	1.84	0.00	−0.18	0.46
/cut9	−1.01	0.00	0.71	0.01	0.07	0.82	−1.49	0.00	1.92	0.00	−0.10	0.68
/cut10	0.05	0.85	1.47	0.00	0.82	0.01	−1.19	0.00	2.11	0.00	0.10	0.69
/cut11	0.68	0.02	2.60	0.00	1.93	0.00	−1.06	0.01	2.19	0.00	0.18	0.45
/cut12	1.61	0.00	3.79	0.00	3.11	0.00	−0.69	0.06	2.43	0.00	0.44	0.08
/cut13	2.62	0.00	5.22	0.00	4.54	0.00	−0.41	0.27	2.62	0.00	0.64	0.01
/cut14	4.08	0.00	5.58	0.00	4.89	0.00	−0.10	0.79	2.84	0.00	0.88	0.00
/cut15	4.46	0.00	6.10	0.00	5.40	0.00	0.72	0.10	3.42	0.00	1.49	0.00
/cut16	5.00	0.00										
no. obs	1088		754		754		809		809		809	
no. gr	118		101		101		73		73		73	
Wald	0		0		0		0		0		0	

Source: own calculations.

The impact of ESG factors varies by sector. Fitch long-term issuer credit ratings are analyzed first (Table 7). The Environmental Pillar Score is especially significant for the energy sector. Similar results are found for basic materials, the industrial sector, technology, and utilities. This variable is unimportant for the consumer cyclical, consumer non-cyclical, and healthcare sectors. These findings are strictly connected to regulations and restrictions given by the European Commission, such as the reduction in pollution and the saving water and energy. It is one of the most significant factors. The received findings suggest that companies from the mentioned sectors should pay attention to the aforementioned variable. In practice, companies can pay more attention in the future during estimation of the credit and default risk on this factor. Credit ratings are used in practice to assess credit risk. As a result, credit rating agencies' decisions connected the estimation of the impact of the E-factor on credit ratings have got an indirect impact on the estimation models prepared by financial institutions.

Table 7. Impact of the ESG measures on Fitch long-term issuer credit ratings by sector.

Rating	Fitch LT															
	3001		3002		3003		3004		3005		3006		3007		3008	
	Coef.	P > z	Coef.	P > z	Coef.	P > z	Coef.	P > z	Coef.	P > z	Coef.	P > z	Coef.	P > z	Coef.	P > z
ENV	-0.0625	0.00	-0.0537	0.02	-0.0526	0.01	-0.0026	0.80	0.0094	0.66	-0.0202	0.30	-0.0564	0.00	-0.0551	0.00
SOC	-0.0104	0.35	-0.0246	0.20	-0.0198	0.39	-0.0505	0.00	-0.0912	0.01	-0.0670	0.00	-0.0402	0.03	-0.0220	0.50
GOV	0.0278	0.01	-0.0432	0.03	0.0053	0.81	-0.0024	0.85	0.0277	0.26	0.0139	0.40	0.0324	0.05	0.0025	0.87
/cut1	-1.4377	0.10	-5.0291	0.01	-2.1334	0.09	-2.3585	0.01	-2.8269	0.11	-4.6134	0.01	-1.2290	0.42	-3.1897	0.08
/cut2	-0.7488	0.37	-4.8353	0.02	-1.7996	0.15	-1.6915	0.04	-2.7115	0.12	-4.2409	0.01	-1.1681	0.44	-2.9865	0.10
/cut3	-0.6808	0.41	-4.7386	0.02	-1.4271	0.24	-0.8428	0.30	-2.5848	0.14	-4.1232	0.01	-1.0377	0.49	-0.9449	0.57
/cut4	-0.6106	0.46	-4.2896	0.03	-0.8765	0.46	-0.1787	0.84	-2.0731	0.23	-3.6650	0.02	-0.9690	0.52		
/cut5	-0.5394	0.51	-3.6753	0.06	-0.2347	0.85			-0.8075	0.64	-2.9959	0.04	-0.8308	0.58		
/cut6	-0.4653	0.57											-0.7575	0.61		
/cut7	-0.3892	0.64											0.2174	0.88		
/cut8	-0.1466	0.86											0.9288	0.52		
/cut9	0.3282	0.70														
no. obs	125		110		77		89		43		71		180		93	
no. gr	12		8		8		7		4		5		17		10	
Wald	0		0.02		0.01		0		0		0		0		0	

Legend: 3001: Energy; 3002: Basic Materials; 3003: Industrials; 3004: Consumer Cyclical; 3005: Consumer Non-Cyclical; 3006: Healthcare; 3007: Technology; 3008: Utilities; 3009: Real Estate. Source: own calculations.

The strongest impact of the Social Pillar Score is in the consumer non-cyclical sector. It is strictly connected to the construction of this sector, i.e., food, personal products, and drugs. It is also significant for the consumer cyclical, healthcare, and technology sectors. The remaining credit ratings, divided by the type of sector, are insignificant.

The corporate governance pillar measures how well a company's systems and processes ensure that its board members and executives act in the best interests of its long-term shareholders. It reflects a company's capacity through its use of best management practices to direct and control its rights and responsibilities through the creation of incentives, as well as checks and balances to generate long-term shareholder value. This variable is especially significant for the basic material, energy, and technology sectors.

The results of the impact of the ESG measures on Moody's long-term issuer credit ratings are presented in Table 8. The environmental pillar score is significant for the energy sector and utilities. The impact of this factor is strictly connected to regulations connected to pollution reduction and the conservation of water and energy. The social pillar score is significant only for the industrial sector. It measures a company's capacity to generate trust and loyalty with its workforce, customers, and society through the use of best management practices. It reflects the company's reputation and the health of its license to operate, which are key factors in determining its ability to generate long-term shareholder value. The corporate governance pillar score is significant only for the materials sector, e.g., aluminum, gold, and iron mining.

Table 8. Impact of the ESG measures on Moody's long-term issuer credit ratings by sector.

Rating	Moody's LT											
	3001		3002		3003		3004		3005		3008	
	Coef.	P > z	Coef.	P > z	Coef.	P > z	Coef.	P > z	Coef.	P > z	Coef.	P > z
ENV	−0.0210	0.06	−0.0012	0.92	−0.0046	0.45	−0.0106	0.42	−0.0015	0.94	−0.0363	0.00
SOC	−0.0054	0.57	−0.0146	0.21	0.0261	0.00	−0.0028	0.83	−0.0190	0.37	−0.0036	0.85
GOV	−0.0062	0.51	0.0208	0.04	−0.0115	0.12	−0.0149	0.29	−0.0023	0.86	0.0060	0.47
/cut1	−9.5754	0.00	−4.0064	0.01	−2.4038	0.00	−6.4775	0.00	−6.5816	0.00	−5.4969	0.00
/cut2	−8.5974	0.00	1.0574	0.26	−1.5443	0.01	−4.5045	0.01	−6.2563	0.00	−3.9008	0.00
/cut3	−2.6045	0.06	3.9152	0.00	−1.3350	0.02	−2.2005	0.15	−4.7362	0.01	−2.6018	0.02
/cut4	−1.3874	0.31	4.3816	0.00	−1.1811	0.03	0.8677	0.61	−3.5788	0.03	−1.9864	0.07
/cut5	0.0445	0.97	6.8515	0.00	−0.4890	0.37	4.5025	0.02	−2.4200	0.13	−1.4476	0.19
/cut6	2.7706	0.07			0.5663	0.30	5.0930	0.01	−1.5117	0.34	0.7723	0.47
/cut7	4.6153	0.00			1.0931	0.05			−1.2648	0.42	1.2642	0.24
/cut8	5.0001	0.00			2.0341	0.00			3.0926	0.10		
/cut9	5.2008	0.00			2.8868	0.00						
/cut10	5.6548	0.00										
no. obs	118		85		131		73		59		85	
no. group	16		15		13		9		8		12	
Wald	0		0		0.01		0.06		0.33		0	

Legend: 3001: Energy; 3002: Basic Materials; 3003: Industrials; 3004: Consumer Cyclical; 3005: Consumer Non-Cyclical; 3006: Healthcare; 3007: Technology; 3008: Utilities; 3009: Real Estate. Source: own calculations.

The comparison of results received for Moody's and Fitch subsamples suggests that Fitch notes are more sensitive on the ESG measures, both in a whole sample the same as in subsamples for the particular subsectors. The mentioned situation confirms the opinion that both agencies have got the different visions on the significance of ESG measures. It can also be an effect of the sample of entities that are assessed by particular agencies. The analysis of the whole sample confirms that the subsamples are varied by the size of the entities. It suggests that not only the type of sector can be significant but also the size of the company. The important factor can also be the COVID-19 pandemic situation. During the last two years, Fitch especially put attention on the mentioned group of indicators. The prepared analysis also confirms the rising effect of the influence of E-factors to verify the probability of default.

The impact of the ESG Controversies Score on the Fitch credit ratings is presented in Table 9, and that on the Moody's ratings are in Table 10. The controversies connected to negative ESG events are especially significant for the energy, industrial, consumer cyclical, and technology sectors in terms of Fitch credit ratings. The strength of the influence is similar for all of these sectors. The same sectors (except for consumer cyclical) are sensitive to controversies connected to negative ESG events for the Moody's subsample. The strength of the impact of this variable in terms of Moody's credit ratings is similar to the results found for Fitch. The presented analysis confirms that positive and negative information connected with ESG policies and especially the company's impact on the environment is not without significance. Previous studies suggested that ESG-CSR policies can be used to create a better opinion about a company in the group of potential clients and investors. The previous events that were not without significance on the default risk are the VW Euro norm emission problem, information about oil spill and water contamination, deforestation, exploitation of minors for work, bad working conditions, but also during the last two years, information about COVID-19 cases and lockdown decisions. All of these types of events have had an impact on the companies' reputations, and investors' willingness to invest, and indirectly, the probability to increase capital, and finally, the probability of default.

Table 9. Impact of the ESG Controversies Scores on the Fitch long-term issuer credit ratings by sector.

Rating	Fitch LT															
	3001		3002		3003		3004		3005		3006		3007		3008	
	Coef.	P > z	Coef.	P > z	Coef.	P > z	Coef.	P > z	Coef.	P > z	Coef.	P > z	Coef.	P > z	Coef.	P > z
CONT	0.0120	0.02	0.0046	0.56	0.0128	0.09	0.0219	0.04	-0.0045	0.51	0.0054	0.31	0.0126	0.02	0.0068	0.35
/cut1	1.7429	0.00	1.5817	0.03	2.0904	0.00	2.7623	0.01	0.3664	0.45	1.1807	0.00	2.1538	0.00	1.6959	0.01
/cut2	2.1112	0.00	1.6804	0.02	2.2755	0.00	3.1445	0.00	0.4397	0.37	1.3557	0.00	2.1816	0.00	1.8026	0.01
/cut3	2.1490	0.00	1.7344	0.02	2.5150	0.00	3.7012	0.00	0.5175	0.29	1.4203	0.00	2.2405	0.00	2.9645	0.00
/cut4	2.1885	0.00	2.0043	0.01	2.8836	0.00	4.1285	0.00	0.7946	0.11	1.6510	0.00	2.2717	0.00		
/cut5	2.2303	0.00	2.3290	0.00	3.3736	0.00			1.4215	0.01	2.0012	0.00	2.3378	0.00		
/cut6	2.2745	0.00										2.3730	0.00			
/cut7	2.3215	0.00										2.8510	0.00			
/cut8	2.4776	0.00										3.2275	0.00			
/cut9	2.8175	0.00														
no. obs	125		110		77		89		43		71		160		93	
no. gr	12		8		8		7		4		5		17		10	
Wald	0.02		0.56		0.08		0.04		0.6		0.7		0.02		0.35	

Legend: 3001: Energy; 3002: Basic Materials; 3003: Industrials; 3004: Consumer Cyclical; 3005: Consumer Non-Cyclical; 3006: Healthcare; 3007: Technology; 3008: Utilities; 3009: Real Estate. Source: own calculations.

Table 10. Impact of the ESG Controversies Score on Moody's long-term issuer credit ratings by sector.

Rating	Moody's LT															
	3001		3002		3003		3004		3005		3006		3007		3008	
	Coef.	P > z	Coef.	P > z	Coef.	P > z	Coef.	P > z	Coef.	P > z	Coef.	P > z	Coef.	P > z	Coef.	P > z
CONT	0.0124	0.01	0.0025	0.71	0.0109	0.01	0.0047	0.47	-0.0129	0.27	0.0027	0.57	0.0119	0.04	-0.0042	0.57
/cut1	-6.3375	0.01	-4.0889	0.01	-2.4112	0.00	-4.1953	0.00	-5.8231	0.00	-9.0963	0.02	-7.0615	0.00	-3.2780	0.00
/cut2	-5.5467	0.02	0.8653	0.36	-1.4306	0.01	-2.2960	0.08	-5.4511	0.00	-8.1663	0.03	-5.3700	0.01	-1.8613	0.02
/cut3	0.2981	0.81	3.6261	0.00	-1.2074	0.02	-0.2694	0.84	-3.8978	0.00	-1.4080	0.46	-4.3576	0.02	-0.7774	0.35
/cut4	1.4994	0.22	4.0877	0.00	-1.0442	0.04	2.5835	0.10	-2.8476	0.03	0.3306	0.87	-1.1021	0.43	-0.2212	0.79
/cut5	2.9402	0.02	6.5215	0.00	-0.3398	0.50	5.9070	0.00	-1.8222	0.15	2.2884	0.25	2.7018	0.06	0.2421	0.77
/cut6	5.6855	0.00			0.7161	0.15	6.4585	0.00	-1.0298	0.42	4.4416	0.04	3.1511	0.03	2.0065	0.02
/cut7	7.5906	0.00			1.2760	0.01			-0.8099	0.53	6.8355	0.00	4.4471	0.00	2.3645	0.01
/cut8	7.9739	0.00			2.2738	0.00			3.2029	0.05	8.3659	0.00	6.1020	0.00		
/cut9	8.1569	0.00			3.1147	0.00							9.5633	0.00		
/cut10	8.5746	0.00														
no. obs	118		85		131		73		59		95		96		85	
no. gr	16		15		13		9		8		10		14		12	
Wald	0		0.71		0		0.47		0.27		0.57		0.04		0.58	

Legend: 3001: Energy; 3002: Basic Materials; 3003: Industrials; 3004: Consumer Cyclical; 3005: Consumer Non-Cyclical; 3006: Healthcare; 3007: Technology; 3008: Utilities; 3009: Real Estate. Source: own calculations.

4.2. Financial Indicators Significance during the Corporate Credit Rating Estimation

The last analysis relies on the impact of both the financial ratios and the ESG scores on the credit ratings. Results are presented in Table 11. The findings confirm the significance of the ESG factors, especially in the case of the Fitch long-term issuer credit ratings. This impact is especially important in the case of environmental policies, which have been mentioned before. There are notable differences in the impact of financial ratios and ESG factors compared to models where only ESG measures are considered. This relates to the indirect impact of ESG measures on a company's financial results. The Social Pillar Score loses on the significance. Previous studies about the impact of the S-factor on the cost of debt (Hoepner et al. 2016) suggest that the mentioned indicator is not as important as a few years ago. It is strictly connected with the negative changes in the environmental area and gives attention to regulators on this phenomenon. Studies also prepared for CSR policies, which in practice have analyzed especially the social factors impact on the investor's decisions, showed that the CSR is unimportant for making a decision about allocation capital sources. The corporate governance indicator has a significant impact on the Fitch corporate credit ratings. Previous studies about the influence of corporate governance on firms' performance (Bebchuk and Weisbach 2010; Bhagat and Bolton 2008) suggested a positive correlation with operating performance. Bhojraj and Sengupta (2003) found that corporate governance measures increase ratings that reduce bond yields. On the other hand, commercially available corporate governance indicators do not bring useful information for stakeholders. This opinion presented by Daines et al. (2010) can explain the insignificant impact on the Corporate Governance Pillar Score on the Moody's note.

Table 11. Impact of the ESG factors and financial ratios on Fitch's and Moody's long-term issuer credit ratings.

Rating	Fitch LT				Moody's LT							
	Coef.	P > z	Coef.	P > z	Coef.	P > z	Coef.	P > z	Coef.	P > z	Coef.	P > z
GM	-0.1617	0.00	-0.0086	0.63	-0.0185	0.42	-0.0163	0.76	-0.0324	0.52	-0.0218	0.67
TAX	0.0671	0.00	0.0287	0.08	0.0234	0.06	0.0008	0.82	-0.0003	0.92	0.0007	0.81
ASS	14.0024	0.01	7.7373	0.08	7.3338	0.13	9.5910	0.00	9.1720	0.00	9.3771	0.00
ROA	1.6930	0.00	1.2025	0.00	1.0581	0.00	0.1255	0.64	0.1051	0.63	0.0877	0.71
RET	0.0951	0.12	0.3019	0.44	0.0945	0.47	0.0436	0.16	0.0365	0.09	0.0421	0.08
RINV	0.3699	0.00	0.1620	0.04	0.1817	0.01	-0.0869	0.03	-0.0819	0.03	-0.0887	0.02
CUR	1.4142	0.32	-0.0669	0.96	-0.2456	0.86	-1.4372	0.24	-0.8484	0.58	-1.1025	0.49
IN	-0.1589	0.00	-0.1466	0.00	-0.1174	0.00	-0.0061	0.79	0.0038	0.87	0.0014	0.95
NET	-0.0017	0.14	0.0013	0.14	0.0004	0.64	0.0008	0.86	-0.0019	0.72	0.0008	0.86
DEB	-0.0185	0.03	-0.0125	0.08	-0.0112	0.10	-0.0113	0.00	-0.0109	0.00	-0.0104	0.00
LTD	-0.0989	0.01	0.0133	0.67	0.0407	0.23	-0.0064	0.79	0.0004	0.99	-0.0073	0.79
AR	-0.0390	0.73	0.0504	0.46	0.0389	0.61	0.1501	0.02	0.1322	0.01	0.1537	0.01
INT	0.2188	0.13	0.0648	0.62	0.0921	0.42	-0.4090	0.00	-0.3700	0.00	-0.4442	0.00
FIX	-1.7800	0.01	-0.5117	0.02	-0.5980	0.01	0.2395	0.40	0.1895	0.65	0.1929	0.58
WC	0.0043	0.33	-0.0012	0.63	-0.0016	0.49	-0.0093	0.21	-0.0105	0.35	-0.0110	0.29
ENV	0.0780	0.01					0.0032	0.88				
SOC	-0.0185	0.43					0.0139	0.69				
GOV	0.0579	0.09					0.0165	0.41				
CONT			0.0081	0.57					-0.0097	0.41		
ESG					-0.0384	0.09					0.0207	0.23
/cut1	-3.39	0.27	0.99	0.54	-1.55	0.27	-9.09	0.00	-11.27	0.00	-9.81	0.00
/cut2	-3.25	0.29	1.06	0.51	-1.47	0.30	-8.73	0.00	-10.98	0.00	-9.49	0.00
/cut3	-2.93	0.34	1.21	0.45	-1.29	0.36	-7.71	0.01	-10.14	0.00	-8.53	0.01
/cut4	-2.26	0.45	1.57	0.36	-0.88	0.54	-5.17	0.05	-7.69	0.01	-5.96	0.05
/cut5	-1.21	0.68	2.15	0.19	-0.31	0.81	-3.36	0.16	-5.90	0.04	-4.12	0.15
/cut6	-0.89	0.75	2.40	0.12	-0.10	0.93	-2.30	0.31	-4.91	0.07	-3.05	0.27
/cut7							-1.02	0.64	-3.75	0.16	-1.78	0.51
/cut8							-0.25	0.91	-3.02	0.28	-1.02	0.72
/cut9							2.45	0.30	-0.32	0.90	1.61	0.55
no. obs			163						88			
no. group			22						17			
vce			vce(robust)						vce(robust)			

Source: own calculations.

The prepared analysis suggests that in a long period of time, the negative events presented by the ESG Controversies Score do not have a significant impact on credit ratings. It can be connected for a few reasons. At first, the negative information, according to the perspective theory, has got a stronger negative impact on the utility than a positive one. In practice, the mentioned reaction may be noticed in a shorter period and has a direct impact on the companies' financial condition. The model has used lagged variables; as a result, the negative impact can be included directly in the influence of the financial ratio.

The analysis of financial factors suggests that profitability indicators have a significant impact on Fitch credit ratings. To the analyzed factors belong the gross margin and the effective tax rate. A higher gross margin increases notes and confirms previous studies (Jiang and Packer 2017; Gray et al. 2006; Murcial et al. 2014; Poon and Chan 2008; Fink et al. 2010; Altman 1968; Logue and Merville 1972; Adams et al. 2003; Daniels et al. 2009; Galil 2003). The mentioned relationship is observed only for credit ratings given by Fitch. It is not noticed for Moody's corporate credit ratings. The higher the effective tax rate, the higher the credit ratings. The mentioned relationship was varied in previous analyses (Jiang and Packer 2017; Murcial et al. 2014; Fink et al. 2010). In practice, the high value of the effective tax rate should increase the probability of default. On the other hand, the lowest tax effective rates are in tax heavens. In the mentioned area, the production, mining, and technology sectors are less developed, or there are not located in these areas.

This situation may not be without significance. The received findings suggest that Fitch notes are especially sensitive on the profitability indicators. The trade-off theory suggests a positive correlation between profitability and debts because the high value of debt decreases tax liabilities. As a result, companies that want to minimize the values of taxes invest capital. The mentioned relationship confirms the correlation between the significance of the profitability and leverage ratios. On the other hand, the profitability is negatively correlated with debts (Mac an Bhaired 2010) because financing by cash flows reduce the possibility to receive credit (Degryse et al. 2012; Ching et al. 2011; Sharma and Kumar 2011; Shubita and Alsawalhah 2012; Akoto et al. 2013; Mateev et al. 2013).

The earning power is represented by asset turnover, pre-tax ROA, earnings retention, and reinvestment rate. Fitch long-term issuer credit ratings are sensitive to asset turnover, pre-tax ROA, and reinvestment rate. Moody's ratings are impacted by asset turnover, earnings retention, and reinvestment rate. From the mentioned variables, the strongest impact on the credit rating estimation is asset turnover. It is noticed the positive reaction on the mentioned variable that was suggested in previous studies (Matousek and Stewart 2009; Kumar and Bhattacharya 2006; Kim and Gu 2004). It presents the efficiency with which an entity is using its assets to generate revenue. Return on assets is significant in the case of Fitch notes. The positive reaction of the credit ratings is consistent with previous research (Matousek and Stewart 2009; Kim and Gu 2004; Frey 2013). These two factors were also one of the most important variables accept leverage ratios for the estimation of the credit ratings. It has been confirmed in mentioned studies. The earnings retention and reinvestment rates have got the lower significance during notes estimation. The first of these variables has got the significant impact only for notes given by Moody's. It measures the value of the percentage of the net income that is retained to grow the business. It measures how much money a company is keeping to reinvest in the company's operations. The higher value of financial sources is reinvested, it can create an opinion that the default risk will be lower. As a result, the higher the mentioned ratio, the higher notes received by a company. In the case of the reinvestment rate, the negative impact is noticed only for Moody's notes. The high value of the reinvestment rate can create a reinvestment risk. In practice, the analysis of this factor's significance should be compared with other indicators.

In the case of liquidity indicators, the current ratio and the time interest earned are considered. Only the time interest earned (assessing how many times in a fiscal year a company generates enough operating income to meet its interest payments) has a significant impact on Fitch ratings. Obviously, no company needs to cover its debts several times over to survive. However, the time interest earned ratio is an indication of a company's relative freedom from the constraints of debt. Generating enough cash flow to continue to invest in the business is better than merely having enough money to stave off bankruptcy (Matousek and Stewart 2009; Kim and Gu 2004; Tanthanongsakkun and Treepongkaruna 2008; Frey 2013; Alp 2013). The received findings confirm the opinion presented by Kane et al. (1996), Priego-de-la-Cruz et al. (2020), and Scalzer et al. (2019) because of the low value of the profitability and liquidity levels is the first signal of the business failure. The received findings, data analysis, and methodology review suggest that the significance of the profitability, earning power, and liquidity indicators have been lower during the last two years. It is an effect of changes in the macroeconomic situation connected with the regulation changes. The mentioned relationship confirms Lee et al. (2010) study. They verified the impact of the corporate governance index and financial variables on the default risk and found that a combination of both financial and corporate governance indicators offered better predictions for financial distress. It has not been observed the collinearity between these three groups of variables and ESG measures in the credit ratings estimation models, but it can be connected with the limited sample. It will be worth in the near future to check the mentioned relationship for a longer period. The possible connection between these groups of variables suggested the literature about the impact of the ESG measures on the companies' financial condition.

The next group of indicators is leverage ratios, i.e., the debt to equity ratio, the long-term debt to capital ratio, and the net-debt to EBITDA ratio. Among all these factors, the debt to equity ratio has the most significant impact. High leverage decreases both Moody's and Fitch's credit ratings. The mentioned relationship is confirmed in previous studies (Anand et al. 2016; Gray et al. 2006; Kumar and Bhattacharya 2006; Kim and Gu 2004; Elayan et al. 2003; Alp 2013; Cantor and Packer 1997; Pottier and Sommer 1999; Adams et al. 2003; Poon 2003). The received findings confirm previous analyses for some reasons. At first, the high value of the debt to equity ratio suggests that the company does not have capital buffers to survive in the situation of a change in market conditions, for example, increasing of the interest rates, changes of the investment costs, etc. The high value of credits reduces the possibility of a company's growth (Myers 1977). It is an effect of the repayment of the interests from the cash flows (Sheikh and Wang 2011; Deesomsak et al. 2004; Huang 2006; Bae et al. 2011). Of course, the external form of financing is needed to develop a company, especially if they have a high possibility of growth (De Jong 1999; Chen 2004; Giannetti 2003; Degryse et al. 2012); but the high value of the mentioned variable reduce the creditworthiness. The presented results confirm the significance of the leverage ratios indicators. Because of the rebuilding of the credit policies by banks and by credit rating agencies, it will be within the near future to analyze the collinearity between the ESG measures and the leverage ratios and credit ratings. In the presented model, the mentioned relationship has not been confirmed. It is an effect of the small sample. It can be observed after 2021 when the newest CSRD (Corporate Sustainable Reporting Directive) will be introduced. The previous studies are based mostly on the internal credit ratings presented by banks suggested that ESG-CSR policies have got an impact on the increasing default risk (Zeidan et al. 2015; Grunert et al. 2005; Weber et al. 2010). Because of the impact of the ESG-CSR policies on the CDS spreads, i.e., positive (Menz 2010) or negative (Goss and Roberts 2011), it may be observed in the near future the relationship between the ESG measures and the leverage ratios in some sectors. The presented analysis, at now, suggests that the mentioned leverage ratio has got still a significant strong impact on the credit ratings. This relationship does not differ significantly from the results of the research conducted so far. As it was mentioned before, it can be changed in the near future as a result of the CSRD Directive.

The last group of indicators consists of operating indicators, i.e., the A/R turnover ratio, the inventory turnover, the fixed asset turnover, and the working-capital-to-sales-growth ratio. In the case of Fitch notes, only the fixed asset turnover has a significant impact. This is the revenue divided by the sum of the total net property. This indicator increases credit ratings that confirm previous studies (Kumar and Bhattacharya 2006). Moody's credit ratings are sensitive to the A/R turnover ratio and the inventory turnover. The former is calculated as primary revenue divided by the average total net receivable. This indicator increases credit ratings. The inventory turnover is estimated by the total costs of revenue and the average total inventory. Higher costs decrease Moody's ratings.

Studies prepared by Easley and O'hara (2004) suggested that the relationship between operating indicators and default risk can exist. The reduction in information asymmetry by credit rating agencies could decrease the equity costs. As a result, that can have an impact on decreased debts, as an effect of adopting equities. Dasilas and Papasyriopoulos (2015) also suggested that if the director is also the primary shareholder of the company, they do not want to lose control and are more likely to look for internal resources. In practice, the mentioned situation is connected with the company's growth, which represents the operating indicators. The higher the sales revenue, the faster company is growing. If a company has got the possibility for growth, it is more interested in finding financial sources on new investment and has got two possibilities to receive it, by increasing the equity and receiving capital from stakeholders or borrowing it from banks or capital market.

The presented analysis leads to some conclusions from the study. At first, it is observed different significance between particular ESG measures. E-factors will be the most important variables when S-factors lose significance. There are noticed differences in the

profitability, earnings power, and liquidity indicators. The leverage ratios are still the most important factors in the assessment of credit ratings. The received findings have been compared with previous analyses, but in the near future, when the sample will be bigger, it should be prepared the model with the division before and after the CSRD directive. Next, because of the Directive may be observed differences in the assessment method and models used by banks and also credit rating agencies. As a result, it maybe will be noticed collinearity between ESG measures and financial indicators, which is not observed in this research. The significance of the particular variables, also ESG measures may also vary. A problem that is noticed is connected with the quality of the ESG factors. We still observed that, for example, companies from the energy sector that emit carbon dioxide had a the high value for the ESG indexes.

5. Conclusions

The aim of the study was to examine the impact of environmental, social, and governance (ESG) measures on credit ratings given to non-financial institutions by the two largest credit rating agencies according to economic sector divisions. The hypotheses are as follows: a strong negative impact on non-financial institution credit rating changes resulted from ESG risk changes. The reaction of the credit rating changes varied in different sectors. Panel event models were used to verify the hypotheses. The results confirm the significant impact of ESG factors on credit ratings. Analyzed credit rating agencies modified their methodologies that were used some years before and started verifying the impact of ESG measures during assessment credit ratings. The strength of the impact varies for particular credit rating agencies. This is obvious because each credit rating agency has its own methodology. If we compare the significance of the mentioned factors, more sensitive on the ESG measures are notes given by Fitch than Moody's. The most important factor is the environmental measure. The increasing role of the E-factors confirms studies prepared by [Jang et al. \(2020\)](#). Social responsibility loses relevance. Not without significance is the impact of the information published by companies themselves but also the negative events on credit rating estimation. The received findings confirm the opinion of some studies about using the ESG policies to create a reputational risk and improve their opinion in society ([Goss and Roberts 2011](#); [Jang et al. 2020](#)). The received findings also confirm the impact of the ESG measures on the estimation of default risk. Credit rating agencies put attention on the mentioned factors, at least during the assessment of credit ratings.

Sectors react differently to ESG scores. The most sensitive are the energy, industrial (on social responsibility), materials, and utility sectors. This is strictly connected to regulations related to pollution reduction as well as energy and water conservation. The importance of the ESG measures in the estimation of credit ratings is also connected with decisions presented by the main investment funds about reduction or even going out from investments in securities of entities that present high carbon emission policy. A few years ago, already in studies prepared by [Revelli \(2017\)](#) and [Revelli and Viviani \(2015\)](#) and [Miralles-Quirós and Miralles-Quirós \(2017\)](#), the importance of ESG indicators in making investment decisions was suggested. Changing regulations about savings water or low CO₂ emission creates the need to rebuild the default risk models by credit rating agencies. Financial factors are also integrated with ESG measures. The presented results are opposite to previous studies ([Friede et al. 2015](#); [Orlitzky et al. 2003](#)). It shows how the significance of the ESG measures has been changed during the last years. Company notes are sensitive to negative events connected to the environment, social, and governance pillars. The same as in the previous studies, the most significant are factors connected with the earnings power and leverage ratios.

The presented findings might interest investors and researchers. For investors, models that measure credit risk and the probability of defaults are more accurate when using ESG measures, which can lead to more effective risk management and can create higher profits from investments. Investor reputation and regulatory requirements may direct investors' attention towards high ESGs (e.g., [Franklin 2008](#)). This can lead to lower capital costs for

these firms and, consequently, higher asset values and lower credit spreads (e.g., [Chava 2014](#)). This study can also help to investigate the risk connected to natural disasters or changes in regulations (i.e., [Renneboog et al. 2008](#)). It also confirms the significance of the E-factors in assessing the default risk measures by credit ratings. Next, the received findings can be useful for financial institutions because they present some new points of view on the impact of ESG measures on credit and default risk. Most financial institutions are in the process of rebuilding their credit and default risk assessment methods. The described findings can be a tip in the classification of the significant variables and their importance in the assessment of the mentioned risks. The next group of receivers of the presented results is supervisory institutions and regulators. They can be used to categorize the significance of the mentioned phenomenon in particular sectors and assess the risk of rebuilding portfolios by investors.

The presented study has a few limitations. The received findings were prepared for a short period of time, and additional studies with longer periods of analysis are required. It will help to find reasons for some connections. In the presented analysis, it was impossible to prepare models for the impact of macroeconomic, financial, and ESG measures for particular sectors. It was strictly connected with too small a number of observations and the low volatility of credit ratings. Next, it will be good to verify the significance of the impact of the ESG measures changes before, during, and after the COVID-19 pandemic on credit rating changes in particular sectors. A small part of this analysis will be presented in a separate paper, prepared for the main sensitive sector on the ESG policy, i.e., the energy sector and its subsectors. This analysis will help to verify the attitude of credit rating agencies to ESG regulations.

Researchers and other interested institutions should remember that ESG measures are still not the greatest predictors of ESG risk. The huge companies with a very large value of assets are still high indexed in popular ESG indexes, even if there are not on the top of the institutions that are using ESG policies in practice. As a result, it still exists the need to develop this research area.

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Appendix A. Description of Financial Factors

Variable Name	Description	Abbreviation
Profitability		
Gross Margin	This item is calculated as Gross Profit (Industrial and Utility) for the fiscal year divided by Primary Revenue for the same period and multiplied by 100.	GM
Effective Tax Rate	This value is Total Income Tax for the fiscal year divided by the same period's Income Before Taxes and is expressed as a percentage.	TAX
Earning Power		
Asset Turnover	The amount of revenue generated for each unit of assets, also known as TAT. It is calculated as Primary Revenue for the fiscal year divided by the Average Total Assets for the same period.	ASS
Pretax ROA	This item represents the return on assets before taxes. It is calculated as Income Before Tax for the fiscal year divided by the Average Total Assets for the same period and is expressed as a percentage.	ROA

Variable Name	Description	Abbreviation
Earnings Retention	This is a ratio of Retained Earnings to Income Available to Common Excluding Extraordinary Items for the fiscal year and expressed as a percentage.	RET
Reinvestment Rate	This ratio is calculated by dividing Retained Earnings for the fiscal year by the average Common Shareholders Equity for the same period and is expressed as a percentage. Retained Earnings refer to the Income Available to Common Excluding Extraordinary Items minus Gross Dividends (Common Stock).	RINV
Liquidity		
Current Ratio	This is the ratio of Total Current Assets for the fiscal year divided by Total Current Liabilities for the same period. This item does not distinguish between current and long-term assets and liabilities.	CUR
Time Interest Earned	Measures the number of times within a fiscal year the company generates enough operating income to meet its interest payments. It is calculated as Earnings Before Interest and Taxes for the fiscal year divided by Interest Expense for the same period.	IN
Leverage		
Debt/Equity	This is the ratio of Total Debt as of the end of the fiscal year to Common Shareholders Equity for the same period and is expressed as a percentage. Not available for Banks.	DEB
LT Debt/Capital	This is the ratio of Long-Term Debt divided by Total Capital at the end of the fiscal year and is expressed as a percentage. Total Capital is the sum of Total Equity, Total Debt, and Minority Interest.	LTD
(Total Debt-Cash)/EBITDA	This is the average Net Debt divided by the EBITDA for the fiscal year. EBITDA is EBIT for the fiscal year plus the same period's Depreciation and Amortization expenses.	NET
Operating		
A/R Turnover	This item measures the number of times receivables are cycled through in a given period. It is calculated as Primary Revenue for the fiscal year divided by the Average Total Net Receivables for the same period.	AR
Inv Turnover	This is the ratio of Total Cost of Revenue for the fiscal year to the average Total Inventory for the same period.	INT
Fixed Assets Turnover	The amount of revenue generated for each unit of fixed assets. It is calculated as primary revenue for the fiscal year divided by the sum of Total Net Property, Plant and Equipment, and Total Net Utility Plant for the same period.	FIX
WC/Sales Growth	This is the change in Working Capital to Sales for the fiscal year.	WC

Source: own elaboration.

Appendix B. Sector Description

Name of Sector	Name of Subsectors
Energy	Oil and Gas Drilling, Oil and Gas Transportation Services, Oil Related Services and Equipment, Integrated Oil and Gas, Oil and Gas Exploration and Production, Oil and Gas Refining and Marketing, Coal, Renewable Energy Equipment and Services, Renewable Fuels, Uranium
Basic Materials	Agricultural Chemicals, Commodity Chemicals, Diversified Chemicals, Specialty Chemicals, Construction Materials, Diversified Mining, Mining Support Services and Equipment, Specialty Mining and Metals, Gold, Aluminum, Iron and Steel, Non-Gold Precious Metals and Minerals, Non-Paper Containers and Packaging, Paper Packaging, Forest and Wood Products, Paper Products
Industrials	Electrical Components and Equipment, Heavy Electrical Equipment, Heavy Machinery and Vehicles, Industrial Machinery and Equipment, Shipbuilding, Aerospace and Defense, Business Support Services, Business Support Supplies, Commercial Printing Services, Employment Services, Environmental Services and Equipment, Professional Information Services, Diversified Industrial Goods Wholesale, Construction and Engineering, Airport Operators and Services, Highways and Rail Tracks, Marine Port Services, Airlines, Passenger Transportation, Ground and Sea, Courier, Postal, Air Freight and Land-based Logistics, Ground Freight and Logistics, Marine Freight and Logistics
Consumer Cyclical	Auto and Truck Manufacturers, Auto, Truck and Motorcycle Parts, Tires and Rubber Products, Recreational Products, Toys and Children's Products, Appliances, Tools and Housewares, Home Furnishings, Construction Supplies and Fixtures, Homebuilding, Apparel and Accessories, Footwear, Textiles and Leather Goods, Advertising and Marketing, Broadcasting, Consumer Publishing, Entertainment Production, Casinos and Gaming, Hotels, Motels and Cruise Lines, Leisure and Recreation, Restaurants and Bars, Apparel and Accessories Retailers, Auto Vehicles, Parts and Service Retailers, Computer and Electronics Retailers, Home Furnishings Retailers, Home Improvement Products and Services Retailers, Miscellaneous Specialty Retailers, Department Stores, Discount Stores
Consumer Non-Cyclical	Fishing and Farming, Food Processing, Tobacco, Brewers, Distillers and Wineries, Non-Alcoholic Beverages, Household Products, Personal Products, Personal Services, Drug Retailers, Food Retail and Distribution, Consumer Goods Conglomerates
Healthcare	Healthcare Facilities and Services, Advanced Medical Equipment and Technology, Medical Equipment, Supplies and Distribution, Biotechnology and Medical Research, Pharmaceuticals
Technology	Integrated Telecommunications Services, Computer Hardware, Household Electronics, Phones and Handheld Devices, Office Equipment, Electronic Equipment and Parts, Communications and Networking, Semiconductor Equipment and Testing, Semiconductors, IT Services and Consulting, Online Services, Software, Blockchain and Cryptocurrency, Financial Technology (Fintech), Miscellaneous Educational Service Providers, Wireless Telecommunications Services
Utilities	Multiline Utilities, Water and Related Utilities, Natural Gas Utilities, Electric Utilities, Independent Power Producers

Source: own elaboration.

Note

¹ Variables are described in the Appendix A.

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