ANNA CHMIELEWSKA,[a] KRZYSZTOF KLUZA[b]

ESG RISK RATING AND COMPANY VALUATION: THE CASE OF THE WARSAW STOCK EXCHANGE

RATING RYZYKA ESG A WYCENA SPÓŁEK GIEŁDOWYCH NA WARSZAWSKIEJ GIEŁDZIE PAPIERÓW WARTOŚCIOWYCH

This research investigates whether investors on the Warsaw Stock Exchange are willing to pay a premium to invest in large companies with a relatively more favourable environmental, social and governance (ESG) risk profile. The theory is that lower exposure to ESG risks and better ESG risk management practices are perceived by investors as a signal of potentially lower financial uncertainty and improved ability of companies to grow future earnings. The analysis was conducted for companies included in the mWIG40 and WIG20 indices. The relationship between market ratios reflecting company valuation, such as price to net book value and enterprise value to EBITDA, and their ESG risk ratings was modelled using regression models. Those were estimated using ordinary and generally least squares techniques. Although ESG management practices are still at a relatively early stage of implementation in Central Europe (including Poland), the results of the analysis confirm a strong negative relationship between the severity of ESG risks and the relative valuation of the company, accompanied by the existence of significant valuation differences across industries. Of particular note is the impact of a favourable ESG risk rating on a higher Enterprise Value to EBITDA ratio. This ratio is important because it is very often used as a valuation basis in corporate buy-sell transactions. The research confirms that investors are willing to pay more for companies that have built business models that are less vulnerable to future ESG risks and have a quality management culture. As a result, the research provides evidence that consciously investing in climate risk mitigation and improving corporate governance practices in large companies pays off for shareholders.

Keywords: ESG; environmental reporting; corporate valuation; risk; rating
JEL: G32, G11, G12

———

Celem badania jest weryfikacja, czy inwestorzy na Giełdzie Papierów Wartościowych w Warszawie są skłonni płacić premię, inwestując w duże spółki o relatywnie korzystniejszym profilu ryzyka środowiskowego, społecznego i zarządczego (ESG). Literatura przedmiotu dostarcza argumentów, że istnieje istotna zależność pomiędzy poziomem ryzyk ESG, jakością zarządzania nimi a wyceną firm oraz ich wynikami finansowymi. Mniejsza skala ryzyk ESG oraz lepsza jakość zarządzania tymi aspektami pozwalają inwestorom spodziewać się ograniczenia niepewności, natomiast

[a] SGH Warsaw School of Economics, Poland / Szkoła Główna Handlowa w Warszawie, Polska
achmiel3@sgh.waw.pl, https://orcid.org/0000-0002-7586-081X
[b] SGH Warsaw School of Economics, Poland / Szkoła Główna Handlowa w Warszawie, Polska
kkluza@sgh.waw.pl, https://orcid.org/0000-0002-2792-8234

raportowanie ESG uzupełnia lukę informacyjną oraz zmniejsza asymetrię informacji i koszty agencyjne. Badanie zostało przeprowadzono dla spółek wchodzących w skład indeksów mWIG40 i WIG20. Zależność pomiędzy ich wskaźnikami wyceny rynkowej, takimi jak cena do wartości księgowej netto i wartość przedsiębiorstwa do EBITDA, a ratingami ryzyka ESG oszacowana została za pomocą modeli regresji, oszacowanych klasyczną i uogólnioną metodą najmniejszych kwadratów. Choć praktyki zarządzania ryzykami ESG w Europie Środkowej (w tym w Polsce) znajdują się na stosunkowo wczesnym etapie wdrożenia, wyniki analiz potwierdzają silną negatywną zależność pomiędzy dotkliwością ryzyk ESG dla spółki a względną rynkową wyceną spółki, przy występowaniu zarazem znaczących różnic w wycenach pomiędzy branżami. Na szczególną uwagę zasługuje wpływ posiadania korzystnego ratingu ryzyka ESG na wyższy wskaźnik EV/EBITDA (wartość przedsiębiorstwa w relacji do zysku operacyjnego powiększonego o amortyzację), gdyż wskaźnik ten jest bardzo często stosowany jako podstawa wyceny w transakcjach kupna-sprzedaży przedsiębiorstw. Badanie potwierdza, że inwestorzy są skłonni zapłacić więcej za spółki, które zbudowały modele biznesowe mniej podatne na przyszłe ryzyka ESG oraz posiadają wysokiej jakości mechanizmy zarządzania. W rezultacie badanie dostarcza argumentów na rzecz tezy, że świadome inwestowanie w zarządzanie ryzykami środowiskowymi oraz doskonalenie praktyk ładu korporacyjnego w spółce przynosi wymierne korzyści finansowe dla akcjonariuszy.

Słowa kluczowe: ESG; raportowanie środowiskowe; wycena przedsiębiorstw; rating; ryzyko
JEL: G32, G11, G12

I. INTRODUCTION

With growing awareness of the likelihood of climate crises and their potential short- and long-term consequences, companies are increasingly scrutinizing their operations. Recent years have shown that the impact of climate risks on business can be massive. This is reflected in, among other things, the increasing frequency of physical risks as the number of extreme weather events rises (Scatigna et al., 2021, pp. 86–87), and the growing awareness of environmental, social and governance (ESG) issues, with the number of ESG issues mentioned in earnings calls more than doubling over the past five years.

Growing awareness is also reflected in the increasing number of companies that are incorporating ESG issues into their reporting and risk management processes, often on a voluntary basis. An IFAC survey of 1,350 large companies suggests that around 95% of them already include ESG issues in their regular reporting, with two-thirds seeking external certification (IFAC, 2023, p. 2). The Sustainability Accounting Standards Board (SASB) standards and the Task Force on Climate-Related Financial Disclosures (TCFD) model remain the most popular implementation frameworks. With more obligatory reporting and with ESG factors playing an increasingly important role in corporate strategy, it is not surprising that stock market investors are taking them into account in their investment decisions.

The corporate finance literature has already incorporated ESG issues into the general theory of shareholder value and stakeholder theory (Hart & Zingales, 2017, pp. 247–275). While the former focuses on the tangible monetary value enhancement associated with ESG management, the latter builds more

on the company's non-financial objectives and the context of corporate and social responsibility. While the early implementation of ESG policies appeared to follow the latter approach, there is growing empirical evidence that the quality of ESG management and reporting can be an incremental value driver. This paper aims to examine whether ESG issues can be translated into higher company valuations in the context of the Polish stock market.

From an investor's perspective, the easiest way to assess a company's exposure to climate risks and management's approach to them is through the company's ESG reporting and ESG ratings. Consequently, data on the company's ESG rating is used as a proxy for ESG practices. The paper provides early evidence that even in the economy that is lagging behind the global green transition agenda, ESG issues are already playing a role in company valuation.

The paper is structured as follows. The first section places the proposed research in the context of selected other theoretical and empirical research on the topic. The second section discusses the choice of ESG rating and research focus. Section three describes the methodology used in this research. The remaining sections present the findings and conclusions, as well as areas for further research.

II. LITERATURE REVIEW

As stated above, this paper aims to validate the impact of ESG aspects on companies' financial performance and consequently on their valuation on the Warsaw Stock Exchange. This research focus seems to be well founded in both the theoretical and empirical literature. The literature on ESG aspects in corporate finance provides increasingly solid evidence that there is a significant link between the level of ESG-related risks, the quality of their management and the company's valuation and financial results.

While there is a parallel stream of literature that places ESG in the context of companies' non-financial objectives (Ioannou & Serafeim, 2012, p. 836), the authors believe that the stock market investor's perspective fits better with the 'value-driven' theory, in which management is rewarded for, and thus focused on, achieving the best financial results, with potentially other objectives (including corporate and social responsibility) providing a more complex set of tools to achieve the desired financial outcomes. The key advantage of this perspective lies in the opportunity to analyse a company's decision-making process based primarily on value enhancement. Hence, it justifies an attempt to de facto assign a monetary value to non-financial aspects, including – in this particular case – ESG aspects. Doing so could assist in making decisions towards implementing a stricter ESG framework.

The theoretical literature (see, e.g. Giese et al., 2019, pp. 80–82) identifies several channels through which ESG issues may affect company valuation. By far the leading role can be attributed to the fact that ESG management

undoubtedly increases a company's awareness of climate risks. It is therefore seen as an additional source of information that, if used wisely, should lead to better forecasting of related changes and thus limit the unintended impact of such risks on the volatility of the company's results. At the same time, ESG reporting contributes to increased transparency of ESG risks and opportunities, thereby reducing agency costs and the information gap between the company and its stakeholders. Both of these aspects lead to reduced uncertainty about the company's results (the former in absolute terms and the latter in the perception of investors), which shall have a positive impact on the risk-return profile and should therefore contribute positively to the company's valuation.

These are the most obvious, but not the only, channels of ESG influence. Another important one is the classic cost argument. It can be argued that adopting a more rigorous ESG approach leads to a reduction in the company's costs that more than offsets the associated governance costs (Nurn & Tan, 2010, pp. 360–371). Such cost reduction can typically be attributed to the optimization of various environmental payments. The cost reduction is reinforced by the improved ability to avoid environmental penalties and other costs associated with changes in ESG regulation (Henisz et al., 2019, p. 4).

There is also extensive scholarly literature arguing that adopting ESG approach can also lead to better investment selection or strategy adjustments. This is well reflected in one of the most commonly used ESG frameworks, in line with the TCFD recommendation. In a nutshell, the TCFD approach requires companies to look both at the risks and costs related to the ESG factors and also consider opportunities that climate change creates. It calls for regarding ESG governance as part of the wider company strategy, rather than as treating it as element of risk. This in turn has an impact on the long-term revenues and profitability of companies, making the strategy more appropriate and therefore more profitable in the context of climate change. This translates into positive implications for capital allocation (Kempf & Osthoff, 2007, pp. 908–922; Riding & Mooney, 2020, p. 1).

From a purely financial perspective, there is also growing evidence that companies with a sound ESG approach can achieve a lower weighted cost of capital. This is linked to the growing commitment of investors and financiers to green or sustainable finance, which entails that projects and companies that are in line with the sustainable economy model have greater financing opportunities and availability of external finance compared to those that are highly exposed to ESG risks or do not have adequate ESG processes in place (El Ghoul et al., 2011, pp. 2388–2406).

The literature has also identified other channels of potential positive influence of better ESG profile on the financials of the company. In particular, an improvement in the company's reputation among its customers, employees, business partners and other stakeholders (Carroll & Shabana, 2010, pp. 85–105). Many papers (see, e.g. Grant, 2008, pp. 108–124; Weber, 2008, pp. 247–261) also argue for a reduction in information asymmetries, while several point to increased employee engagement, which can translate into higher productivity and quality, as well as increased customer loyalty (Xie et al., 2017, pp. 26–39).

A comprehensive ESG approach puts companies at the forefront of innovation (Carrasco-Monteagudo & Buendía-Martínez, 2013, p. 295). There is also some evidence that increased ESG reporting leads to a so-called positive feedback loop, as stakeholders are incentivized to provide feedback, which can then lead to improvements in the company's practices (Sulkowski, 2021, p. 1). Finally, there is the argument that implementing ESG practices positions companies better in international value chains (Schiller, 2018, p. 2) – a factor that may be important from the perspective of a relatively small economy.

The empirical verification of the impact of ESG on corporate financial performance remains quite extensive. An interesting review article by Friede et al. (2015, pp. 210–233) found that over 90% of the 2,200 research articles did not document a negative impact of ESG, while a significant majority actually confirmed a positive relationship. However, both this and other review articles point to significant differences in the methodology of the underlying research.

While at first glance all of the research included in these studies analyses the relationship between ESG characteristics and financial performance, there are fundamental differences even when looking only at the measure of ESG used in the papers. In general, one can distinguish between empirical work that focuses on analysing the link between companies' financial performance and ESG risks:

– The overall level of ESG risks to which the business model of that company is exposed. This would either look at some industry characteristics (SIC-based research) or environmental KPIs (such as the level of emissions) as focus variables.

– The quality of ESG management, proxied by certifications obtained or environmental risk ratings. A good example is research on green bond premiums for issuers, using the MSCI KLD index as a proxy for ESG standards (Bauer & Hann, 2010, pp. 1–44).

– The level of ESG awareness and transparency, where the proxy is either the quality of environmental reporting or inclusion in sustainability indices.

The research also varies in scope. While there are many empirical studies of German (Verbeeten et al., 2016, p. 1359), UK (Li et al., 2018, p. 60) or US (Fatemi et al., 2018, p. 45) companies, there are also analyses of less developed local markets (e.g. Africa) or specific industries (Al-Hyari & Kolsi, 2021, p. 1). While the overall results tend to be relatively consistent (and demonstrate ESG awareness as a company value driver), local research can provide a better understanding of the nature of the impact.

To this end, empirical research on the impact of ESG factors on stock market valuation remains particularly fragmented in Central Europe, and especially in Poland, where companies have been relatively late in adopting ESG practices compared to more advanced economies. The results so far have been mixed. Most of the research on the relationship between ESG practices and company value in Poland focuses on reporting requirements or the cost of capital (i.e. existence of the so-called greenium). Regarding the former, several authors, including Czaja-Cieszyńska and Kordel (2023, pp. 1–2), Czerwińska and Kaźmierkiewicz (2022, pp. 211–248), Janicka and Sajnóg (2022,

pp. 1–2), conclude that there is a positive correlation between ESG reporting practices and company valuation, while Jędrzejka (2014, pp. 1–2) does not find a strong counterargument. Similarly, research by Tarczyńska-Luniewska et al. (2022, pp. 259–260) struggles to provide a strong argument in favour of implementing ESG practices. A comparative analysis by Baran et al. (2022, pp. 1–3) showed significant differences even within a small sample of companies. Several studies (incl. Gawęda, 2022, pp. 91–104) took a sectoral rather than a cross-sectoral approach. On the green premium, Liberadzki et al. (2022, pp. 1–12) provided some evidence based on case studies, while Jabłecki (2023, pp. 45–47) confirmed a slightly lower cost of funding on a larger sample. Research led by Hadaś-Dyduch et al. (2022, pp. 1–3) outlined similarities between Poland and the Vishegrad countries.

Consequently it can be concluded that empirical research in this field is still relatively underdeveloped and that there is still a clear research gap in this area.

III. ESG RISK RATINGS AND RESEARCH HYPOTHESIS

The authors of this paper contribute to empirical research at the local level. The aim of the analysis is to validate the extent to which a company's ESG approach is reflected in its stock market valuation.

Given the relatively diversified pool of companies on the Warsaw Stock Exchange and the fact that different sectors differ significantly in terms of ESG reporting requirements and severity of the consequences of the climate risk, the authors decided to focus on overall ESG risks and risk management rather than disclosure aspects. In this respect, the authors have chosen to use the Sustainalytics risk rating. This rating captures both 'exposure to material industry-specific ESG risks and an issuer's management of these risks' (Sustainalytics, 2021, p. 9), which has the advantage of combining the absolute severity of the ESG risks inherent in the company's business model with governance on ESG issues, which can help companies to differentiate themselves positively, especially on a relative basis. The use of sustainability ratings to measure stock market sensitivity to ESG risks is not a new concept. Similar studies have been conducted in other markets, notably the US (Glück et al., 2002, p. 1).

The rating chosen for this research is the Sustainalytics rating. It is a two-dimensional measure designed to capture the balance between overall exposure to material ESG risks and the management of those risks. The first step of the methodology involves identifying the key ESG risk factors affecting a given sub-sector and assessing the company's vulnerability to these specific factors (known as beta indicators) across four key layers (products, financials, events and geography). Based on this, an assessment is made of the extent to which these ESG risks can be managed by the company. The next step is to review the company's management approach to assess the extent to

which such risks are managed in practice. This allows for the quantification of unmanaged risks, consisting of (i) unmanageable risks and (ii) management gaps in addressing manageable risks. The final rating score is calculated 'as the sum of the unmanaged risk scores of each material ESG issue' (Sustainalytics, 2021, p. 12). This sustainability risk measure is regularly updated. The review process includes an annual review of the industry exposure, a review of the selection of indicators and their weighting, and an annual review of the companies assessed. This is further validated by additional quality checks and a company feedback process, which is mainly aimed at filling information gaps (Sustainalytics, 2021, p. 14).

In this study, the authors formulate a hypothesis that ESG ratings provide a robust proxy that could help to illustrate the net effect of the 'discount' in company valuation linked to the overall level of ESG risk exposure, with some 'premium' offered to those who can best manage these risks. Expecting the risk exposure effect to prevail, the authors formulate the hypothesis that *there is a relationship between the level of ESG risk and the value of a company. The more favourable the ESG risk rating, the higher the market valuation of the company.*

IV. DATA AND METHODOLOGY

The study analysed whether a relationship exists between ESG risk ratings and the valuation of large Polish companies listed on the Warsaw Stock Exchange (WSE). The study covered the largest companies listed on the WSE (included in the WIG20 and mWIG40 indices) for which ESG risk ratings were available. A total of 60 companies were analysed.

Four models using typical measures of company market value as dependent variables were estimated. These were the P/E ratio, the P/BV ratio, the P/EBIT ratio and the EV/EBITDA ratio (see Table 1 for a description of the variables).

The ESG risk rating developed by Morningstar Group's Sustainalytics was used as an explanatory variable ('Rating'). It is worth noting that this rating defines the overall level of ESG risk that a company is exposed to (both the unmanageable risk and the risk that the company's management is able to manage effectively but has not taken appropriate action [the so-called management gap]). As such this rating is a reflection of the quality of the company's management of ESG issues, as well as the minimization of costs and maximization of benefits that ESG factors may cause in the future. Higher values of this rating indicate a higher level of ESG risk (worse rating) and lower values indicate lower risk (better rating) – see Sustainalytics (2021, pp. 9–11).

Given that an important part of the risk rating is the unmanageable risk, which varies most depending on the sector in which a company operates, we have introduced 0-1 variables in the models to denote three key sectors, given their abundance in the WIG20 and mWIG40 indices (covering more than 40%

of the companies analysed) and specific valuation levels. The sector of IT and software companies (including the sub-sector of gaming) included 10 companies, the sector of banks included 9 companies and the sector of oil, mining and chemicals included 7 companies. No other control variables were used in the modelling in order to reduce the risk of spurious correlations or other phenomena that may artificially increase the fit of the model. The econometric modelling has been carried out with the use of Gretl (version 2023b) software.

Table 1

Variables used in the study

Variable	Description	Data source
Rating	ESG risk rating prepared by Morningstar Sustainalytics	Sustainalytics
PBV	P/BV ratio: share price to book value per share	Biznesradar.pl
PE	P/E ratio: share price to earnings per share	Biznesradar.pl
PEBIT	P/EBIT ratio: share price to earnings per share	Biznesradar.pl
EVE	EV/EBITDA ratio: Enterprise Value (market capitalization + interest bearing liabilities – cash) to EBITDA	Biznesradar.pl
Bank	Dummy variable: 1 for banks, 0 otherwise	Biznesradar.pl
oil_gas_mining	Dummy variable: 1 for companies from oil, & gas, mining & metal and chemical sectors, 0 otherwise	Biznesradar.pl
IT_Software	Dummy variable: 1 for IT & software companies, 0 otherwise	Biznesradar.pl

Source: the authors' elaboration.

All data used in the research was extracted in July 2023. The market ratios used were calculated on the basis of the financial results available after Q1 2023: they included the 12-month results for the period from Q2 2022 to Q1 2023. Table 2 presents descriptive statistics for the data extracted for this study.

Table 2

Basic descriptive statistics

Variable	Rating	PBV	PE	PEBIT	EVE
Mean	25.31	3.28	85.50	18.42	11.68
Median	23.65	1.79	12.23	8.27	7.78
Minimum	10.40	0.13	0.65	0.53	0.07
Maximum	54.80	21.23	3081.00	340.12	96.55
Standard deviation	9.95	3.87	423.13	46.82	16.65
Coeff. of variation	0.39	1.18	4.95	2.54	1.43
Skewness	0.74	2.55	6.89	6.25	3.77
Ex. kurtosis	0.22	7.85	46.23	39.99	15.01

Table 2 (*continued*)

Variable	Rating	PBV	PE	PEBIT	EVE
5% percentile	10.95	0.27	1.75	1.30	1.06
95% percentile	44.42	10.28	298.31	57.29	53.04
Q3-Q1 range	14.68	3.09	17.86	10.52	7.70
Missing observations	0	0	7	6	11[a]

[a] EVE (EV/EBITDA) ratio is not applicable for banks, hence the higher number of missing observations.

Source: the authors' calculations.

The data in Table 2 show that for some indicators there is a large difference between the mean and the median, accompanied by a high value of the coefficient of variation. Therefore, in the next step the elimination of outlying observations was carried out for the above group of indicators. The approach used was to identify outliers as those that do not fall within the range: Mean +/– 3*Standard deviation. As a result of this procedure, three additional observations were removed, one for each of the indicators: PE, PEBIT and EVE.

The variables were then used in logarithmic form for modelling. Descriptive statistics for the logarithmized variables are presented in Appendix (Table A1). The logarithmization of the variables was done to overcome the problems of non-normal distribution of the residuals in the models.

The preliminary analysis of the data showed promising results, in line with the hypothesis to be tested. The correlation analysis revealed a moderate negative correlation between the ESG risk rating and individual stock market indicators (in logarithmic form), as shown in Table 3. The problem of collinearity of variables was not detected in the proposed models (see the results and discussion section).

Table 3

Correlation between the variables

Variable	Ln_PBV	Ln_PE	ln_PEBIT	lnEVE
ln_Rating	−0.4058	−0.3251	−0.3395	−0.3316

Source: the authors' calculations.

Consequently, four models were analysed. Each model has the following functional form:

$$\text{Ln}(Ratio)_I = a + \beta \cdot \text{Ln}(Rating)_i + \Gamma \cdot SECTOR_i + \varepsilon_i,$$

where: *Ratio* – the dependent variable, such as PBV, PE, PEBIT, EVE ratios in each of the four models; *Rating* – the independent variable representing the ESG risk rating score (obtained from Sustainalytics); *SECTOR* – a set of three

dummy variables representing the specific sectors (Banks, IT & Software, Oil & Gas & Mining & Chemicals); i – denotes the i-th company (observation); $α$, $β$, $Γ$ are the regression coefficients ($Γ$ is a set of three coefficients for the respective dummy variables) and $ε$ is the error term.

Note: For the dependent variable EVE, only two sector dummies are considered. The EV/EBITDA ratio does not apply to banks.

The modelling was initially carried out using ordinary least squares (OLS). The results were encouraging as they supported the research hypothesis, however, all the models except the one with the EV/EBITDA dependent variable were characterized by heteroskedasticity of the variance of the error term (see results of OLS modelling in Appendix, Table A2), which can lead to biased coefficient estimators.

As a consequence, the generalized least squares (GLS) method was applied, which is the standard approach to remove the changing variance of ε that violates OLS assumptions (Greene, 2003, pp. 201–211). GLS models have been calculated for PBV, PE, PEBIT variables based on the method of Swamy and Arora (1972, pp. 261–275), which is a standard method used in Gretl software.

V. RESULTS AND DISCUSSION

The models obtained using the GLS method and the one estimated for EVE using the OLS method support the research hypothesis of a positive impact of a favourable ESG risk rating on the company's market value.

Below are two models with relatively best-fitting coefficients and favourable test statistics:

– Model 1 for PBV (Price to Book Value) calculated using the GLS method – see Table 4,

– Model 2 for EVE (Enterprise Value to EBITDA) calculated using OLS – see Table 5.

The remaining models, calculated first by OLS and then by GLS, are presented in Appendix (Table A2 and Table A3).

Table 4

Model 1 – relationship between ESG risk rating and P/BV ratio.
GLS estimation (heteroskedasticity correction); dependent variable ln_PBV; no. of obs. = 60

Variable	Coefficient	Std. error	*t*-ratio	*p*-value
Const	2.85487	1.06203	2.6881	0.00949 ***
ln_Rating	−0.653148	0.34466	−1.8951	0.06335 *
Bank	−0.59293	0.215382	−2.7529	0.00799 ***

Table 4 (*continued*)

Variable	Coefficient	Std. error	*t*-ratio	*p*-value
oil_gas_mine	−0.583298	0.293989	−1.9841	0.05225 *
IT_Software	0.379729	0.439018	0.8650	0.39082
R-squared	0.244265	Adjusted *R*-squared		0.189303
F(4, 55)	4.444219	*p*-value (F)		0.003488
Log-likelihood	−119.0808	Akaike criterion		248.1616
Schwarz criterion	258.6334	Hannan-Quinn		252.2577
Norm. distr. of resid.: Chi-sqr(2)	0.0533445	*p*-value		0.97368
Variance Inflation Factors:	ln_Rating: 1.190	bank: 1.108	oil_gas_mine: 1.140	IT_Software: 1.141

Source: the authors' calculations.

Table 5

Model 2 – relationship between ESG risk rating and EV/EBITDA ratio.
OLS estimation; dependent variable ln_EVE; no. of obs. = 48

Variable	Coefficient	Std. error	*t*-ratio	*p*-value
Const	3.60691	0.860469	4.1918	0.00013 ***
ln_Rating	−0.533971	0.290424	−1.8386	0.07273 *
oil_gas_mine	−0.666591	0.335687	−1.9857	0.05331 *
IT_Software	0.632868	0.375117	1.6871	0.09866 *
R-squared	0.237497	Adjusted *R*-squared		0.185508
F(3, 44)	5.563773	*p*-value (F)		0.002517
Log-likelihood	−58.64436	Akaike criterion		125.2887
Schwarz criterion	132.7735	Hannan-Quinn		128.1172
Norm. distr. of resid.: Chi-sqr(2)	0.0888772	*p*-value		0.62010
RESET F(2, 42)	0.293883	*p*-value		0.746884
White's test for heteroskedasticity	8.20894	*p*-value		0.223192
Variance Inflation Factors:	ln_Rating: 1.155	oil_gas_mine: 1.119		IT_Software: 1.070

Source: the authors' calculations.

The results of the analyses firstly confirm the existence of significant differences in indicators/valuations between different industries, such as software & IT, fuel & gas and banking. This is not surprising, especially in the context of the highly diversified exposure of different industries to ESG risks. This is particularly true for the chosen metric, as the industry also has a strong influence on the level of complexity. For example, in the fuel industry,

the unmanageable environmental risk component is significantly higher than in other industries, resulting in a weaker average ESG risk rating for these companies than for companies in other industries.

At the same time, the analyses confirm the hypothesis that a favourable rating is associated with a higher company valuation. Given that the model incorporates the industry correction mentioned above, these results indicate that the ranking does indeed provide meaningful information to senior management. This implies that companies can significantly improve their individual valuation by effectively managing their ESG risks, which is reflected in a more favourable ESG risk rating, regardless of the industry in which they operate. Institutional investors do take into consideration ESG ratings (Van Duuren et al., 2016, pp. 530–532).

On the statistical analysis side, these relationships are most significant for the P/BV ratio (see Model 1) and the EV/EBITDA ratio (see Model 2). However, they can also be seen for other ratios such as P/E and P/EBIT (see Appendix, Table A2 and A3).

The strength of the relationship can also be determined. Models 1 and 2 show, for example, that a 10% improvement in a company's ESG risk rating is associated with an increase of around 7% in its P/BV ratio. In the case of the EV/EBITDA ratio, the increase would be around 6%. In both cases, there are also economies of scale: the market disproportionately favours larger ESG rating improvements over small increments – see Table 6 for the sensitivity analysis.

Of particular note is the positive impact of a favourable ESG risk rating on the EV/EBITDA ratio. This ratio is very often used as a valuation basis in corporate buy-sell transactions. It can be seen that investors are willing to pay more for companies that have developed business models that are less vulnerable to future climate-environmental and socio-demographic risks and have a quality management culture.

Table 6

Sensitivity analysis

Ratio	Rating change = >	Ratio change
P/BV	−5%	+3.4%
P/BV	−10%	+7.1%
P/BV	−20%	+15.7%
P/BV	−30%	+26.2%
EV/EBITDA	−5%	+2.8%
EV/EBITDA	−10%	+5.8%
EV/EBITDA	−20%	+12.7%
EV/EBITDA	−30%	+21.0%

Note: A negative change of the rating score indicates an improvement of the rating score in the case of the Sustainalytics ESG risk ratings.

Source: the authors' calculations.

The results confirm the hypothesis that in the context of the Warsaw Stock Exchange one can identify a negative relationship between the level of a company's ESG risk exposure and its valuation. This result is in line with several studies for other stock exchanges, for example for FTSE 350 listed firms in the United Kingdom. In addition this relationship remains significant even after controlling for sector-specific valuation triggers, which suggests that ESG management standards (captured within the chosen rating) can play a meaningful role in determining the company value (Li et al., 2018, pp. 69–72). The *p*-values under certain specifications amounting to over 5% encourage additional validation of these findings for subsequent years to reconfirm the robustness of the results.

This result, which is consistent with the consensus of recent empirical research on the subject (Wong et al., 2021), can serve as a useful guidance for companies and management. Even in Poland, which is not seen as a frontrunner of climate change or green transition of economy, ESG issues can no longer be ignored. This can be triggered by investor or lender preferences, but also by a real business case and the real risk of not getting it through the international value chain.

The present research can be further extended, also to address its current limitations. In particular, additional control variables could be added to deepen the understanding of the relationship analysed. These could include the size variable as well as the relative market position. Another direction of research could be to expand the group of companies analysed. Currently, the study is limited to large companies listed on the WSE, which is a significant limitation. It is also worth repeating the data modelling on a full year audited data for 2023. For further research, it would be particularly interesting to examine how the strength of this relationship evolves over time, especially after the recently introduced mandatory reporting based on the CSRD Directive. It would also be worthwhile to compare these results with similar research using an ESG proxy variable based on either reporting or management practices alone. Another interesting angle for follow-up research would be to include other Central European stock markets to see if there are any regional specifics that might affect this region compared to Western Europe.

VI. CONCLUSIONS

The aim of the research was to test whether investors on the Warsaw Stock Exchange are willing to pay a premium to invest in companies with a relatively more robust ESG risk profile. With growing awareness of the likelihood of climate crises and their potential short- and long-term consequences, companies are increasingly scrutinizing their operations. It is therefore not surprising that investors are increasingly taking ESG factors into account when making investment decisions. From an investor's perspective, the eas-

iest way to assess a company's exposure and management's approach to climate risks is through the company's ESG reporting and ESG ratings. This appears to be supported by the empirical literature, which provides strong evidence that there is a significant link between the extent of ESG-related risks, the quality of their management and the company's valuation and even financial performance.

Lower levels of ESG risks and better ESG risk management practices are perceived by investors as a signal of potentially lower financial uncertainty, while ESG reporting can help to bridge the information gap and thus reduce information asymmetry and agency costs. In addition, better ESG management can help improve internal corporate processes or even exploit synergies from increased interaction with the company's stakeholders. These channels are expected to be reflected in a higher valuation of companies that are ESG leaders (the existence of the so-called ESG premium), which in turn can incentivize other companies and contribute to the spread of best practices in ESG management.

Although ESG management practices are still at a relatively early stage in Central Europe (and in Poland in particular), the research shows that the valuations of large public companies in Poland (included in the mWIG40 and WIG20 indices) are linked to their ESG risk management practices, as measured by the Sustainalytics ESG Risk Rating. The better performers in ESG management practices are able to achieve a significant valuation premium as a result of being least exposed to climate risks and related phenomena. The most statistically significant relationship is found for the P/BV and Enterprise Value/EBITDA ratios. The positive impact of a favourable ESG risk rating on the EV/EBITDA ratio is particularly noteworthy as this ratio is often used as a key valuation metric in Merger & Acquisition transactions. The relationship found is independent of the industry in which the companies operate. Consequently, the research provides arguments in favour of the thesis that conscious investment in climate risk mitigation and improved corporate governance practices pays off for shareholders, regardless of the company's sector-specific profile.

References

Al-Hiyari, A., & Kolsi, M. C. (2021). How do stock market participants value ESG performance? Evidence from Middle Eastern and North African Countries. *Global Business Review*, 09721509211001511, 1–23. https://doi.org/10.1177/09721509211001511

Baran, M., Kuźniarska, A., Makieła, Z. J., Sławik, A., & Stuss, M. M. (2022). Does ESG reporting relate to corporate financial performance in the context of the energy sector transformation? Evidence from Poland. *Energies*, *15*(2), 1–22. https://doi.org/10.3390/en15020477

Bauer, R., & Hann, D. (2010). Corporate environmental management and credit risk. ECCE Working Paper. University Maastricht. The European Centre for Corporate Engagement, 1–44.

Carrasco-Monteagudo, I., & Buendía-Martínez, I. (2013). Corporate social responsibility: A crossroad between changing values, innovation and internationalisation. *European Journal of International Management*, *7*(3), 295–314. https://doi.org/10.1504/EJIM.2013.054327

Carroll, A. B., & Shabana, K. M. (2010). The business case for corporate social responsibility: A review of concepts, research and practice. *International Journal of Management Reviews*, *12*(1), 85–105. https://doi.org/10.1111/j.1468-2370.2009.00275.x

Cheng, B., Ioannou, I., & Serafeim, G. (2014). Corporate social responsibility and access to finance. *Strategic Management Journal*, *35*(1), 1–23. https://doi.org/10.1002/smj.2131

Chong, W. N., & Tan G. (2010). Obtaining intangible and tangible benefits from corporate social responsibility. *International Review of Business Research Papers*, *6*(4), 360–371. https://ink.library.smu.edu.sg/lkcsb_research/2939

Coelho, R., Jayantilal, S., & Ferreira, J. J. (2023). The impact of social responsibility on corporate financial performance: A systematic literature review. *Corporate Social Responsibility and Environmental Management*, *30*(4), 1535–1560. https://doi.org/10.1002/csr.2446

Czaja-Cieszyńska, H. E., & Kordela, D. (2023). Sustainability reporting in energy companies – is there a link between social disclosures, the experience and market value? *Energies*, *16*(9), Article 3642. https://doi.org/10.3390/en16093642

Czerwińska, T., & Kaźmierkiewicz, P. (2015). ESG rating in investment risk analysis of companies listed on the public market in Poland. *Economic Notes: Review of Banking, Finance and Monetary Economics*, *44*(2), 211–248. https://doi.org/10.1111/ecno.12031

El Ghoul, S., Guedhami, O., Kwok, C., & Mishra, D. (2011), Does corporate social responsibility affect the cost of capital? *Journal of Banking & Finance*, *35*(9), 2388–2406. https://doi.org/10.1016/j.jbankfin.2011.02.007

Fatemi, A., Glaum, M., & Kaiser, S. (2018). ESG performance and firm value: The moderating role of disclosure. *Global Finance Journal*, *38*, 45–64. https://doi.org/10.1016/j.gfj.2017.03.001

Friede, G., Busch, T., & Bassen, A. (2015). ESG and financial performance: Aggregated evidence from more than 2000 empirical studies. *Journal of Sustainable Finance & Investment, 5*(4), 210–233. https://doi.org/10.1080/20430795.2015.1118917

Gawęda, A. (2022). ESG rating and market valuation of the firm: Sector approach. *European Journal of Sustainable Development*, *11*(4), 91–104. https://doi.org/10.14207/ejsd.2022.v11n4p91

Giese, G., Lee, L. E., Melas, D., Nagy, Z., & Nishikawa, L. (2019). Foundations of ESG investing: How ESG affects equity valuation, risk, and performance. *The Journal of Portfolio Management*, *45*(5), 69–83. https://doi.org/10.3905/jpm.2019.45.5.069

Glück, M., Hübel, B., & Scholz, H. (2022). ESG rating events and stock market reactions. http://dx.doi.org/10.2139/ssrn.3803254

Grant, A. M. (2008). The significance of task significance: Job performance effects, relational mechanisms, and boundary conditions. *Journal of Applied Psychology*, *93*(1), 108–124. https://doi.org/10.1037/0021-9010.93.1.108

Greene, W. H. (2003). *Econometric Analysis* (5th ed.). Prentice Hall.

Hadaś-Dyduch, M., Puszer, B., Czech, M., & Cichy, J. (2022). Green bonds as an instrument for financing ecological investments in the V4 Countries. *Sustainability*, *14*(19), Article 12188. https://doi.org/10.3390/su141912188

Hart, O., & Zingales, L. (2017). Companies should maximize shareholder welfare not market value. *Journal of Law, Finance, and Accounting*, *2*(2), 247–275. https://doi.org/10.1561/108.00000022

Henisz, W., Koller, T., & Nuttall, R. (2019). Five ways that ESG creates value. *McKinsey Quarterly*, 1–12. https://www.mckinsey.com/~/media/McKinsey/Business%20Functions/Strategy%20and%20Corporate%20Finance/Our%20Insights/Five%20ways%20that%20ESG%20creates%20value/Five-ways-that-ESG-creates-value.ashx

IFAC. (2023, February). The state of play: sustainability disclosure and assurance, 2019–2021 trends and analysis. Retrieved 20 August 2023, from https://ifacweb.blob.core.windows.net/publicfiles/2023-02/IFAC-State-of-Play-Sustainability-Assurance-Disclosures_0.pdf

Ioannou, I., & Serafeim, G. (2012). What drives corporate social performance? The role of national-level institutions. *Journal of International Business Studies*, *43*(9), 834–864. https://www.jstor.org/stable/41674526

Jabłecki, J. (2023). Doing well while doing good: The elusive quest for green bond returns. *The Journal of Impact and ESG Investing*, *3*(3), 45–60. https://doi.org/10.3905/jesg.2022.1.058

Janicka, M., & Sajnóg, A. (2022). The ESG reporting of EU public companies – Does the company's capitalisation matter? *Sustainability*, *14*(7), Article 4279. https://doi.org/10.3390/su14074279

Jędrzejka, D. (2014). Ujawnienia ESG polskich spółek giełdowych w świetle wyników badań [ESG disclosure in Polish listed companies – research findings]. *Studia Ekonomiczne*, *186*(2), 13–26.

Kempf A., & Osthoff, P. (2007). The effect of socially responsible investing on portfolio performance. *European Financial Management*, *13*(5), 908–922. https://doi.org/10.1111/j.1468-036X.2007.00402.x

Li, Y., Gong, M., Zhang, X. Y., & Koh, L. (2018). The impact of environmental, social, and governance disclosure on firm value: The role of CEO power. *The British Accounting Review*, *50*(1), 60–75. https://doi.org/10.1016/j.bar.2017.09.007

Liberadzki, M., Jaworski, P., & Liberadzki, K. (2021). Spread analysis of the sustainability-linked bonds tied to an issuer's greenhouse gases emissions reduction target. *Energies*, *14*(23), Article 7918. https://doi.org/10.3390/en14237918

Riding S., & Mooney, A. (2020). Investors blast EU's omission of oil from ESG disclosures. *Financial Times*. https://www.ft.com/content/07083de6-c4d4-4f1b-8dc4-c4490e670216

Scatigna, M., Xia, F. D., Zabai, A., & Zulaica, O. (2021). Achievements and challenges in ESG markets. *BIS Quarterly Review*, December, 83–97. https://www.bis.org/publ/qtrpdf/r_qt2112f.htm

Schiller, C. (2018). Global supply-chain networks and corporate social responsibility. In *13th Annual Mid-Atlantic Research Conference in Finance (MARC) Paper*. http://dx.doi.org/10.2139/ssrn.3089311

Sulkowski, A. J. (2021). Sustainability (or ESG) reporting: Recent developments and the potential for better, more proactive management enabled by blockchain. http://dx.doi.org/10.2139/ssrn.3948654

Sustainalytics. (2021). ESG Risk Ratings – Methodology Abstract. Morningstar Sustainalytics, Version 2.1, January.

Swamy, P. A. V. B., & Arora, S. S. (1972). The exact finite sample properties of the estimators of coefficients in the error components regression models. *Econometrica*, *40*(2), 261–275. https://doi.org/10.2307/1909405

Tarczyńska-Luniewska, M., Flaga-Gieruszynska, K., & Ankiewicz, M. (2022). Exploring the nexus between fundamental strength and market value in energy companies: Evidence from environmental, social, and corporate governance perspective in Poland. *Frontiers in Energy Research*, *10*, Article 910921. https://doi.org/10.3389/fenrg.2022.910921

van Duuren, E., Plantinga, A., & Scholtens, B. (2016). ESG integration and the investment management process: Fundamental investing reinvented. *Journal of Business Ethics*, *138*(3), 525–533. https://doi.org/10.1007/s10551-015-2610-8

Verbeeten, F. H. M., Gamerschlag, R., & Möller, K. (2016). Are CSR disclosures relevant for investors? Empirical evidence from Germany. *Management Decision*, *54*(6), 1359–1382. https://doi.org/10.1108/MD-08-2015-0345

Weber, M. (2008). The business case for corporate social responsibility: A company-level measurement approach for CSR. *European Management Journal*, *26*(4), 247–261. https://doi.org/10.1016/j.emj.2008.01.006

Wong, W. C., Batten, J. A., Mohamed-Arshad, S. B., Nordin, S., & Adzis, A. A. (2021). Does ESG certification add firm value? *Finance Research Letters*, *39*, Article 101593. https://doi.org/10.1016/j.frl.2020.101593

Xie X., Yaoyang J., Xiaohua M., & Chao L. (2017). Corporate social responsibility, customer satisfaction, and financial performance: The moderating effect of the institutional environment in two transition economies. *Journal of Cleaner Production*, *150*, 26–39. https://doi.org/10.1016/j.jclepro.2017.02.192

APPENDIX

Table A1

Selected descriptive statistics for the variables used in the modelling process; in logarithmic form

Variable	ln_Rating ESG	ln_PBV	ln_PE	ln_PEBIT	ln_EVE
Mean	3.15526	0.612792	2.57798	2.10716	1.99283
Median	3.16336	0.5822	2.49357	2.07944	2.06173
Minimum	2.34181	−2.04022	−0.43078	−0.63488	−0.27444
Maximum	4.00369	3.05542	5.70711	4.54393	4.57006
St. deviation	0.396816	1.13182	1.13444	0.931346	0.950203
Coef. of variation	0.125763	1.847	0.44005	0.441991	0.47681
Skewness	−0.11579	−0.1342	0.202508	−0.38012	0.174585
Ex. kurtosis	−0.55861	−0.5278	1.44877	1.14583	0.683737

Source: the authors' calculations.

Table A2

Summary of model results obtained using OLS estimation method

Estimation method	OLS		OLS		OLS		OLS	
Dependent variable	ln_PBV		ln_PE		ln_PEBIT		ln_EVE	
	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
Constant	3.7690	0.0018 ***	5.1139	0.0003 ***	3.7836	0.0002 ***	3.6069	0.0001 ***
ln_Rating	−0.9548	0.0097 ***	−0.7497	0.0969 *	−0.5290	0.0972 *	−0.5340	0.0727 *
Bank	−0.6594	0.0870 *	−1.1151	0.0246 **	−0.7566	0.0843 *	–	–
oil_gas_mine	−0.8687	0.0468 **	−0.4919	0.0197 **	−0.1405	0.3969	−0.6666	0.0533 *
IT_Software	0.3398	0.3599	–	–	0.6120	0.0810 *	0.6329	0.0987 *
selected statistics:								
R² / Adjusted R²	54.4006	0.9945	0.2082	0.1587	0.2454	0.1826	0.2375	0.1855
F test	0.2802	0.2279	5.6708	0.0021	3.4280	0.0152	5.5638	0.0025
Normal distr. of residuals	0.0889	0.9565	7.1553	0.0279	1.3658	0.5052	0.0889	0.6201
RESET test	0.4687	0.6284	0.7794	0.4647	1.3463	0.2703	0.2939	0.7469
White's test for heterosk.	18.6381	0.0169	5.5874	0.4710	8.5612	0.3806	8.2089	0.2232

Source: the authors' calculations.

Table A3

Summary of model results obtained using GLS estimation method

Estimation method	GLS		GLS		GLS	
Dependent variable	ln_PBV		ln_PE		ln_PEBIT	
	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
Constant	3.7690	0.0018 ***	5.1139	0.0003 ***	3.7836	0.0002 ***
ln_Rating	−0.9548	0.0097 ***	−0.7497	0.0969 *	−0.5290	0.0972 *
Bank	−0.6594	0.0870 *	−1.1151	0.0246 **	−0.7566	0.0843
oil_gas_mine	−0.8687	0.0468 **	−0.4919	0.0197 **	−0.1405	0.3969
IT_Software	0.3398	0.3599	–	–	0.6120	0.0810 **
selected statistics:						
R² / Adjusted R²	54.4006	0.9945	0.2082	0.1587	0.2454	0.1826
F test	0.2802	0.2279	5.6708	0.0021	3.4280	0.0152
Normal distr. of residuals	0.0889	0.9565	7.1553	0.0279	1.3658	0.5052

Source: the authors' calculations.