“The nonlinear association between ESG disclosure and firm performance: Evidence from Vietnam’s listed energy firms”

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THE NONLINEAR ASSOCIATION BETWEEN ESG DISCLOSURE AND FIRM PERFORMANCE: EVIDENCE FROM VIETNAM'S LISTED ENERGY FIRMS

Abstract

Vietnam's energy sector faces growing tensions between production expansion and environmental protection, making the economic consequences of ESG disclosure particularly important. Accordingly, this study examines the nonlinear associations between composite and pillar-level ESG disclosure on 30 energy firms listed on Vietnam's stock exchanges during 2015–2024. Annual report data were extracted by optical character recognition, with a large language model supporting paragraph classification into predefined E, S, and G categories, then quantified into an ESG score and each pillar based on frequency score and coverage score on 300 firm-year observations. The feasible generalized least squares regression results, with cautious interpretation for the relatively small sample size, indicate that ESG disclosure exhibits a statistically significant, though not uniformly robust, inverse U-shaped association with return on assets (ROA) ($\beta = 0.012$; $\beta^2 = -0.002$), Tobin's Q ($\beta = 0.025$; $\beta^2 = -0.004$), and return on sales (ROS) ($\beta = 0.003$; $\beta^2 = -0.001$) although the statistical evidence is stronger for ROA. The E pillar shows a significant nonlinear association with ROA ($\beta = 0.006$, $\beta^2 = -0.001$) and ROS ($\beta = 0.003$[HT1.1], $\beta^2 = -0.001$), but no statistically significant association with Tobin's Q. Governance disclosure shows comparatively stronger associations, particularly with Tobin's Q ($\beta = 0.034$; $\beta^2 = -0.005$), while social disclosure is significantly associated with ROA and ROS but not with Tobin's Q. These findings are associated with stronger governance signaling for market valuation, suggesting that energy firms may benefit from weighing governance strength alongside environmental disclosure aligned with operational capacity.

Keywords ESG, disclosure, firm performance, nonlinearity, energy, Vietnam

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INTRODUCTION

ESG has become a central focus of research in response to the demands of environmental sustainability and sustainable economic development. The environmental pillar is the most fundamental, considered the core of the sustainable growth model, where economic efficiency conflicts with environmental constraints. ESG research not only addresses stringent legal frameworks such as the Corporate Sustainability Reporting Directive (CSRD) or global net-zero commitments, but also tackles information asymmetry between businesses and stakeholders. Research on the impact of ESG clarifies the mechanisms by which intangible values are transformed into financial performance. Especially for developing countries, ESG research is crucial for building a sustainable green competitive advantage, attracting foreign direct investment, and participating in global supply chains in the digital age.

Studying the relationship between ESG and firm performance is particularly significant in the energy sector. While energy underpins eco-

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nomic growth, it faces significant pressure to expand production while ensuring energy security and reducing emissions. For energy businesses, ESG is no longer just an external evaluation criterion. However, it has become a mechanism that directly impacts performance through capital costs, risk levels, resource access, investor confidence, and the sustainability of the business model. Environmental improvements may increase costs in the short term before translating into economic benefits. Therefore, the relationship between ESG and the performance of energy sector businesses should be viewed as a genuine economic relationship, not merely a governance standard or a sustainable development discourse.

In Vietnam's energy sector, this issue is even more noteworthy. Vietnam faces the need to restructure its development model toward greater sustainability, but it confronts very real limitations in technology, institutions, the quality of information disclosure, and enforcement capacity. Listed energy firms are not only subject to capital market scrutiny and environmental regulatory pressures, but also bear significant responsibility for the growth, energy transition, and green development goals of the entire economy. Against this background, this study examines whether ESG disclosure, both as a composite score and across its pillars, is nonlinearly associated with the financial and market performance of Vietnam's listed energy firms. Formally, the study addresses the following research question: Does ESG disclosure exhibit a nonlinear (inverse U-shaped) relationship with the financial and market performance of Vietnam's listed energy firms, and does this relationship differ across the environmental, social, and governance pillars?

1. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

The academic literature on ESG and firm performance has grown substantially over the past decade, spanning multiple theoretical perspectives, diverse institutional contexts, and various industry settings.

The relationship between ESG and firm performance can be explained through stakeholder theory, legitimacy theory, and the resource-based view. Stakeholder theory (Freeman, 1984) explains that businesses create value through effective management of their relationships with stakeholders. When stakeholders perceive that a firm's ESG commitment is credible, they are more willing to provide critical resources such as capital, loyalty, and social license to operate (Servaes & Tamayo, 2013; Zhou et al., 2024). Legitimacy theory (Suchman, 1995) further clarifies the function of ESG in maintaining social acceptance and reducing institutional risk for businesses, particularly in environmentally sensitive industries where public scrutiny is high (Cho & Patten, 2007; Deegan, 2002). Furthermore, the resource-based view (Barney, 2000) provides a deeper explanation of how ESG can enhance firm-performance indicators for businesses by developing endogenous capabilities. Capabilities in pollution prevention, product management, and sustainable development can become strategic resources for a business (Hart, 1995; Hart & Dowell, 2011).

Numerous empirical studies have confirmed that ESG generates economic benefits for businesses. A large-scale review by Friede et al. (2015), which synthesized over 2,000 empirical studies, showed that the majority of evidence supports a non-negative relationship between ESG and corporate performance. Across different markets, ESG has been found to enhance both firm value and profitability (Alareeni & Hamdan, 2020; Aydoğmuş et al., 2022; Carnini Pulino et al., 2022; Yoon et al., 2018). This positive association appears particularly pronounced in environmentally sensitive industries, where ESG practices improve financial outcomes through cost reduction and risk mitigation (Zhao et al., 2018; Mohammad & Wasiuzzaman, 2021). ESG is positively associated with both accounting efficiency (measured by ROE) and market efficiency (measured by Tobin's Q) in both developed and emerging markets (Naeem et al., 2022).

However, empirical evidence on ESG and firm performance remains inconsistent, with some studies showing statistically insignificant effects, depending on the specific metrics, national con-

text, or industry characteristics. Some studies report that ESG positively affects accounting-based measures such as ROA but not market-based indicators such as Tobin's Q (Velte, 2017), while others find no significant association between composite ESG and either ROE or Tobin's Q, although aggregate ESG influences the cost of capital in Malaysia (Atan et al., 2018). Furthermore, the environmental and social pillars do not have a direct or significant impact on firm performance. At the same time, national institutional quality alters this relationship in ASEAN (Handoyo & Anas, 2024). In Vietnam, overall ESG disclosure, along with the E and G pillars, has a positive impact on the financial performance of Vietnamese commercial banks (Bui et al., 2024). However, environmental disclosure by manufacturing and energy firms is significant in only some model specifications in Vietnam (Nguyen et al., 2025). That suggests the ESG effect is unstable across different estimation and control methods. These inconsistencies highlight the need for more nuanced analytical approaches that move beyond simple linear assumptions (Dwibedi et al., 2024).

Furthermore, the impact of ESG may depend on the level of ESG disclosure, institutional quality, industry characteristics, governance structure, and firm capabilities. ESG disclosure influences firm performance in Global South economies, depending on industry characteristics and the degree of board independence (Bamel et al., 2025). In the Indian context, the ESG-firm performance relationship is more complicated than a simple linear relationship (Dwibedi et al., 2024). Therefore, ESG research should be contextualized within specific industries, particularly those with high environmental impact and considerable institutional pressures, such as the energy sector.

Several studies have documented an inverse U-shaped relationship, whereby firm performance increases with ESG disclosure up to a certain threshold and then declines as the marginal costs of compliance, reporting, and operational restructuring begin to outweigh the benefits (Barnett & Salomon, 2012; Nollet et al., 2016). In the Indian context, the ESG–firm performance relationship has been found to be more complex than a simple linear model can capture, particularly when individual pillars are considered separately (Dwibedi et al., 2024). Similarly, the threshold at which ESG transitions from value-creating to value-destroying may depend on firm size, industry exposure to environmental regulation, and the maturity of a country's ESG disclosure ecosystem (Bamel et al., 2025; Bruna et al., 2022). For energy firms operating under tightening environmental constraints, this nonlinearity is especially relevant: moderate investments in ESG may strengthen legitimacy and reduce risk, while excessive or poorly targeted ESG spending may divert resources from core operations without proportional returns.

Regarding the environmental pillar, it is particularly significant in the energy sector because business operations are often directly linked to greenhouse gas emissions, resource consumption, water use, waste management, environmental compliance, and the requirement to transition to a low-carbon growth model. Amid climate change and increasing pressure for sustainability reporting, the environmental pillar not only reflects regulatory compliance but also demonstrates a company's ability to identify, manage, and transform environmental risks into operational capabilities and strategies (Nguyen et al., 2025; Tsang et al., 2023). Environmental disclosure positively impacts firm performance by reducing costs, mitigating risks, enhancing reputation, and improving access to capital (Aydoğmuş et al., 2022). Furthermore, the costs associated with sustainability initiatives and expanded reporting may temporarily reduce short-term profitability before yielding longer-term benefits (Barnett & Salomon, 2012; Nollet et al., 2016). In Vietnam, environmental disclosure in manufacturing and energy enterprises is positively correlated with performance. However, this effect loses significance when tightly controlling for firm and year fixed effects (Nguyen et al., 2025).

Regarding the social pillar, social issues can directly affect project progress, operating costs, operational continuity, and business reputation. According to stakeholder theory (Freeman, 1984; Servaes & Tamayo, 2013), businesses that effectively fulfill their social responsibilities can strengthen employee engagement, enhance community trust, and minimize the risk of operational disruption, thereby improving firm performance. However, the benefits of the social pillar on firm performance often lag and depend on the extent

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to which businesses integrate social responsibility into their operational strategy, rather than simply implementing it as a compliance or image communication activity (Liang & Renneboog, 2017). In emerging markets, where labor regulations and community engagement frameworks are still developing, the social pillar's effect on firm performance is particularly heterogeneous, varying across industries and institutional settings (Bamel et al., 2025; Handoyo & Anas, 2024).

Regarding the governance pillar, the quality of the board of directors, transparency of information, internal control mechanisms, shareholder rights, accountability, risk management, and managerial oversight capacity are important foundations for improving access to external resources (Freeman, 1984; Tran & Ha, 2023). At the same time, governance capacity is considered a crucial organizational resource that helps businesses achieve firm performance (Barney, 2000). In ASEAN, while the environmental and social pillars have little direct impact, the governance pillar positively affects firm performance (Handoyo & Anas, 2024). In high-risk industries, governance initiatives can become a strategic advantage by mitigating risks and attracting investors (Jasni & Zulkifli, 2024). Board independence has also been found to moderate the broader ESG–performance relationship, reinforcing the view that governance acts as an enabling mechanism through which other ESG pillars generate value (Bamel et al., 2025).

Overall, previous studies have provided important evidence on the relationship between ESG and firm performance. However, the results remain inconsistent due to differences in institutional context, industry characteristics, ESG measurement methods, performance indicators, and estimation models. In Vietnam, empirical studies on ESG in listed energy firms are relatively limited.

Therefore, this study investigates how ESG disclosure and each of its pillars (environmental, social, and governance) affect the financial and market performance of listed energy firms in Vietnam, with particular attention to the possibility of a nonlinear relationship.

Based on the above overview analysis, the following research hypotheses are proposed:

H1: The ESG disclosure score is nonlinearly associated with the performance of listed energy firms in Vietnam.

H2: The environmental disclosure score is nonlinearly associated with the performance of listed energy firms in Vietnam.

H3: The social disclosure score is nonlinearly associated with the performance of listed energy firms in Vietnam.

H4: The governance disclosure score is nonlinearly associated with the performance of listed energy firms in Vietnam.

2. METHOD

This study focuses on listed energy firms in Vietnam during the period 2015–2024. The sample consists of 300 firm-year observations of 30 firms listed on the Ho Chi Minh Stock Exchange (HoSE) and the Hanoi Stock Exchange (HNX). ESG and pillar-level data were collected from annual reports, while financial and market variables were obtained from audited financial statements and the FiinPro database.

The ESG-related content and its pillars are approached using a large language model and optical character recognition (OCR) methodology. In this procedure, OCR was used only as a text-conversion tool to transform annual reports into machine-readable format. The large language model was not used to generate ESG scores directly; instead, it supported the classification of ESG-related paragraphs into predefined E, S, and G categories. The scoring was subsequently conducted based on observable disclosure frequency and topic coverage, rather than on subjective model-generated evaluations. This distinction is important because the resulting index measures ESG disclosure in annual reports, not actual ESG performance. Specifically, the OpenAI GPT o3-pro large language model, accessed via the OpenAI API in July 2025, was used in two roles: first, to correct optical character recognition errors in the OCR-extracted text, and second, to classify filtered paragraphs into the predefined E, S, and G subtopics of the classification framework. For classification, the model was

prompted using a standardized coding protocol developed from the predefined ESG classification framework, and the classified outputs were incorporated into the final dataset for subsequent analysis. Paragraphs with very low semantic relevance to any subtopic, and paragraphs with implausibly high relevance scores driven by superficial keyword matches (for example, firm names containing environment-related words), were excluded to reduce noise and overfitting. As with any LLM-assisted text classification procedure, misclassification risk cannot be fully ruled out.

ESG scores are constructed through a three-stage procedure. First, the study uses OCR technology to convert annual reports into computer-readable text. After grammatical standardization and spell-checking, the content is categorized into the environmental (E), social (S), and governance (G) pillars. Second, the content is filtered to remove low-semantic-relevance and excessive self-referencing paragraphs. Third, two complementary scores are computed for each pillar: a frequency score (S_Freq) and a coverage score (S_Cov), each rescaled to a common 0–10 range so that they can be meaningfully averaged. The frequency score captures the intensity of ESG disclosure: for each firm-year, the total number of ESG-related content occurrences within a pillar is computed, and this count is then converted to a 0–10 scale based on its percentile rank relative to the distribution of occurrence counts across all firms in the sample (i.e., a firm at the top of the distribution of mentions receives a score close to 10, and a firm with few or no mentions receives a score close to 0). The coverage score (S_Cov) measures the breadth of disclosed subtopics relative to a standardized framework:

$$Cov_{i,t} = \frac{n_{i,t}}{N} \cdot 10, \tag{1}$$

where $n_(i,t)$ is the number of ESG subtopics disclosed by firm i in year t and N is the total number of subtopics in the classification framework. The classification framework comprises N = 114 predefined ESG subtopics organized into 16 sub-categories across the three pillars (e.g., climate change mitigation, pollution, and resource use under the Environmental pillar), adapted from established ESG disclosure taxonomies.

The composite ESG score is the arithmetic mean of the E, S, and G pillar scores. This approach is particularly suitable for the Vietnamese context, where standardized ESG data from commercial databases remain limited. To avoid giving priority to either disclosure volume or thematic coverage, both components are assigned equal weights. Accordingly, the pillar-level score is calculated as:

$$ScorePillar_{(k,i,t)} = \frac{S_{Freq(k,i,t)} + S_{Cov(k,i,t)}}{2}, \tag{2}$$

where $k \in \{E, S, G\}$ represents the environmental, social, or governance pillar, respectively, while i and t denote the firm and year, S_Freq and S_Cov represent the disclosure frequency and coverage scores, respectively, for pillar k of firm i in year t. Each pillar-level score is calculated as the equally weighted average of these two components. The composite ESG disclosure score is then derived as the arithmetic mean of the three pillar-level scores.

The dependent variables capture two dimensions of firm performance: financial performance, measured by return on assets (ROA) and return on sales (ROS), and market performance, measured by Tobin's Q. The independent variables are the composite ESG score and the individual E, S, and G pillar scores. Six control variables are included to account for firm-specific financial characteristics and market risk. All variable definitions, calculations, and supporting literature are summarized in Appendix A, Table A1.

To examine the nonlinear association between ESG and firm performance, the study developed the following baseline model:

$$\begin{aligned} FP_{it} &= \alpha + \beta_1 ESG_score_{it} \\ &+ \beta_2 ESG_score_{it}^2 + \gamma X_{it} + \varepsilon_{it}, \end{aligned} \tag{3}$$

where subscripts i and t denote the firm and year, respectively. FP_{it} represents firm performance measured by ROA, ROS, or Tobin's Q, ESG_score_{it} denotes the composite ESG disclosure score, company-specific control variables are represented by X_{it}, and ε_{it} is the error term. The squared term captures potential nonlinearity in the ESG-performance relationship. To examine the pillar-specific associations, three additional

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models replace *ESG_score* with *E_score*, *S_score*, and *G_score*, respectively, each with its corresponding squared term.

The model is estimated using feasible generalized least squares (FGLS), which produces efficient and consistent standard errors under groupwise heteroskedasticity, first-order autocorrelation, and cross-sectional dependence. As reported in Table 4, the LM test rejects pooled OLS in favor of a panel specification, the Hausman test favors the fixed-effects model over the random-effects model, and the Modified Wald, Wooldridge, and Pesaran-CD tests jointly indicate the presence of these three error-structure issues across most model specifications. Because a fixed-effects estimator with cluster-robust standard errors does not fully address all three issues simultaneously, and because the short cross-sectional dimension (30 firms) makes instrument-based dynamic-panel estimators such as system GMM unreliable in this setting (Roodman, 2009), FGLS is applied to obtain valid inference under this error structure (Wooldridge, 2010). Accordingly, the empirical results should be interpreted as evidence from a focused sectoral panel of listed energy firms in Vietnam.

3. RESULTS

Descriptive statistics (Table 1) indicate significant heterogeneity among listed energy firms in Vietnam across firm performance, ESG disclosure, and financial characteristics. Firm performance indicators show relatively high dispersion. This indicates significant differences in financial and market performance among listed energy firms in Vietnam during the period 2015–2024. The average ESG score is 3.346, with governance scores being the highest, and relatively high standard deviations reflect uneven ESG disclosure among companies. For the control variables, buy-and-hold returns, asset turnover, stock return volatility, and tangibility exhibit substantial dispersion, whereas firm size and leverage are comparatively less dispersed.

The stationarity test results for the variables in the model in Table 2 indicate that all variables except bh_return and tang are stationary at level. Most variables are stationary at the 1% significance level, whereas size is stationary at the 10% level. The variables bh_return and tang become stationary after first differencing.

Table 3 reports the correlations among the study variables. Most coefficients between the explanatory and control variables are low to moderate. The composite ESG disclosure score is highly correlated with the E, S, and G scores because it is constructed from these three pillars. The performance measures are positively correlated, although the strength of the relationships differs. ESG disclosure is more closely correlated with Tobin's Q (0.210) than with ROA (0.057) or ROS (–0.002). At the pillar level, S_score and G_score are more strongly correlated with Tobin's Q (0.249 and 0.263, respectively) than E_score (0.054), while their correlations with accounting-based performance remain generally weak. To avoid overlap between the composite score and its components, the study estimates separate models for ESG disclosure and for each pillar. Multicollinearity is further examined using the Variance Inflation Factor.

Table 1. Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
ROA	300	.051	.043	–.122	.355
tobinq	300	.454	.34	.005	2.206
ROS	300	.036	.038	–.039	.161
ESG_score	300	3.346	1.89	.083	7.375
E_score	300	3.04	1.902	0	7.375
S_score	300	3.428	2.142	0	8
G_score	300	3.571	2.114	0	7.75
size	300	14.317	1.594	11.91	18.297
vol_return	300	.465	.418	0	6.683
bh_return	300	.281	2.093	–.75	35.682
lev	300	.542	.202	.078	.928
atr	300	2.596	2.747	.014	13.901
tang	300	.343	.248	0	.887

Table 2. Panel unit root test results

Variable (in level)	Statistic	Variable (in difference)	Statistic
ROA	0.1601***		
tobinq	0.5054***		
ROS	0.1621***		
ESG_score	0.1669***		
E_score	0.1273***		
S_score	0.0895***		
G_score	0.1335***		
size	0.6591*		
vol_return	0.1452***		
bh_return	0.7910	D.bh_return	−0.3823***
lev	0.6016***		
atr	0.4010***		
tang	0.7253	D.tang	−0.1280***

Note: *** p < 0.01, ** p < 0.05, * p < 0.1.

Table 3. Matrix of correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) ROA	1.000												
(2) tobinq	0.454	1.000											
(3) ROS	0.354	0.112	1.000										
(4) ESG_score	0.057	0.210	−0.002	1.000									
(5) E_score	−0.033	0.054	−0.045	0.868	1.000								
(6) S_score	0.091	0.249	0.018	0.948	0.721	1.000							
(7) G_score	0.090	0.263	0.017	0.940	0.698	0.881	1.000						
(8) size	−0.147	0.064	0.214	0.423	0.512	0.366	0.303	1.000					
(9) vol_return	0.012	−0.112	−0.065	−0.141	−0.145	−0.120	−0.127	−0.151	1.000				
(10) bh_return	0.102	0.031	−0.017	0.054	0.030	0.062	0.055	−0.087	0.047	1.000			
(11) lev	−0.412	−0.634	−0.385	−0.144	0.066	−0.239	−0.203	0.096	0.022	−0.013	1.000		
(12) atr	0.395	0.175	−0.417	0.017	−0.041	0.007	0.076	−0.387	0.095	0.164	−0.045	1.000	
(13) tang	−0.032	−0.164	0.232	0.049	0.064	0.076	−0.004	0.078	0.094	0.076	−0.021	−0.266	1.000

The results of the variance inflation factor test indicate that multicollinearity in the model is not a concern. The VIF values of the independent variables are all low, and the mean VIF is 1.225 is also significantly lower than the warning thresholds commonly used in empirical studies. The 1/VIF values are all greater than 0.1, indicating a low degree of linear correlation between the explanatory variables. Therefore, it can be concluded that the model does not exhibit serious multicollinearity.

The diagnostic tests in Table 4 support the use of panel estimation. The significant LM and Hausman tests favor the fixed-effects model over pooled OLS and REM. However, the Modified Wald, Wooldridge, and Pesaran-CD tests reveal heteroskedasticity, first-order autocorrelation in the ROA and Tobin's Q models, and cross-sectional dependence across all models. These results justify the use of FGLS to address these issues simultaneously.

Table 5 reports the condensed results for the nonlinear associations between ESG disclosure and ROA, while the full estimates are presented in Appendix B, Table B1. Composite ESG disclosure exhibits a statistically significant inverse U-shaped association with ROA. Specifically, the linear term of ESG has a positive coefficient of 0.012 and is statistically significant at the 1% level, while the squared term of ESG has a negative coefficient of −0.002 and is also statistically significant at the 1% level. This pattern indicates that, at low or moderate disclosure levels, the estimated conditional association between ESG disclosure and ROA is positive. Beyond the estimated turning point, the association becomes negative.

For the ESG pillars, the results show notable differences. The E score has a positive coefficient and is statistically significant in both linear and nonlinear models. As environmental disclosures increase, ROA tends to improve, but the impact's intensity gradually decreases as the environmental

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Table 4. Diagnostics

Model with (dep)	Model with (indep)	LM_test	Hausman	Modified Wald	Wooldridge	Pesaran-CSD
ROA	ESG_score	40.7690***	14.1890**	5.3e+04***	3.5383*	2.8619***
ROA	E_score	40.8309***	14.2346**	2.5e+04***	3.6276*	2.6402***
ROA	S_score	40.2595***	13.6693*	5.1e+04***	3.5414*	3.0472***
ROA	G_score	41.1693***	14.1061**	9.2e+04***	3.4956*	2.9919***
tobinq	ESG_score	231.4200***	15.6015**	4.9e+04***	12.5745***	7.8946***
tobinq	E_score	240.0294***	13.1850*	2.2e+04***	11.1413***	7.1950***
tobinq	S_score	233.2322***	15.9669**	4.5e+04***	12.6013***	6.4822***
tobinq	G_score	221.8453***	16.4263**	2.2e+04***	12.1163***	7.6097***
ROS	ESG_score	211.1099***	15.2205**	1.6e+04***	2.7498	2.3907**
ROS	E_score	217.3337***	14.9590**	1.6e+04***	2.7585	2.1589**
ROS	S_score	194.6650***	16.4085**	1.6e+04***	2.8430	2.5892***
ROS	G_score	223.1096***	14.6159**	1.7e+04***	2.7917	2.4244**

Note: *** p < 0.01, ** p < 0.05, * p < 0.1.

score rises. For energy firms, improving their environmental pillars through activities such as energy efficiency, emission control, and waste management enhanced legal compliance. Increased environmental transparency can help reduce operating costs, mitigate the risk of penalties, improve their image with investors, and enhance asset utilization efficiency.

With the social and governance pillars, S_score and G_score are not statistically significant in the linear model. Thus, for energy firms, the environmental pillar has a clearer, direct relationship with ROA than the social and governance pillar does under a linear relationship. However, when considering the nonlinear relationship, both S_score and G_score become more statistically significant.

The control variables show broadly consistent results. Leverage is negatively associated with ROA at the 1% level across all models, while asset turnover is positively associated with ROA at the same level. The effects of return volatility, buy-and-hold returns, and asset tangibility are generally insignificant. Firm size is statistically insignificant in the ESG, environmental, and social disclosure specifi-

Table 5. FGLS estimates of the associations between ESG disclosure and ROA (FGLS)

Variables	ESG	E	S	G
Disclosure score	0.012***	0.006**	0.009***	0.012***
	(0.003)	(0.003)	(0.002)	(0.002)
Squared disclosure score	−0.002***	−0.001*	−0.001***	−0.002***
	(0.000)	(0.000)	(0.000)	(0.000)
size	0.002	−0.000	0.001	0.003**
	(0.001)	(0.001)	(0.001)	(0.001)
vol_return	−0.000	0.000	−0.001	−0.000
	(0.003)	(0.003)	(0.003)	(0.003)
bh_return	0.000	0.000	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
lev	−0.100***	−0.097***	−0.099***	−0.100***
	(0.007)	(0.007)	(0.007)	(0.007)
atr	0.005***	0.004***	0.005***	0.005***
	(0.001)	(0.001)	(0.001)	(0.001)
tang	0.005	0.004	0.004	0.002
	(0.006)	(0.005)	(0.006)	(0.005)
Constant	0.055***	0.087***	0.070***	0.043**
	(0.019)	(0.017)	(0.018)	(0.019)
Observations	300	300	300	300
Firms	30	30	30	30

Note: Standard errors in parentheses; *** p < 0.01, ** p < 0.05, * p < 0.1.

cations, but shows a positive association with ROA in the governance disclosure specification.

Table 6 summarizes the nonlinear results for Tobin's Q. The full regression results are reported in Appendix B, Table B2. Composite ESG shows an inverse U-shaped association with Tobin's Q. The linear term of ESG has a positive coefficient of 0.025 and is statistically significant at the 10% level. In comparison, the squared term has a negative coefficient of –0.004 and is also statistically significant at the 10% level. This suggests that ESG disclosure may enhance market valuation up to a certain point, after which its marginal effect weakens and may turn negative.

By contrast, the environmental pillar is not statistically significant in either the linear or nonlinear specification, providing no empirical evidence that the market values environmental disclosure among the firms in the study sample. Similarly, the social pillar is not statistically significant in either model specification. Governance is the only ESG pillar that shows a statistically significant nonlinear effect on Tobin's Q. Specifically, the linear term of the G score has a positive coefficient of 0.034. It is statistically significant at the 5% level, while its squared term has a negative coefficient of –0.005 and is also statistically significant at the 5% level. This finding indicates an inverse U-shaped relationship between governance disclosure and market performance.

Among the control variables, firm size is positively associated with Tobin's Q in all models. In contrast, both leverage and asset tangibility consistently show negative associations. Asset turnover is positively significant in some models. However, stock return volatility and buy-and-hold returns are generally insignificant once other firm characteristics are accounted for.

Table 7 presents the condensed nonlinear results for ROS, with the full specifications reported in Appendix B, Table B3. In the linear specifications, the composite ESG score and all three pillar scores, including E, S, and G, have significantly negative coefficients. However, after the squared terms are introduced, all four variables display a statistically significant inverse U-shaped relationship with ROS.

For composite ESG, the linear term has a positive coefficient of 0.003. The squared term has a negative coefficient of –0.001 and is statistically significant at the 1% level. This indicates that ESG dis-

Table 6. FGLS estimates of the associations between ESG disclosure and Tobin's Q (FGLS)

Variables	ESG	E	S	G
Disclosure score	0.025*	–0.006	0.018	0.034**
	(0.015)	(0.014)	(0.012)	(0.014)
Squared disclosure score	–0.004*	0.001	–0.003	–0.005**
	(0.002)	(0.002)	(0.002)	(0.002)
size	0.020***	0.019***	0.020***	0.022***
	(0.007)	(0.007)	(0.007)	(0.007)
vol_return	–0.026	–0.021	–0.025	–0.022
	(0.023)	(0.024)	(0.023)	(0.022)
bh_return	0.005	0.006	0.005	0.005
	(0.005)	(0.005)	(0.005)	(0.005)
lev	–1.034***	–1.026***	–1.041***	–1.030***
	(0.034)	(0.033)	(0.034)	(0.035)
atr	0.011**	0.009*	0.011**	0.010*
	(0.005)	(0.005)	(0.005)	(0.005)
tang	–0.081**	–0.091***	–0.084**	–0.088**
	(0.035)	(0.034)	(0.035)	(0.035)
Constant	0.664***	0.732***	0.685***	0.629***
	(0.111)	(0.106)	(0.105)	(0.114)
Observations	300	300	300	300
Firms	30	30	30	30

Note: Standard errors in parentheses; *** p < 0.01, ** p < 0.05, * p < 0.1.

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closure may improve ROS at lower levels, but its marginal contribution to profit margins declines once ESG disclosure exceeds a certain threshold.

At the pillar level, the environmental disclosure score also exhibits an inverse U-shaped association with ROS. The linear term of the E score has a positive coefficient of 0.003 and is statistically significant at the 5% level. In contrast, its squared term has a negative coefficient of –0.001 and is statistically significant at the 1% level. A similar pattern is observed for the social score, with a positive linear coefficient of 0.003, significant at the 5% level, and a negative squared coefficient of –0.001, significant at the 1% level. Governance follows the same trend, as the linear term of the G score has a positive coefficient of 0.003 and is statistically significant at the 5% level. In comparison, its squared term has a negative coefficient of –0.001 and is statistically significant at the 1% level.

Among the control variables, firm size and asset tangibility are positively associated with ROS at the 1% level across all models, whereas leverage and asset turnover show significant negative associations. These results suggest that larger firms and greater tangible-asset intensity are linked to higher profit margins, while high leverage and asset turnover are associated with lower ROS.

Based on the regression results, the hypothesis testing outcomes are summarized across the three

Table 7. FGLS estimates of the associations between ESG disclosure and ROS (FGLS)

Variables	ESG	E	S	G
Disclosure score	0.003*	0.003**	0.003**	0.003**
	(0.002)	(0.002)	(0.002)	(0.002)
Squared disclosure score	–0.001***	–0.001***	–0.001***	–0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
size	0.005***	0.005***	0.004***	0.005***
	(0.001)	(0.001)	(0.001)	(0.001)
vol_return	–0.001	–0.001	–0.001	–0.001
	(0.001)	(0.001)	(0.001)	(0.002)
bh_return	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
lev	–0.067***	–0.067***	–0.068***	–0.069***
	(0.005)	(0.005)	(0.005)	(0.005)
atr	–0.003***	–0.003***	–0.003***	–0.003***
	(0.000)	(0.000)	(0.000)	(0.000)
tang	0.014***	0.016***	0.014***	0.012***
	(0.004)	(0.004)	(0.004)	(0.004)
Constant	0.003	–0.003	0.005	0.007
	(0.012)	(0.012)	(0.012)	(0.012)
Observations	300	300	300	300
Firms	30	30	30	30

Note: Standard errors in parentheses; *** p < 0.01, ** p < 0.05, * p < 0.1.

Table 8. Summary of hypotheses testing results

Hypothesis	ROA	Tobin's Q	ROS	Conclusion
H_1. The ESG disclosure score is nonlinearly associated with the performance of listed energy firms in Vietnam.	Supported (inverse U, p < 0.01)	Supported (inverse U, p < 0.10)	Supported (inverse U, p < 0.01)	Supported
H_2. The environmental disclosure score is nonlinearly associated with the performance of listed energy firms in Vietnam.	Supported (inverse U, p < 0.1)	Not supported	Supported (inverse U, p < 0.01)	Partially supported
H_3. The social disclosure score is nonlinearly associated with the performance of listed energy firms in Vietnam.	Supported (inverse U, p < 0.01)	Not supported	Supported (inverse U, p < 0.01)	Partially supported
H_4. The governance disclosure score is nonlinearly associated with the performance of listed energy firms in Vietnam.	Supported (inverse U, p < 0.01)	Supported (inverse U, p < 0.05)	Supported (inverse U, p < 0.01)	Supported

performance measures in Table 8. A hypothesis is classified as "supported" when the nonlinear (squared) term is statistically significant at the 10% level or below, "partially supported" when significance is observed for some but not all performance measures, and "not supported" when no statistically significant relationship is detected in any specification.

4. DISCUSSION

The results show that the relationship between ESG and the performance of listed energy firms in Vietnam during the period 2015–2024 is nonlinear and varies across performance measures.

The ESG score has an inverse U-shaped association with ROA, Tobin's Q, and ROS. When ESG disclosure increases from low to medium levels, the estimated conditional association is positive. After exceeding a certain threshold, the marginal benefit of additional disclosure diminishes and may turn into an adverse association with financial results. This finding complements the findings of Friede et al. (2015) and Carnini et al. (2022), and indicates that the observed association varies across disclosure levels and performance measures.

For the environmental pillar, the E_score exhibits an inverse U-shaped association with ROA. At lower disclosure levels, the association is positive, whereas it becomes negative beyond the estimated turning point. This suggests that initial environmental disclosure may signal firms' attention to operational risks, compliance issues, and stakeholder concerns. However, as environmental disclosure continues to increase, the additional reporting and documentation costs may outweigh the short-term financial benefits. This finding is consistent with Nguyen et al. (2025). More notably, the E score is not statistically significant for Tobin's Q, suggesting that the market has not yet clearly reflected the value of environmental score in energy company valuations. This result is not entirely consistent with Zhao et al. (2018) or Naeem et al. (2022). However, this result is consistent with the characteristics of emerging markets like Vietnam. Environmental information is often difficult to quantify and payback periods are long.

The social pillar exhibits a pattern similar to the environmental pillar: a significant inverse U-shaped relationship with ROA and ROS, but no detectable association with Tobin's Q. This finding is consistent with Liang and Renneboog (2017). In Vietnam's energy sector, where social disclosure may reflect firms' stated attention to occupational safety, community engagement, and labor standards, the disconnect between accounting-based associations and market recognition is not surprising. The S pillar's association with ROA and ROS suggests that social disclosure can reduce operational disruptions and strengthen internal efficiency, consistent with stakeholder theory (Freeman, 1984; Servaes & Tamayo, 2013). However, the present study does not directly measure the quality or effectiveness of the underlying social practices.

For ROS, the environmental disclosure score is negatively associated with performance in the linear specification but exhibits an inverse U-shaped relationship in the nonlinear specification. This pattern may reflect the energy sector's high fixed costs, capital intensity, and environmental compliance burden, where disclosure-related costs arise before corresponding economic benefits. Thus, the short-term decline in profit margins does not necessarily diminish the long-term value of environmental disclosure for operational sustainability, capital access, and legal risk reduction. The finding therefore complements Friede et al. (2015) and Carnini Pulino et al. (2022) by showing that ESG benefits depend on disclosure intensity, time horizon, performance measures, and firms' ability to convert environmental commitments into economic gains.

Among the three ESG pillars, governance disclosure has the strongest and most stable statistical association especially on Tobin's Q. This result is consistent with Handoyo and Anas (2024). This can be explained by the fact that governance disclosure is a more observable component for investors than the substantive quality of environmental and social activities in Vietnam's energy sector. The stronger effect of the G score should be interpreted as evidence of the market relevance of governance disclosure rather than as direct evidence that governance-related disclosure itself has been fully captured.

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CONCLUSION

This study set out to determine whether and how ESG disclosure and its environmental, social, and governance pillars exert a nonlinear association with the financial and market performance of listed energy firms in Vietnam over the 2015–2024 period. Based on a feasible generalized least squares (FGLS) panel model, the study supplements empirical evidence from an emerging market where ESG disclosure mechanisms are still developing, and energy firms face increasing environmental pressure. Furthermore, the study clarifies the multidimensional nature of the ESG disclosure-firm performance relationship by separating ESG into the E, S, and G pillars, examining their associations across multiple dependent variables, and accounting for nonlinear relationships. This helps explain why previous studies have often yielded inconsistent findings regarding the ESG disclosure and firm performance relationship. The estimated relationship varies with the level of disclosure, making a 'more ESG disclosure is better' prescription misleading under resource constraints. The results also indicate that governance disclosure is more closely associated with market valuation. In contrast, environmental and social disclosure show stronger links to accounting-based performance, though they have yet to translate into market premiums.

The research findings suggest that Vietnamese energy firms should make their disclosure strategies more selective. In the short term, strengthening governance disclosure may provide clearer market-relevant signals for accounting-based performance and market valuation. Regarding the environmental pillar, companies need to move beyond a purely disclosure-oriented approach by linking environmental information to operational indicators. This approach may reduce the risk that ESG disclosure remains merely a formality while also helping stakeholders assess the financial implications of environmental costs. Regarding the social pillar, the value created may take longer to translate into financial indicators; it needs to be more closely linked to human resource management, occupational safety, and community relations in energy projects.

This study opens several avenues for further investigation. The three ESG pillars were treated symmetrically; incorporating moderating variables such as state ownership, board independence, or regulatory intensity could reveal the conditions under which each pillar's turning point shifts. Extending the time horizon beyond 2024 would also allow researchers to assess whether the ESG-performance relationship evolves as Vietnam's disclosure standards mature and capital markets become more ESG-sensitive. A further limitation concerns the ESG disclosure scoring procedure itself: paragraph classification into E, S, and G subtopics was performed with the assistance of a large language model, and this classification has not yet been validated against independent human coding. Although the classification followed a defined, rule-based procedure (predefined subtopics, frequency-and coverage-based scoring, and relevance-based filtering), some misclassification risk cannot be ruled out. Future work could strengthen this measure by manually double-coding a random subsample of classified paragraphs and reporting the percentage agreement between the LLM and human coders.

AUTHOR CONTRIBUTIONS

Conceptualization: Thuy Duong Phan.
Data curation: Thuy Duong Phan.
Formal analysis: Thuy Duong Phan.
Funding acquisition: Thuy Duong Phan, Thi Thanh Hoang.
Investigation: Thuy Duong Phan, Thi Thanh Hoang.
Methodology: Thuy Duong Phan.
Project administration: Thuy Duong Phan.
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Software: Thuy Duong Phan.
Supervision: Thuy Duong Phan, Thi Thanh Hoang.
Validation: Thuy Duong Phan, Thi Thanh Hoang.
Visualization: Thuy Duong Phan, Thi Thanh Hoang.
Writing – original draft: Thuy Duong Phan, Thi Thanh Hoang.
Writing – review & editing: Thuy Duong Phan, Thi Thanh Hoang.

DECLARATION OF GENERATIVE AI

In conducting this study, the authors used OpenAI GPT o3-pro via the OpenAI API, accessed in July 2025, to correct OCR-related text errors and classify annual-report paragraphs into predefined environmental, social, and governance categories. ChatGPT was also used for language editing and proofreading. All AI-assisted outputs were reviewed and edited by the authors, who retained full control over the research process and take full responsibility for the final content.

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APPENDIX A

Table A1. Definitions of variables

Variables	Symbols	Calculation	Supporting Literature
Dependent Variables			
Return on Assets	ROA	Net income/ Total assets	Alareeni and Hamdan (2020); Dwibedi et al. (2024)
Return on Sales	ROS	Net income/ Net revenue	Dwibedi et al. (2024)
Tobin's Q	tobinq	(Market value of equity + Book value of total assets - Book value of equity) / Book value of total assets	Wong et al. (2021); Dwibedi et al. (2024); Yavuz et al. (2025)
Independent Variables			
ESG_Score	ESG_Score	$ESG_{i,t} = \frac{E_score_{i,t} + S_score_{i,t} + G_score_{i,t}}{3}$	Dwibedi et al. (2024); Handoyo and Anas (2024); Our construction
Environmental Pillar Score	E_score	frequency and coverage of environmental topics	Clarkson et al. (2008); Our construction
Social Pillar Score	S_score	frequency and coverage of labor, community, and social responsibility topics	Michelon et al. (2015); Our construction
Governance Pillar Score	G_score	board structure, transparency, internal controls	Tran and Ha (2023); Our construction
Control Variables			
Firm Size	size	Natural logarithm of total assets	Alareeni and Hamdan (2020); Carnini Pulino et al. (2022)
Stock Return Volatility	vol_return	annualized stock return volatility in fiscal year t and winsorized at the 99th percentile	Lohmann et al. (2025)
Buy-and-Hold Return	bh_return	buy-and-hold stock return in fiscal year t, also winsorized at the 99th percentile	Lyon et al. (1999); Lohmann et al. (2025)
Leverage	lev	Total debt/ Total assets	Alareeni and Hamdan (2020); Nguyen et al. (2025)
Asset Turnover	atr	Net sales / Average total assets	Servaes and Tamayo (2013)
Tangibility	tang	Fixed assets/ Total assets	Almeida and Campello (2007)

APPENDIX B

Table B1. Full FGLS estimation results for ROA: Linear and nonlinear specifications

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	ROA	ROA	ROA	ROA	ROA	ROA	ROA	ROA
ESG_score	0.001*	0.012***						
	(0.001)	(0.003)						
ESG_score2		−0.002***						
		(0.000)						
size	−0.001	0.002	−0.001	−0.000	−0.001	0.001	−0.001	0.003**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
vol_return	0.001	−0.000	0.000	0.000	0.000	−0.001	0.000	−0.000
	(0.004)	(0.003)	(0.004)	(0.003)	(0.004)	(0.003)	(0.004)	(0.003)
bh_return	0.001	0.000	0.001	0.000	0.001	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
lev	−0.088***	−0.100***	−0.092***	−0.097***	−0.087***	−0.099***	−0.087***	−0.100***
	(0.006)	(0.007)	(0.007)	(0.007)	(0.006)	(0.007)	(0.006)	(0.007)
atr	0.004***	0.005***	0.004***	0.004***	0.004***	0.005***	0.004***	0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
tang	0.003	0.005	0.005	0.004	0.003	0.004	0.003	0.002
	(0.005)	(0.006)	(0.005)	(0.005)	(0.005)	(0.006)	(0.005)	(0.005)
E_score			0.002**	0.006**				
			(0.001)	(0.003)				
E_score^2				−0.001*				
				(0.000)				

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Table B1 (cont.). Full FGLS estimation results for ROA: Linear and nonlinear specifications

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	ROA	ROA	ROA	ROA	ROA	ROA	ROA	ROA
S_score					0.001	0.009***		
					(0.001)	(0.002)		
S_score^2						−0.001***		
						(0.000)		
G_score							0.001	0.012***
							(0.001)	(0.002)
G_score^2								−0.002***
								(0.000)
Constant	0.098***	0.055***	0.103***	0.087***	0.099***	0.070***	0.095***	0.043**
	(0.016)	(0.019)	(0.016)	(0.017)	(0.015)	(0.018)	(0.016)	(0.019)
Observations	300	300	300	300	300	300	300	300
Number of ID	30	30	30	30	30	30	30	30

Note: Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1.

Table B2. Full FGLS estimation results for Tobin's Q: Linear and nonlinear specifications

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	tobinq	tobinq	tobinq	Tobinq	tobinq	tobinq	tobinq	tobinq
ESG_score	0.001	0.025*						
	(0.005)	(0.015)						
ESG_score^2		−0.004*						
		(0.002)						
size	0.016**	0.020***	0.019***	0.019***	0.017**	0.020***	0.015**	0.022***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
vol_return	−0.022	−0.026	−0.020	−0.021	−0.021	−0.025	−0.022	−0.022
	(0.024)	(0.023)	(0.024)	(0.024)	(0.024)	(0.023)	(0.023)	(0.022)
bh_return	0.006	0.005	0.006	0.006	0.006	0.005	0.006	0.005
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
lev	−1.028***	−1.034***	−1.031***	−1.026***	−1.030***	−1.041***	−1.018***	−1.030***
	(0.034)	(0.034)	(0.033)	(0.033)	(0.034)	(0.034)	(0.035)	(0.035)
atr	0.009*	0.011**	0.010*	0.009*	0.009*	0.011**	0.008	0.010*
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
tang	−0.097***	−0.081**	−0.094***	−0.091***	−0.095***	−0.084**	−0.098***	−0.088**
	(0.035)	(0.035)	(0.035)	(0.034)	(0.035)	(0.035)	(0.035)	(0.035)
E_score			−0.001	−0.006				
			(0.004)	(0.014)				
E_score^2				0.001				
				(0.002)				
S_score					0.001	0.018		
					(0.004)	(0.012)		
S_score^2						−0.003		
						(0.002)		
G_score							0.003	0.034**
							(0.004)	(0.014)
G_score^2								−0.005**
								(0.002)
Constant	0.757***	0.664***	0.727***	0.732***	0.752***	0.685***	0.760***	0.629***
	(0.098)	(0.111)	(0.101)	(0.106)	(0.095)	(0.105)	(0.096)	(0.114)
Observations	300	300	300	300	300	300	300	300
Number of ID	30	30	30	30	30	30	30	30

Note: Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1.

Table B3. Full FGLS estimation results for ROS: Linear and nonlinear specifications

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	ROS	ROS	ROS	ROS	ROS	ROS	ROS	ROS
ESG_score	−0.001***	0.003*						
	(0.001)	(0.002)						
ESG_score^2		−0.001***						
		(0.000)						
size	0.004***	0.005***	0.004***	0.005***	0.004***	0.004***	0.004***	0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
vol_return	−0.001	−0.001	−0.001	−0.001	−0.001	−0.001	−0.001	−0.001
	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)
bh_return	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
lev	−0.069***	−0.067***	−0.069***	−0.067***	−0.070***	−0.068***	−0.069***	−0.069***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
atr	−0.003***	−0.003***	−0.003***	−0.003***	−0.003***	−0.003***	−0.004***	−0.003***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
tang	0.012***	0.014***	0.013***	0.016***	0.011***	0.014***	0.011***	0.012***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
E_score			−0.001**	0.003**				
			(0.001)	(0.002)				
E_score^2				−0.001***				
				(0.000)				
S_score					−0.001***	0.003**		
					(0.000)	(0.002)		
S_score^2						−0.001***		
						(0.000)		
G_score							−0.001**	0.003**
							(0.000)	(0.002)
G_score^2								−0.001***
								(0.000)
Constant	0.021*	0.003	0.014	−0.003	0.021**	0.005	0.026***	0.007
	(0.011)	(0.012)	(0.011)	(0.012)	(0.011)	(0.012)	(0.010)	(0.012)
Observations	300	300	300	300	300	300	300	300
Number of ID	30	30	30	30	30	30	30	30

Note: Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1.

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