



“The impact of environmental disclosure on value relevance: Moderating role of environmental performance”

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THE IMPACT OF ENVIRONMENTAL DISCLOSURE ON VALUE RELEVANCE: MODERATING ROLE OF ENVIRONMENTAL PERFORMANCE

Abstract

Existing research lacks to adequately examine how environmental performance moderates the influence of environmental disclosure on value relevance. This study pursues to investigate the direct influence of environmental disclosures on value relevance, measured by the fair value of common equity. Moreover, it tests how environmental performance moderates the influence of environmental disclosures on value relevance.

Data were gathered from the annual reports of Jordanian industrial firms listed on the Amman Stock Exchange from 2018 to 2021. The study employed the Ohlson model to assess the value relevance. Furthermore, both earnings and the book value of equity were included as other independent variables, as required by the model.

This study found that environmental disclosures positively impact the value relevance of industrial firms listed on the Amman Stock Exchange. Moreover, such disclosures positively influence the value relevance of industrial firms with greater environmental performance. Earnings and the book value of equity also positively influence the value relevance. The results were similar to those obtained by conducting panel regression after controlling for both the industry and year effects.

It is therefore recommended that directors exploit environmental disclosures to increase the value relevance of the firm. At the same time, they should consider environmental disclosures as an essential component to integrate into future strategies. Hence, firm managers should consistently evaluate the environmental and financial performance, followed by developing well-designed strategies to increase the environmental performance and reliability of environmental disclosure due to their positive role in enhancing value relevance.

Keywords

value relevance, environmental disclosure, environmental performance, Olson model, fair value, equity, Jordan

JEL Classification

M41, Q56

INTRODUCTION

The global interest in voluntary disclosure, such as environmental, social, and governance disclosure, has recently become evident (Chouaibi & Affes, 2021). Voluntary disclosures can be obtained from integrated reporting or corporate social responsibility (CSR) reports, including social, environmental, and forward-looking information, alongside those recommended by standards or regulations (Ananzeh et al., 2022).

Despite this global interest, the influence of voluntary disclosure on either financial performance or the firm's value remains under debate; for example, an analysis conducted on conventional and Islamic banks in an emerging economy reported that voluntary disclosures do not significantly influence bank performance (Nobanee & Ellili, 2022).



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Moreover, Hsiao et al. (2022) found no correlation between voluntary integrated reporting and the cost of equity and firm value. Yet, a study conducted in Bangladesh found that integrated reporting disclosure under a voluntary regime positively impacts the return on assets and return on equity (Islam, 2021). This has led to a debate regarding the value of enhanced voluntary disclosures related to integrated reporting (Hsiao et al., 2022).

The effects of environmental disclosures on the value relevance and the moderating role of environmental performance are yet to be conclusively determined. Thus, the current study is relevant due to the potentially vital role of environmental disclosures and environmental performance in reflecting firms' responsibility toward environmental matters, which might increase firms' CSR and enhance the sustainability deemed essential to global concerns. Such focus is pertinent due to the negative impact of pollution, emissions, and waste on the environment and living organisms, particularly given the emerging climate change phenomenon. Moreover, the Jordanian government has adopted environmental rules to compel industrial firms to decrease their emissions. Therefore, enhancing the environmental disclosures and environmental performance will assist the government and responsible bodies in exercising their supervisory responsibilities toward the environment, alongside the potentially positive influence on performance that can ultimately support the economy in general and the firm value in particular.

1. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Disclosure has two facets. Mandatory disclosure investigates how companies comply with either proper financial reporting standards or prescribed regulations (Appiah et al., 2016). Voluntary disclosure examines the quality of transparency regarding the overall effectiveness (Nandi & Ghosh, 2013). In contrast to mandatory disclosure research, there is increasing demand for the study of voluntary disclosure. The broad dissatisfaction with mandatory disclosure in preventing poor corporate conduct has been cited as the impetus for this emphasis on additional voluntary disclosure (Binh, 2012). It is believed that enhanced voluntary disclosure in annual reports provides several advantages for businesses, managers, owners, and other stakeholders; for example, an effective disclosure policy can reduce the information asymmetry between the principles and agents, which lowers the agency cost (Jensen & Meckling, 1976).

One of the main determinants utilized for promoting the quality of accounting information is environmental disclosure. The enhanced disclosure of environmental action highlights the effectiveness of corporate governance and potentially eliminates the obstacles that impede companies from accessing capital markets (Ahmadi & Bouri, 2017).

As environmental disclosure provides stakeholders with relevant information, shareholders require environmental information to be mandatorily disclosed, audited, and published within the content of the annual report, as well as on the firm's website (De Villiers & Van Staden, 2012). On the other hand, Radhouane et al. (2018) asserted that although the environmental obligations are satisfactory by customers and shareholders of companies with superior environmental performance, shareholders perceive and interpret these disclosures differently from customers. Therefore, Rahim (2021) emphasized the need to take appropriate action to improve and enhance the company's environmental disclosure due to its positive role in identifying the efficiency of corporations.

Other benefits of environmental disclosure have been noted, with a study conducted in Jordan by Gerged et al. (2021a) emphasizing the negative associations between corporate environmental disclosure and earnings management, as both social disclosure and environmental disclosure play a major role in enhancing transparency by minimizing the information asymmetry of the stock market (Cormier et al., 2011).

In terms of value relevance, Ohlson (1995) develops and analyzes a model of a firm's market value as it relates to contemporaneous and future earnings, book values, and dividends. Two owners' equity accounting constructs provide the underpin-

nings of the model: the clean surplus relation applies, and dividends reduce current book value but do not affect current earnings. The model satisfies many appealing properties and provides a useful benchmark when one conceptualizes how market value relates to accounting data and other information (p. 661).

Moreover, Bernard (1995) recognized that the contributions of Feltham and Ohlson's (1995, 1996) and Ohlson's (1995) studies might influence the trend of empirical accounting studies by guiding scholars in the accounting field toward forming connections between accounting numbers and company value. This contradicts previous models that emphasized the relationship between firm value and anticipated future accounting numbers. Feltham and Ohlson (1995, 1996) and Ohlson (1995) declared that the relationship between firm value and previous or current accounting numbers was based on the assumption that accounting data progress based on a linear model (Stober, 1999). To express it differently, Feltham and Ohlson's (1995) and Ohlson's (1995) valuation models characterize the value of firms by relying upon (discounted) accounting data instead of future cash flows.

The critical functions that accrual earnings, book value, and dividends play in equity valuation were identified by Feltham and Ohlson (1995, 1996) and Ohlson (1995, 2001); for example, Ohlson's valuation model "states that the firm value is a linear function of book values of owners' equity and earnings" (Tshipa et al., 2018, p. 377).

This model enables researchers to examine the influence of other variables (e.g., the disclosure level) on the value relevance of a firm with the existence of both earnings and the book value of equity (BVE) as independent variables. This was adopted by many researchers who tested the influence of the disclosure level or adoption (e.g., financial instruments and the International Financial Reporting Standards [IFRS]) on the value relevance (Alsarayreh et al., 2022; Srivastava & Muharam, 2022).

Concerning empirical studies that examined the influence of environmental disclosure on companies' value and performance, Yang et al. (2020) confirmed that it significantly influences the val-

ues of listed manufacturing companies, with the same results concluded in the context of Brazilian trading firms (Pedron et al., 2021). Moreover, Fazzini and Dal Maso (2016) reported a positive association between the representative value relevance through the voluntary disclosure of environmental issues and a company's market value.

On the contrary, Deswanto and Siregar (2018) stated that environmental disclosure neither impacts the market value nor mediates the influence of environmental disclosure on the value of Indonesian firms. Similarly, the correlation between environmental disclosure and share market reaction is negative in the context of the USA (Garner & Lacina, 2019).

Regarding the influence of environmental disclosure on performance, Alipour et al. (2019a) reported empirical findings on the positive influence of environmental disclosure on companies' performance. On the other hand, the environmental disclosure of Serbian banks was found to have no positive association with their financial performance (Hanić et al., 2021). Therefore, it might not inevitably echo the real performance, as shown in the context of Australian listed firms (Sutantoputra, 2022).

Accordingly, there is an ongoing debate about the existence and the nature of environmental disclosure effects on either the firm value or performance. Furthermore, the Ohlson model has been widely utilized in studies investigating the effects of numerous variables on the value relevance, except those concerning environmental disclosure. These variables include, for example, IFRS adoption and compliance (Alsarayreh et al., 2022; Srivastava & Muharam, 2022), corporate governance (Tshipa et al., 2018), and fair value disclosure (Mehnaz et al., 2022). Nevertheless, despite many studies empirically investigating the impact of environmental disclosure on firm value or performance, the absence of measuring the value relevance of the firm based on the Ohlson model is evident for those studies concerning environmental disclosure.

Based on this observation, and following the recommendation of Gerged et al. (2021b) regarding the need to conduct further research that gives

greater consideration to market-based proxies when examining the value relevance of corporate environmental disclosure in either advanced or emerging economies, the current study investigates the impact of environmental disclosure on the value relevance by referencing the fair value of common equity as a market proxy, which is based on the Ohlson model.

In terms of the relationship between environmental disclosure and environmental performance, there are two main contradictory disclosure theories: voluntary disclosure and socio-political. Voluntary disclosure theory (Dye, 1985) reflects economic-based disclosure theories, which assume a positive relationship between environmental disclosure and environmental performance. This theory primarily relies upon signaling theory, which argues and implies that good reporting practices reduce the agency problem associated with asymmetric information by enhancing transparency (Connelly et al., 2011).

The results of numerous studies support the voluntary disclosure theory's presumption of a positive association between environmental disclosure and environmental performance (Acar & Temiz, 2020; Ahmadi & Bouri, 2017; Al-Tuwaijri et al., 2004; Clarkson et al., 2008; Deswanto & Siregar, 2018), which can be traced back to the fact that firms with high-quality environmental performance are further encouraged to notify the stakeholders via expanding extent of voluntary disclosures, in contrast to those firms with poor environmental performance (Clarkson et al., 2008). Similarly, such companies are anticipated to have strong disclosure with confirmable value that is difficult to replicate (Al-Tuwaijri et al., 2004).

With this achievement, excellent environmental performance results from adopting a well-defined practical environmental strategy deemed an incentive for companies to increase the environmental disclosure to their investors and other stakeholders (Ahmadi & Bouri, 2017).

The socio-political theories, namely, political economy, legitimacy, and stakeholder theory (Patten, 2002a), assume a negative relationship between the level of environmental disclosure and environmental performance. The key claim

under socio-political theories considers the disclosed information as a sign of either social or political pressure that might be encountered in the business; for example, legitimacy theory deems social disclosure to respond to the force exercised by shareholders and other stakeholders (Magness, 2006). The findings of several studies support the premise of the socio-political theories (Patten, 2002b; Cormier et al., 2011).

Although the debate regarding voluntary disclosure and socio-political theories is more descriptive at the company level of environmental disclosure, the findings are mixed, with some studies asserting that there is no association, or merely a weak association, between environmental disclosure and environmental performance (Ingram & Frazier, 1980; Runtu & Naukoko, 2014; Wiseman, 1982).

Ingram and Frazier (1980) were the first to study the association between environmental disclosure and environmental performance, whereby environmental performance was measured through the Council on Economic Priorities (CEP) index, and no relationship was found between the two variables. Wiseman (1982) performed a similar study, which confirmed the absence of a relationship between environmental performance based on the CEP index and environmental disclosure based on the Wiseman index. However, Patten (2002a) criticized these studies that failed to control for either the firm size or the effect of industry.

Concerning the role of environmental performance in directing the influence of environmental disclosure on companies' performance or value, Runtu and Naukoko (2014) asserted no positive correlation between environmental performance and financial performance, which implicitly indicates that environmental performance has no direct effect on economic performance. As aforementioned, previous studies point toward the possibility of a positive impact or relationship between environmental disclosure and environmental performance, in addition to a positive impact of environmental disclosure on the firm's performance or value. This consequently proposes the possible indirect impact of environmental performance on companies' performance or value, as the extent of environmental performance might first influence environmental disclosure. Then, the level of en-

vironmental disclosure might influence company value. Expressed differently, the environmental performance might moderate the relationship with or the influence of environmental disclosure on firm value (Runtu & Naukoko, 2014).

Based on the above arguments and discussion, two hypotheses were developed, and a positive sign was presumed for both hypotheses as follows:

H1: The level of environmental disclosure positively impacts the value relevance of industrial firms listed on the Amman Stock Exchange.

H2: The level of environmental disclosure positively impacts the value relevance of industrial firms listed on the Amman Stock Exchange with greater environmental performance.

2. METHODOLOGY

The study sample comprised 46 companies (with 184 firm-year observations), representing all of the Jordanian industrial listed companies that published their financial reports during the 2018–2021 period; hence, the entire population was targeted. Selecting industrial firms was based on these firms being more attached to environmental behaviors than other sectors, which would enhance the reliability of the results. The data were collected from the financial reports of the industrial firms for the fiscal years of the study period.

The following criteria were utilized to determine the inclusion of the firm within the study:

- 1) listed on the Amman Stock Exchange before 2018;
- 2) the availability of information for the 2018–2021 period;
- 3) accessibility of the financial statements and additional notes.

After applying these criteria, Table 1 presents the number of industrial firms based on the industry, with most of the firms ($n = 11$) belonging to the mining and extraction sectors.

Table 1. Number of firms by industry

Industry	Number	Percentage
Chemical	6	13.04%
Electrical	3	6.52%
Engineering and Construction	8	17.39%
Food and Beverage	8	17.39%
Mining and Extraction	11	23.91%
Paper and Cardboard	1	2.17%
Pharmaceutical and Medical	6	13.04%
Textiles, Leather, and Clothing	2	4.35%
Tobacco and Cigarettes	1	2.17%
Total	46	100.00%

In developing the indices on either environmental disclosure or environmental performance that represent the independent and moderating variables, respectively, the study aggregated the variables covered by previous studies that comprise the most widely used environmental disclosure and environmental performance indices, as illustrated in Appendix A.

One of the primary employed measurements for environmental reporting by prior studies was the Global Reporting Initiative (GRI) Standards, and particularly the G4 Standard that embraces vital environmental aspects related to business operations (Alipour et al., 2019a, 2019b; Lee, 2017; Nuskiya et al., 2021). The most recent version of the G4 guideline was issued in 2013 to extract information about corporate environmental disclosure (Alipour et al., 2019a) and to facilitate the delivery of measures for precise, comparable, consistent, and confirmable sustainable reports (GRI, 2013). Generally, eleven diverse environmental disclosure dimensions are considered in the GRI, G4 Standard (Appendix B) related to business operations, which is entirely adopted from the GRI guidelines.

Following Lee (2017), the utilized process to score environmental disclosure ranged from 0 to 3 as the following:

- 1) no disclosure (0);
- 2) generally disclosed without any specifications (1);
- 3) non-quantitative but specific disclosures (2);
- 4) quantitatively disclosed (3).

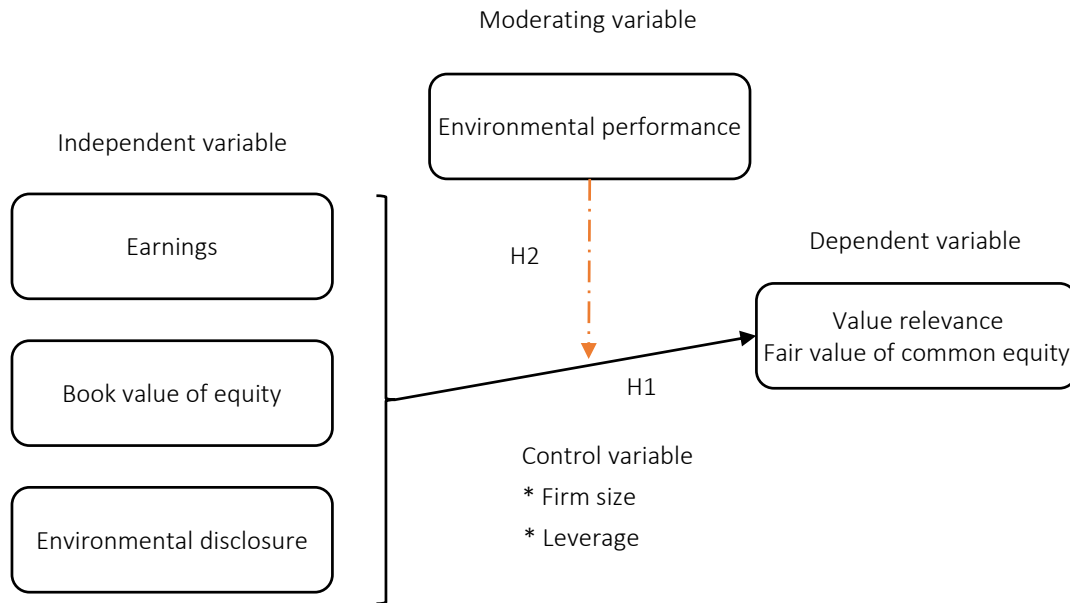


Figure 1. Research model

Environmental performance (moderating variable) is measured based on the ranking of the Council on Economic Priorities (CEP). In addition to these environmental performance indicators (EPI), the credibility within the modified Wiseman index is also considered to measure environmental performance (Acar & Temiz, 2020) alongside the level of compliance. In other words, it is measured based on an index of three parts – indicators, credibility, and compliance – as illustrated in the disclosure index (Appendix C).

The variables are subject to content analysis, a method for collecting information that involves classifying qualitative or quantitative information into particular classes to originate forms in reported information.

Table 2 presents the study variables, as well as the measurement and definition of the variables within the research hypotheses. The Ohlson model also includes earnings and book value of equity as additional independent variables.

Table 2. Definitions of variable and source

Variable	Definition	Source
Dependent variable		
Value relevance (VR)	Fair value of common equity (FVCE), the measurement is based on Ohlson (1995)	Ohlson (1995), Alsarayreh et al. (2022), Tshipa et al. (2018), Mehnaz et al. (2022)
Independent variable		
Environmental disclosure (ED)	Disclosure index (Dummy variables) Second part: based on GRI (G4) guidelines	GRI (2013), Nuskiya et al. (2021), Alipour et al. (2019a, 2019b)
Moderating variable		
Environmental performance (EP)	Performance index (Dummy variables) Comprised of EPI, credibility, and compliance based on CEP, modified Wiseman index and other studies	Acar and Temiz (2020), Tadros and Magnan (2019), Ding and Shahzad (2022), Yao et al. (2020), Ofoegbu et al. (2018)
Control variables		
Firm size	Natural logarithm of total assets	Alipour et al. (2019b), Rahim (2021), Nuskiya et al. (2021), Deswanto and Siregar (2018), Ahmadi and Bouri (2017), Cormier et al. (2011), Ding and Shahzad (2022), Gerged et al. (2021b, 2021c)
Leverage	Ratio of total debt to total assets	Alipour et al. (2019b), Yang et al. (2020), Rahim (2021), Deswanto and Siregar (2018), Ahmadi and Bouri (2017), Cormier et al. (2011), Gerged et al. (2021b, 2021c)

The relationship of these variables based on the Ohlson model (with the existence of both earnings and book value of equity) is shown in Figure 1.

The Ohlson model (Ohlson, 1995) enables researchers to examine the influence of other variables (e.g., the disclosure level) on the value relevance of a firm, with the existence of both earnings and BVE as additional independent variables.

The equation of the Ohlson model is as follows:

$$F(V)CE_{it} = \beta_0 + \beta_1 Earning_{it} + \beta_2 BVE_{it} + \beta_3 other\ variable + \varepsilon_{it} \tag{1}$$

The Ohlson model was adopted to examine the two study hypotheses through two equations. Equation 2 tests hypothesis 1 regarding the positive impact of environmental disclosure on value relevance, which is measured by the fair value of common equity based on the Ohlson model:

$$FVCE_{it} = \beta_0 + \beta_1 Earning_{it} + \beta_2 BVE_{it} + \beta_3 ED + \beta_4 Size_{it} + \beta_5 Leverage_{it} + \varepsilon_{it} \tag{2}$$

Equation 3 tests hypothesis 2 by examining the influence of environmental performance on the presumed impact of environmental disclosure on value relevance:

$$FVCE_{it} = \beta_0 + \beta_1 Earning_{it} + \beta_2 BVE_{it} + \beta_3 ED + \beta_4 EP_{it} + \beta_5 ED \cdot EP_{it} + \beta_6 Size + \beta_7 Leverage_{it} + \varepsilon_{it} \tag{3}$$

where *FVCE* represents the fair value of common equity, *BVE* indicates the book value of equity, *ED* is the environmental disclosure, and *EP* represents the environmental performance, with both the firm size and leverage as control variables.

3. RESULTS

Table 3 presents the descriptive analysis of the variables. The mean environmental disclosure score is 37.05%, signposts a low moderate level. However, this level is relatively higher than those found by Ahmadi and Bouri (2017) and Pedron et al. (2021) but lower than those indicated by Alipour et al. (2019a, 2019b) and Nuskiya et al. (2021). This may be justified since the level of voluntary disclosure amongst companies operating in an emerging capital market might be below the moderate level. On average, the score reported for environmental performance is close to the mean environmental disclosure score. As illustrated, the mean firm size is Jordanian Dinar (JD) 81.25 million, the mean leverage is 53.19%, the mean fair value of common equity (FVCE) is JD 79.66 million, the mean book value of equity (BVE) is JD 51.60 million, and the mean earnings is JD 5.35 million.

Table 4 presents the Pearson correlation coefficient among the variables. There is a significant and positive association between the interactive variables environmental disclosure × environmental performance and value relevance (coefficient = 0.2829; *p* < 0.01), earnings and value relevance (coefficient = 0.6010; *p* < 0.01), and book value of equity and value relevance (coefficient = 0.6221; *p* < 0.01) which was the highest correlation coefficient to occur between variables. Leverage is the only variable that has no association with some variables. Concerning Kennedy (2003), the problem associated with collinearity will happen if the correlation coefficient exceeds 80%, thus signaling that multicollinearity occurs between the variables. As illustrated in Table 4, it can be established that the problem of collinearity does not exist.

Table 3. Descriptive analysis of study variables

Type	Variable	Obs.	Mean	Median	SD	Minimum	Maximum
Dependent	VR: FVCE	184	79,656,953	11,600,000	303022637.1	360,000	2,184,597,960
	Earnings	184	5,345,432	15,708	34460825.07	(19,467,518)	336,363,000
Independent	BVE	184	51,597,578	11,150,040	169049839.3	(12,389,602)	1,067,410,000
	ED	184	37.05%	37.25%	0.206439	2.94%	95.10%
	EP	184	35.60%	36.67%	0.205393	3.33%	93.33%
Control	Firms' Size	184	81,249,647	17,499,479	241349263.7	407,439	1,505,176,000
	Leverage	184	53.19%	42.89%	0.598417	1.88%	512.26%

Note: VR = Value relevance; FVCE = Fair value of common equity; BVE = Book value of equity; ED = Environmental disclosure; EP = Environmental performance.

Table 4. Pearson correlation coefficient

Variable	FVCE	ED	EP	ED · EP	Earnings	BVE	Size	Leverage
FVCE	1.000	–	–	–	–	–	–	–
ED	0.341 0.000***	1.000	–	–	–	–	–	–
EP	0.241 0.000***	0.398 0.000***	1.000	–	–	–	–	–
ED · EP	0.282 0.000***	0.357 0.000***	0.260 0.000***	1.000	–	–	–	–
Earnings	0.601 0.000***	0.148 0.000***	0.252 0.000***	0.281 0.000***	1.000	–	–	–
BVE	0.622 0.000***	0.264 0.000***	0.366 0.000***	0.290 0.000***	0.564 0.000***	1.000	–	–
Size	0.441 0.000***	0.263 0.000***	0.165 0.000***	0.178 0.000***	0.531 0.000***	0.478 0.000***	1.000	–
Leverage	–0.132 0.101	–0.151 0.041**	–0.153 0.038**	–0.157 0.034**	–0.095 0.199	–0.120 0.104	–0.087 0.239	1.000

Note: FVCE = Fair value of common equity; EP = Environmental performance; ED = Environmental disclosure; BVE = Book value of equity. ***, **, and * point to statistical significance if Prob. value is less than 1%, 5%, and 10%, respectively.

Testing the violation of several statistical assumptions is vital before conducting a regression test; these assumptions are the normality of distribution, stationarity, multicollinearity, autocorrelation, and heteroscedasticity.

Concerning the normality assumption, Field (2009) accentuated that the violation of normality is unlikely to occur with a sample size exceeding 30. Therefore, the central limit theorem pertaining to normality was adopted, which implies that the current study's data meet the normality assumption.

The statistical test offered by Levin et al. (2002) was executed to test the stationarity to prevent spurious regressions. The findings, not provided owing to space limits, presented significance levels for all the variables less than 0.05; this indicates that these variables are stationary and that the problem about spurious regression is not in place.

The variance inflation factor (VIF) was utilized to test for multicollinearity between the independent variables. The maximum value of VIF in the regression models of the current study, as shown in Tables 5 and 6, is 2.27, which underlines the absence of a multicollinearity problem since Hair et al. (1998) stated that if the VIF value is lower than 10, then the multicollinearity problem does not exist.

Wooldridge's (2010) test was conducted to examine the autocorrelation and heteroscedasticity, respectively, with the findings again not provided owing to space limitations.

Tables 5 and 6 show the regression analysis results for Model 1, which examines the influence of environmental disclosure on the value relevance within the Ohlson model, without considering the impact of both the year and industry effects, which are tested in Model 2. The findings assert that environmental disclosure positively influences the value relevance ($\beta = 0.0479326$; $p < 0.01$), which confirms the anticipation regarding the positive impact. This, in turn, supports the first hypothesis. Alternatively, a unit rise in the standard deviation of environmental disclosure will increase firms' value relevance by 0.99 percent ($0.0479 \cdot 0.206$).

In terms of other independent variables within the Ohlson model, the results of Model 1 in Tables 5 and 6 show that both earnings and book value of equity positively and significantly influence the value relevance of companies at $p < 0.01$. This was predicted, as it is unlikely for these variables to have no effects on the value relevance within the Ohlson model. Similarly, the control variables (size and leverage) in Model 1 in Tables 5 and 6 significantly influence the value relevance at $p < 0.01$. In contrast, the influence of size is negative, which agrees with the prediction of the current study.

Table 6, Model 1, presents the findings related to the interactive effect of environmental performance on the influence of environmental disclosure on the value relevance related to the second hypothesis. Environmental disclosure · environmental performance has a positive and significant influence on the value relevance in Model 1 ($\beta = 0.0195791$; $p < 0.01$); it can be claimed that maximizing a unit in the standard deviation of environmental disclosure results in increasing the value relevance by 0.92 percent ($0.0443866 \cdot 0.206$) in companies with lower environmental performance. Conversely, unit growth in the standard deviation of environmental disclosure maximizes the value relevance by 1.32 percent ($0.0443866 \cdot 0.206 + 0.0195791 \cdot 0.206$) in firms with higher environmental performance. Hence, the findings support the second hypothesis, given that environmental performance does not directly impact the value relevance in Model 1 ($\beta = -0.0328370$; $p =$ insignificant).

The key kinds of panel data models consist of random-effects and fixed-effects models. The Hausman test is executed to choose between random-effects or fixed-effects models (Hausman, 1978). The results suggested that the fixed-effects regressions are preferable for Model 2, as illustrated in Tables 5 and 6.

The results of the panel data are shown in Model 2 in Tables 5 and 6. Nevertheless, both the industry and year effects are controlled in the regression models. This is vital, as either environmental dis-

closure or environmental performance may vary across industries and throughout the years, affecting firms' value relevance. The equations to the regression model number 2 after controlling for both the industry and year effects are as follows.

Equation 4 tests hypothesis 1 regarding the impact of environmental disclosure on the value relevance, measured by the fair value of common equity based on the Ohlson model after controlling for both the industry and year effects (related to Table 5, Model 2):

$$\begin{aligned}
 FVCE_{it} = & \beta_0 + \beta_1 Earning_{it} + \beta_2 BVE_{it} + \\
 & + \beta_3 ED + \beta_4 Size_{it} + \beta_5 Leverage_{it} + \\
 & + \beta_6 Industry\ fixed\ effects_i + \\
 & + \beta_7 year\ fixed\ effect_t + \mu_{it}.
 \end{aligned}
 \tag{4}$$

Equation 5 tests the influence of EP on the presumed impact of hypothesis 1 of environmental disclosure on the value relevance after controlling for both the industry and year effects (related to Table 6, Model 2):

$$\begin{aligned}
 FVCE_{it} = & \beta_0 + \beta_1 Earning_{it} + \beta_2 BVE_{it} + \\
 & + \beta_3 ED + \beta_4 EP_{it} + \beta_5 ED \cdot EP_{it} + \\
 & + \beta_6 Size + \beta_7 Leverage_{it} + \\
 & + \beta_8 Industry\ fixed\ effects_i + \\
 & + \beta_9 year\ fixed\ effect_t + \mu_{it}.
 \end{aligned}
 \tag{5}$$

Table 5. Regression analysis to examine the impact of environmental disclosure on value relevance

Dependent variable: VR measured by BVCE							
Variable	Predicted sign	Model 1			Model 2		
		Coefficient	Prob.	VIF	Coefficient	Prob.	VIF
Constant	?	-0.1353034	0.001***	-	-0.4950125	0.000***	-
Earnings	+	0.3482853	0.000***	1.30	0.1643092	0.000***	1.30
BE	+	1.938684	0.000***	1.69	0.2798420	0.027**	1.69
ED	+	0.0479326	0.009***	1.52	0.0414211	0.016**	1.52
Size	-	-1.367171	0.000***	2.27	-1.3711142	0.000***	2.27
Leverage	-	0.0651717	0.000***	1.03	0.0213281	0.594	1.03
Year dummy		No	No	-	Yes	Yes	-
Industry dummy		No	No	-	Yes	Yes	-
F-statistic (<i>p-value</i>)		902.89 (0.000)			832.92 (0.000)		
Hausman test (<i>p-value</i>)		4.98 (0.0828)			5.98 (0.0502)		
Lagrangian multiplier test		28.67 (0.000)			30.26 (0.000)		
R ²		0.680			0.7765		
Adjusted R ²		0.670			0.7639		

Note: FVCE = Fair value of common equity; EP = Environmental performance; ED = Environmental disclosure; BVE = Book value of equity. ***, **, and * point to statistical significance if Prob. value is less than 1%, 5%, and 10%, respectively. Model 1 before controlling year and industry effects, and model 2 after controlling these effects.

Table 6. Regression analysis to examine the impact of environmental disclosure on value relevance and the impact of environmental performance on this relationship

Dependent variable: VR measured by FVCE							
Variable	Predicted sign	Model 1			Model 2		
		Coefficient	Prob.	VIF	Coefficient	Prob.	VIF
Constant	?	-0.02817	0.627		-0.4224106	0.000***	
Earnings	+	0.337274	0.000***	1.30	0.1663186	0.000***	1.30
BE	+	1.86783	0.000***	1.69	0.2918539	0.019**	1.69
ED	+	0.0443866	0.066*	1.52	0.0275192	0.011**	1.52
EP	+	-0.0328370	0.155	1.17	-0.0241850	0.015**	1.17
ED×EP	+	0.0195791	0.003***	1.92	0.0154754	0.028**	1.92
Size	-	-1.32957	0.000***	2.27	-1.3337333	0.000***	2.27
Leverage	-	0.061432	.000***	1.03	0.0128522	0.753	1.03
Year dummy		No	No	-	Yes	Yes	-
Industry dummy		No	No	-	Yes	Yes	-
F-statistic (<i>p</i> -value)		681.30 (0.000)			623.24 (0.000)		
Hausman test (<i>p</i> -value)		8.92 (0.0632)			10.47 (0.0333)		
Lagrangian multiplier test		29.42 (0.000)			30.22 (0.000)		
<i>R</i> ²		0.701			0.7809		
Adjusted <i>R</i> ²		0.687			0.7685		

Note: FVCE = Fair value of common equity; EP = Environmental performance; ED = Environmental disclosure; BVE = Book value of equity. ***, **, and * point to statistical significance if Prob. value is less than 1%, 5%, and 10%, respectively. Model 1 before controlling year and industry effects, and model 2 after controlling these effects.

As illustrated in Tables 5 and 6, the regression results for the panel data presented in Model 2 are similar to those presented in Model 1 (without controlling for the industry and year effect). The findings in Table 5, Model 2, show that environmental disclosure positively and significantly impacts the value relevance ($\beta = 0.0414211$; $p < 0.05$), supporting the expectation of a positive impact. Accordingly, this also supports the first hypothesis. Thus, a unit growth in the standard deviation of environmental disclosure will increase companies' value relevance by 0.85 percent ($0.0414 \cdot 0.206$). In contrast to the prior results (Table 5, Model 1), the influence of leverage on the value relevance is insignificant ($\beta = 0.0213281$; $p =$ insignificant). In addition, the influence of the book value of equity is significant at $p < 0.05$ instead of $p < 0.01$.

The findings of Model 2 in Table 6 are similar to those presented in Model 2, Table 5. Furthermore, the results indicate that even after considering the controlling effects of the industry and year, environmental disclosure · environmental performance positively and significantly impact the value relevance in Model 2 ($\beta = 0.0154754$; $p < 0.05$). It might be claimed that increasing a unit in the standard deviation of environmental disclosure results in increasing

the value relevance by 0.57 percent ($0.0275192 \cdot 0.206$) in companies with lower environmental performance, whereas a unit rise in the standard deviation of environmental disclosure results in maximizing the value relevance by 0.89 percent ($0.0275192 \cdot 0.206 + 0.0154754 \cdot 0.206$) in firms with higher environmental performance. Hence, the findings also agree with the second hypothesis and the interactive positive and significant impact of environmental disclosure and environmental performance on the value relevance.

4. DISCUSSION

There is a debate in the literature regarding the possible influence of environmental disclosure on financial performance or firm value. Unlike prior investigations, based on the Ohlson model, the present study examined whether higher environmental performance enhances the positive effect of environmental disclosure on the value relevance.

The results showed that environmental disclosure has a positive significant influence on the value relevance of firms, which is in agreement with the results of Cormier et al. (2011), Fazzini and Dal Maso (2016), Pedron et al. (2021), and

Yang et al. (2020). This may be due to environmental disclosure enhancing the firm's reputation and ethical situation, which, in turn, leads to a positive impression on the stakeholders that eventually enhances the firm's value (Alipour et al., 2019b).

This phenomenon encourages owners to emphasize the environmental information to be disclosed, audited, and published in a mandatory manner in both the annual report and on the firm's website (De Villiers & Van Staden, 2012). However, these results do not agree with Deswanto and Siregar's (2018) and Garner and Lacina's (2019) findings.

Runtu and Naukoko (2014) indicated that environmental performance has no direct influence on financial performance but that environmental performance might moderate the relationship with or the effect of environmental disclosure on firm value, as found by this study. Given that the correlation between both environmental disclosure and environmental performance is positive and significant, there is alignment with the results reported by Acar and Temiz (2020), Ahmadi and Bouri (2017), Al-Tuwaijri et al. (2004), Clarkson et al. (2008), and Deswanto and Siregar (2018), as well as the assumption of voluntary disclosure theory. Meanwhile, this correlation is in opposition to the assumptions of legitimacy theory and stakeholder theory, which assume the presence of a negative correlation between environmental disclosure and environmental performance (Cormier et al., 2011; Patten, 2002a, 2002b).

The outcomes of this study imply various theoretical and practical implications. There is a contribution to the body of literature by delivering unique insights regarding the effect of environmental disclosure on the value relevance of firms, as well as investigating the influence of greater environmental performance on this association. Moreover, the current study is also distinct from other studies measuring the dependent variable. It gave more consideration to market-based proxies when examining the impact of environmental disclosure on the value relevance by referencing the fair value of common equity based on the Ohlson model.

There are a number of practical implications for directors, policymakers, and other stakeholders. In particular, climate change has received significant attention in recent years, thus exposing companies to increased stakeholder pressure.

The findings of the current study imply numerous practical implications. For instance, the findings revealed that environmental disclosure significantly and positively impacts the market-based proxies' measures, by enhancing transparency as well as non-financial disclosures. This implies that directors can exploit environmental disclosure to increase the value relevance of the firm. At the same time, they should consider environmental disclosure as an essential component to integrate into future strategies. The managers of these firms should ensure that they accomplish their environmental mission and increase the quality of environmental disclosure as a mechanism for improved value relevance.

Besides, the results disclosed that increased environmental performance enhances the impact of environmental disclosure on the value relevance of firms. Accordingly, policymakers should focus on increasing environmental performance alongside environmental disclosure, consequently improving common shares' fair value. The implemented procedures should thus be modified to support higher environmental performance to realize the achievable favorable outcomes.

Moreover, there is no particular regulation or guidance about environmental reporting and disclosure in Jordan since environmental information disclosure is voluntary. Hence, policymakers must commence developing rules and guidance to be mandatorily adopted with the potential to improve firms' environmental disclosure and environmental performance, which will boost the value relevance and enhance their reputation and standing. This scenario would benefit emerging markets such as Jordan that have yet to develop or adopt particular rules concerning environmental reporting. Furthermore, global reporting requirements like the GRI guidance might be significantly relied upon and trusted by policymakers because this guidance is globally accepted and adopted in numerous advanced and emerging nations. Alipour et al. (2019a, 2019b) also emphasized this latter recommendation.

CONCLUSION

The aim of this study was to investigate the relationship between environmental disclosure and value relevance based on the Ohlson model while also exploring the influence of environmental performance on this relationship and drawing on economic and legitimacy motivations (voluntary disclosure theory and legitimacy theory). The study sought to address a gap in the previous research, which focused on the direct impact of environmental disclosure on either firm performance or value. However, it did not consider the combined effect of environmental disclosure and performance on value relevance.

This study examined Jordanian industrial companies listed on the Amman Stock Exchange between 2018 and 2021 as a sample of developing countries and emerging markets.

The findings revealed a significant and positive association between environmental disclosure and value relevance. Additionally, it was found that the positive impact of environmental disclosure on value relevance was further strengthened when companies demonstrated robust environmental performance. In other words, firms with superior environmental performance enjoy improved market perception and greater value relevance.

Other variables within the Ohlson model, such as earnings and book value of equity, were found to positively influence value relevance. The study also analyzed control variables like firm size and leverage and found that these variables significantly affected value relevance, with firm size negatively impacting value relevance. However, when controlling for the industry and year effects, the results remained consistent, except for leverage, which no longer significantly influenced value relevance.

Without specific environmental reporting rules in Jordan, global reporting requirements like the Global Reporting Initiative could be relied upon. Stakeholders can utilize reliable environmental information to make informed decisions, ultimately improving the firm's financial performance and value relevance, as preferred by stakeholders.

The study recommends that companies conduct practical assessments of both the environmental and financial performance to develop strategies to enhance their market reputation and attract investments while promoting sustainability and environmental responsibility. On the other hand, investors should consider environmental disclosure and performance as vital factors in their decision-making process. Integrating these factors into their valuation models can empower them to make sound investment choices.

Future research could focus on small and medium-sized entities, explore the impact of environmental performance on other dependent variables like sustainability or competitive advantage, and investigate the influence of other social aspects within the Global Reporting Initiative Standards on market-based proxy measures. Additionally, examining the role of technological advancements in enhancing the reliability and availability of environmental information might provide valuable insights.

AUTHOR CONTRIBUTIONS

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APPENDIX A

Table A1. Variables included in environmental disclosures and environmental performance indices

Variable	Related studies
Independent variable – environmental disclosure – environmental aspects related to business operations	
Material	Nuskiya et al. (2021), Rahim (2021), Alipour et al. (2019a, 2019b)
Energy	Nuskiya et al. (2021), Rahim (2021), Alipour et al. (2019a, 2019b), Gerged et al. (2021b, 2021c)
Water	Nuskiya et al. (2021), Rahim (2021), Alipour et al. (2019a, 2019b)
Biodiversity	Nuskiya et al. (2021), Rahim (2021), Alipour et al. (2019a, 2019b)
Emission	Rahim (2021), Alipour et al. (2019a, 2019b), Nuskiya et al. (2021)
Effluents and waste	Nuskiya et al. (2021), Rahim (2021), Alipour et al. (2019a, 2019b)
Product and service	Nuskiya et al. (2021), Rahim (2021), Alipour et al. (2019a, 2019b)
Supplier environmental assessment	Nuskiya et al. (2021), Alipour et al. (2019a, 2019b)
Environmental grievance mechanisms	Nuskiya et al. (2021), Alipour et al. (2019a, 2019b)
Transport	Nuskiya et al. (2021), Alipour et al. (2019a, 2019b)
Overall	Nuskiya et al. (2021), Alipour et al. (2019a, 2019b)
Moderating variable – environmental performance	
Environmental performance indicators (EPI)	Acar and Temiz (2020), Pedron et al. (2021), Yao et al. (2020), Tadros and Magnan (2019)
Creditability	Acar and Temiz (2020), Pedron et al. (2021), Yao et al. (2020), Rahim (2021), Tadros and Magnan (2019)
Compliance	Ahmadi and Bouri (2017), Cormier et al. (2011), Ofoegbu et al. (2018), Tadros and Magnan (2019), Ding and Shahzad (2022)

APPENDIX B. Environmental disclosure index

A. Material

1. The material used by weight or volume used by the organization
2. Percentage of recycled input materials used by the organization

B. Energy

1. Energy consumption within the organization
2. Energy consumption outside of the organization
3. Energy intensity
4. Reduction of energy consumption
5. Reductions in energy requirements of products and services

C. Water

1. Total water withdrawal by source
2. Water sources significantly affected by withdrawal of water
3. Percentage and total volume of water recycled and reused

D. Biodiversity

1. Operational sites owned, leased, managed in, or adjacent to, protected areas and areas of high biodiversity value outside protected areas
2. Description of significant impacts of activities, products, and services on biodiversity in protected areas and areas of high biodiversity value outside protected areas
3. Habitats protected or restored

4. Total number of International Union for Conservation of Nature red list species and national conservation list species with habitats in areas affected by operations, by level of extinction risk

E. Emission

1. Direct greenhouse gas (GHG) emissions
2. Energy indirect greenhouse gas (GHG) emissions
3. Other indirect greenhouse gas (GHG) emissions
4. Greenhouse gas (GHG) emissions intensity
5. Reduction of greenhouse gas (GHG) emissions
6. Emissions of ozone-depleting substances (ODS)
7. Nox, Sox, and other significant air emissions

F. Effluents and waste

1. Total water discharge by quality and destination
2. Total weight of waste by type and disposal method
3. Total number and volume of significant spills
4. Weight of transported, imported, exported, or treated waste deemed hazardous under the terms of the Basel convention and percentage of transported waste shipped internationally
5. Identity, size, protected status, and biodiversity value of water bodies and related habitats significantly affected by the organization's discharges of water and runoff

G. Product and service

1. Extent of impact mitigation of environmental impacts of products and services
2. Percentage of products sold and their packaging materials that are reclaimed by category
3. Monetary value of significant fines and total number of non-monetary sanctions for non-compliance with environmental laws and regulations

H. Transport

1. Significant environmental impacts of transporting products and other goods and materials for the organization's operations and transporting members of the workforce

I. Overall

1. Total environmental protection expenditures and investments by type

J. Supplier environmental assessment

1. Percentage of new suppliers that were screened using environmental criteria
2. Significant actual and potential negative environmental impacts in the supply chain and actions taken

K. Environmental grievance mechanisms

1. Number of grievances about environmental impacts filed, addressed, and resolved through formal grievance mechanisms

APPENDIX C. Environmental Performance index

A. Environmental performance indicators (EPI)

1. EPI on energy use, energy conservation, and/or energy efficiency
2. EPI on water use, water conservation, and/or water use efficiency
3. EPI on Greenhouse gas: carbon emission; greenhouse gas emission; air pollution
4. EPI on other air emissions
5. EPI on TRI (land, water, air)
6. EPI on other discharges / impact, releases and/or spills (not TRI)
7. EPI on waste generation and/or management (recycling, re-use, reducing, treatment and disposal)
8. EPI on land and resources use, biodiversity and conservation, land conservation/ use; sustainability
9. EPI on environmental impacts of products and services
10. EPI on compliance performance (e.g., exceedances, reportable incidents)

B. Creditability

1. Adoption of GRI sustainability reporting guidelines or provision of a CERES report
2. Independent verification/assurance about environmental information disclosed in the EP report/web
3. Certification of environmental programs by independent agencies
4. Product Certification with respect to environmental impact
5. External environmental performance awards and/or inclusion in a sustainability index
6. Stakeholder involvement in the environmental disclosure process
7. Participation in industry specific associations/initiatives to improve environmental practices
8. Participation in other environmental organizations/associations to improve environmental practices
9. Information related to ISO environmental system authentication

C. Compliance

1. Implementation of the “three simultaneous” system
2. Legal disposal of industrial solid and hazardous wastes
3. Applications for discharge permit
4. Noise condition
5. Compliance with pollution laws and regulations
6. Compliance with health and safety standards and regulations
7. Compliance status with environmental and/or health and safety such as ISO, EMS, BS OHSAS, and PAS
8. Compliance with EPA and other federal environmental rules/ regulations
9. Compliance with State and local environmental rules/ regulations
10. No Penalties for non-compliance of environmental law
11. There is no required compensation to be paid by court environmental order