JOURNAL OF MANAGEMENT AND BUSINESS SOLUTIONS

Investigating the Impact of ESG Disclosure Quality on Liquidity Risk and Financial Flexibility: The Moderating Role of Cash Holdings

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ABSTRACT

This study aimed to examine the effect of ESG disclosure quality on liquidity risk and financial flexibility, with emphasis on the moderating role of cash holdings among companies listed on the Tehran Stock Exchange. This applied study employed a descriptive-correlational research design based on panel data analysis. Based on theoretical foundations in sustainability reporting and financial structure literature, multiple regression models were developed. Data extracted from companies' financial statements and management discussion reports were analyzed using the Generalized Least Squares (GLS) method. The findings indicated that improving the quality of sustainability and ESG disclosures contributes significantly to reducing liquidity risk and enhancing corporate financial stability by decreasing information asymmetry and improving stakeholder relationships. Furthermore, ESG-related risks, such as reputational risks, increase the likelihood of stakeholder sanctions and make external financing more costly. In this regard, cash holdings played a significant moderating role. Companies exposed to ESG-related risks increased their cash holdings based on a precautionary motive to cope with adverse financial shocks and maintain operational continuity. This cash buffer mitigated the effects of financial constraints and contributed to preserving financial flexibility. ESG disclosure quality is not merely a tool for increasing transparency; rather, it serves as a strategic mechanism for managing liquidity risk and enhancing financial flexibility. By adopting optimal cash holding policies, managers can mitigate the negative consequences of reputational risks and cash flow fluctuations and ensure corporate continuity and financial stability under conditions of economic uncertainty.

Keywords: ESG disclosure quality; sustainability reporting; liquidity risk; financial flexibility; cash holdings; Tehran Stock Exchange.

Introduction

Over the past two decades, the information needs of capital-market participants have expanded beyond conventional financial statements. Investors, creditors, regulators, and other stakeholders increasingly seek information about the environmental consequences, social responsibilities, and governance structures of firms because these dimensions can materially influence operational continuity, corporate reputation, financing capacity, and long-term value creation. Environmental, Social, and Governance (ESG) disclosure has consequently evolved from a largely voluntary reputational practice into an important component of corporate reporting and strategic financial management. Companies are now expected to explain not only their historical financial performance but also how they identify, manage, and communicate environmental exposures, relationships with employees and

Article history:
Received 19 April 2026
Revised 17 July 2026
Accepted 25 July 2026
Initial Publish 28 August 2026
Published online 01 July 2027

How to cite this article:
Aghazadeh, F., & Aghazadeh, S. (2027). Investigating the Impact of ESG Disclosure Quality on Liquidity Risk and Financial Flexibility: The Moderating Role of Cash Holdings. *Journal of Management and Business Solutions, 5*(4), 1-18. https://doi.org/10.61838/jmbs.393

communities, ethical responsibilities, board oversight, and sustainability-related risks. As a result, the quality of ESG disclosure has become an increasingly relevant criterion for evaluating corporate transparency, risk management, and organizational resilience (1, 2).

The growing importance of ESG information reflects a broader transformation in the concept of corporate accountability. Traditional accounting reports primarily represent the financial consequences of past transactions, whereas ESG reports provide additional information about risks and opportunities that may not yet be fully reflected in accounting numbers. Environmental liabilities, regulatory exposure, employee relations, supply-chain vulnerabilities, stakeholder conflicts, managerial conduct, and governance deficiencies may affect a firm's future cash flows and financing requirements even when their immediate financial consequences remain uncertain. High-quality ESG disclosure can therefore improve the ability of investors and creditors to assess corporate risk, evaluate long-term sustainability, and distinguish firms with effective risk-management systems from those that merely make symbolic sustainability claims. Evidence further suggests that the complexity of accounting reports influences the extent and usefulness of ESG disclosure, indicating that the clarity, organization, and comprehensibility of corporate reporting are central to whether sustainability information can effectively reduce uncertainty (2).

ESG disclosure quality differs from the mere quantity or existence of sustainability information. High-quality disclosure should be relevant, complete, balanced, comparable, specific, timely, and supported by credible qualitative and quantitative evidence. Firms may publish extensive sustainability narratives without adequately identifying material risks, performance deficiencies, measurable outcomes, or governance responsibilities. Such generalized disclosure may provide limited decision-useful information and may even increase uncertainty when stakeholders cannot distinguish substantive performance from impression management. In contrast, high-quality ESG reporting clearly identifies material environmental and social exposures, explains governance processes, presents measurable indicators, discloses unfavorable as well as favorable outcomes, and enables comparison across firms and reporting periods. The informational value of ESG reporting thus depends on the transparency and materiality of the disclosed content rather than on reporting volume alone (3, 4).

The economic importance of disclosure quality can be explained through information asymmetry. Corporate managers possess detailed information about operational risks, financial pressures, investment plans, environmental liabilities, stakeholder relationships, and governance practices that external capital providers cannot observe directly. When this informational imbalance is substantial, investors and creditors may demand higher returns, impose stricter contractual conditions, limit credit availability, or discount firm value to compensate for uncertainty and adverse-selection risk. High-quality ESG disclosure can reduce these information gaps by providing additional evidence about managerial competence, risk oversight, stakeholder commitment, and the sustainability of corporate activities. Consequently, transparent firms may encounter fewer financing obstacles and enjoy more favorable relationships with financial institutions and investors (5, 6).

Signaling theory similarly suggests that firms with stronger sustainability performance and more effective governance have incentives to communicate their quality to the market. Because the implementation of robust ESG systems, the collection of reliable sustainability data, and the publication of specific performance indicators require organizational resources and managerial commitment, credible ESG disclosure may serve as a positive signal concerning management quality and long-term orientation. Companies capable of producing transparent and verifiable ESG reports may be perceived as better prepared to identify emerging risks, comply with regulations, respond to stakeholder demands, and maintain stable operations. Managerial ability is particularly relevant in this process because capable managers are more likely to establish effective information systems, recognize the financial relevance of sustainability issues, and provide voluntary ESG disclosure and assurance (7). Conversely, managerial myopia may weaken ESG transparency when managers prioritize short-term accounting outcomes over the communication and management of long-term sustainability risks (8).

Legitimacy theory provides another important explanation for ESG reporting. Firms operate within a broader social environment and depend on continued acceptance from governments, investors, customers, employees, local communities, and other stakeholders. Corporate activities that are perceived as inconsistent with social expectations can generate reputational damage, regulatory intervention, consumer sanctions, employee dissatisfaction, or restrictions on access to resources. ESG disclosure enables organizations to demonstrate alignment with prevailing environmental, social, and governance expectations and to explain how their practices respond to stakeholder concerns. Sustainability reporting can consequently function as a mechanism for maintaining organizational legitimacy, preserving stakeholder support, and reducing the adverse consequences of perceived social or environmental misconduct (1). However, this legitimizing function is sustainable only when disclosures are sufficiently credible and consistent with actual organizational policies and performance.

The financial consequences of ESG disclosure are particularly important in relation to firms' cost of capital and access to external finance. Corporate social responsibility and sustainability practices can improve access to financial resources by reducing agency costs, strengthening stakeholder engagement, and lowering the perceived probability of adverse events (5). Firms with stronger social responsibility profiles may also experience a lower cost of capital because investors perceive them as less exposed to reputational, regulatory, and operational risks (9). More recent evidence indicates that ESG disclosure is associated with the cost of capital, suggesting that transparent sustainability reporting can influence financing conditions by reducing uncertainty among capital providers (6). Within the Iranian capital market, ESG performance has similarly been linked to financing costs, while green financing may shape the strength of this relationship (10). These findings imply that ESG disclosure quality can have direct implications for corporate liquidity management and financing capacity.

Liquidity risk represents the possibility that a company will be unable to meet its short-term obligations when they become due without incurring substantial financing costs, selling assets at unfavorable prices, or disrupting normal operations. This risk may arise from unstable operating cash flows, excessive leverage, limited access to credit, weak working-capital management, unexpected expenditures, or adverse changes in stakeholder confidence. Liquidity shortages can prevent firms from paying suppliers, employees, lenders, and tax authorities, potentially producing operational interruptions and financial distress. Even firms with valuable long-term assets may face severe difficulties when those assets cannot be converted into cash rapidly or when external funds are unavailable. Liquidity risk is therefore not merely an accounting concern; it is a central dimension of corporate survival and resilience.

ESG disclosure quality may reduce liquidity risk through several related mechanisms. First, enhanced transparency can reduce uncertainty and strengthen creditors' willingness to provide short-term and long-term finance. Second, credible sustainability reporting can protect corporate reputation and reduce the probability of stakeholder sanctions, regulatory disputes, and disruptions to commercial relationships. Third, effective ESG reporting may reflect stronger internal controls and risk-management systems, enabling firms to anticipate environmental, social, and governance-related cash-flow pressures. Fourth, improved disclosure can broaden the investor base and reduce dependence on a limited number of financing sources. Sustainability information may therefore strengthen firms' liquidity positions both by improving access to capital and by reducing the probability of ESG-related operational shocks.

The relationship between ESG disclosure and corporate reputation is especially relevant to liquidity risk. Reputation constitutes an intangible resource that influences customer loyalty, creditor confidence, supplier relationships, employee commitment, and investor evaluations. Reputational damage may trigger declining revenues, contractual restrictions, financing difficulties, and increased monitoring by capital providers. Firms exposed to higher reputation risk may therefore alter their liquidity policies to prepare for possible losses or restricted financing access. Evidence indicates that corporate reputation risk is significantly associated with cash-holding decisions, demonstrating that managers consider reputational exposure when determining precautionary liquidity reserves (11). Evidence from companies listed on the Tehran Stock Exchange also shows that the relationship between reputation risk and cash holdings depends on financial constraints and corporate governance, emphasizing the interaction among information environment, governance quality, and liquidity policy (12).

In addition to liquidity risk, financial flexibility is an essential dimension of corporate financial health. Financial flexibility refers to a firm's ability to obtain and reallocate financial resources in response to unexpected shocks, changing economic conditions, and profitable investment opportunities. A financially flexible firm can withstand temporary cash-flow shortages, adjust its capital structure, obtain additional debt, finance strategic investments, and continue operations during periods of uncertainty. Financial flexibility is particularly valuable in emerging markets, where firms may encounter volatile macroeconomic conditions, inflation, financing constraints, limited capital-market depth, and unstable access to external funds. Under these conditions, the capacity to preserve unused borrowing capacity and liquid financial resources can determine whether a company can survive a crisis or exploit an emerging opportunity.

High-quality ESG disclosure may enhance financial flexibility by improving the credibility of the firm's information environment. When external capital providers can more accurately assess sustainability risks and governance quality, they may be more willing to provide financing under favorable conditions. Transparent ESG information can also reduce perceived default risk, facilitate the evaluation of long-term cash flows, and strengthen the firm's relationships with lenders and institutional investors. Moreover, ESG disclosure may support corporate value by enabling the market to recognize sustainability performance more accurately. Evidence indicates that ESG performance and disclosure jointly affect firm value, with disclosure shaping the extent to which sustainability performance is incorporated into investors' assessments (13). The quality of ESG disclosure is also associated with corporate value, reinforcing the proposition that transparent sustainability information constitutes an economically relevant organizational resource (3).

ESG disclosure may additionally contribute to organizational capabilities that indirectly reinforce financial flexibility. The integration of ESG information into corporate systems can strengthen sustainability-oriented culture, encourage green innovation, and improve coordination between social responsibility objectives and operational practices (14). Firms that develop such capabilities may be better positioned to adapt to regulatory changes, technological transitions, environmental pressures, and shifting stakeholder expectations. These adaptive capacities may stabilize future cash flows and reduce the financial consequences of unexpected sustainability-related events. Investor-focused ESG disclosure also becomes more informative when firms emphasize financially material issues rather than providing undifferentiated sustainability narratives, while ownership structures can influence the incentives to provide such material information (4).

Despite the potential financing benefits of ESG transparency, companies must still determine how much cash to retain. Cash holdings are among the most important instruments available for managing liquidity risk and preserving financial flexibility. Firms hold cash to finance routine transactions, respond to unexpected cash-flow shortages, avoid costly external financing, and exploit investment opportunities without delay. The foundational literature on corporate liquidity identifies firm size, growth opportunities, cash-flow risk, leverage, dividend policy, access to capital markets, and the availability of substitute liquid assets as important determinants of cash holdings (15). Under the precautionary motive, firms accumulate cash when future cash flows are uncertain or when external finance may be unavailable or excessively costly. Under the transaction motive, cash reduces the costs associated with repeatedly raising external funds or liquidating assets.

Cash reserves can therefore directly reduce liquidity risk by providing an immediately available source of finance. During periods of declining revenues, delayed receivables, financial-market disruption, or unexpected expenditure, firms with adequate cash reserves can continue meeting their contractual obligations without relying on emergency borrowing or distressed asset sales. Cash holdings also enhance financial flexibility by allowing firms to finance valuable projects rapidly and maintain investment expenditure during economic downturns. From the perspective of the pecking-order theory, companies prefer internal funds because external financing is subject to information asymmetry, issuance costs, and possible adverse market reactions. Cash accumulation can consequently preserve managerial discretion and prevent the abandonment of positive-net-present-value investments when external financing becomes difficult.

Nevertheless, holding excessive cash also entails costs. Liquid assets typically generate lower returns than productive investments, and large cash balances may create agency problems when managers have discretion to invest in inefficient projects, expand corporate empires, or avoid capital-market monitoring. Corporate governance consequently determines whether cash is retained for legitimate precautionary purposes or used in ways that reduce shareholder value. Evidence from the United States indicates that governance structures significantly influence corporate cash holdings and the consequences of maintaining large cash balances (16). In firms characterized by weak governance and limited transparency, investors may interpret high cash holdings as a potential source of managerial opportunism. Conversely, strong governance and credible disclosure can increase confidence that cash reserves will be used to protect operations and finance value-enhancing opportunities.

The quality and comparability of financial reporting also shape cash-holding policies. When accounting information is transparent and comparable, investors and creditors can assess firms more accurately, which may reduce financing frictions and alter the need to accumulate precautionary cash. Financial reporting quality has been identified as an important mediating mechanism in the relationship between financial statement comparability and cash holdings (17). Similarly, sustainability disclosure and accounting information comparability can enhance the usefulness and persistence of reported earnings, indicating that financial and non-financial transparency jointly contribute to a more reliable corporate information environment (18). These findings suggest that cash holdings should not be examined independently from the quality of the firm's reporting system.

Cash holdings may specifically moderate the relationships between ESG disclosure quality, liquidity risk, and financial flexibility. ESG transparency can reduce uncertainty and facilitate external financing, but the immediate capacity to meet obligations still depends partly on the availability of internal liquid resources. A company with high-quality ESG disclosure but insufficient cash may remain vulnerable to short-term cash-flow shocks, particularly when financial markets are disrupted. Conversely, a firm combining credible ESG disclosure with adequate cash reserves possesses both reputational capital and an internal liquidity buffer. The credibility generated by transparent ESG reporting can improve access to external resources, while cash holdings provide immediate protection against financing delays and unexpected expenditures. The simultaneous presence of these resources may therefore strengthen the negative effect of ESG disclosure quality on liquidity risk.

A similar moderating mechanism can be expected for financial flexibility. High-quality ESG disclosure improves the firm's informational position and may expand its financing alternatives, while cash holdings create the internal capacity to react rapidly. Firms with both transparent ESG reporting and adequate liquidity reserves can finance investment opportunities without delay, sustain operations during uncertainty, negotiate with creditors from a stronger position, and avoid unfavorable asset sales or emergency financing. Moreover, strong ESG disclosure and governance may reduce concerns that retained cash will be misused, thereby increasing the strategic value of cash holdings. In this context, cash reserves become not merely idle assets but complementary resources that convert informational transparency into effective financial flexibility.

The moderating role of cash holdings is likely to be particularly important in the Tehran Stock Exchange. Iranian firms operate in an environment characterized by economic uncertainty, inflationary pressures, restricted access to some international financial resources, capital-market limitations, and potential fluctuations in financing conditions. Such circumstances can intensify precautionary liquidity motives and increase the value of internal financial resources. At the same time, ESG reporting in Iran remains comparatively developing, and firms differ substantially in the completeness, measurability, and credibility of their sustainability disclosures. Research conducted in the Iranian context indicates that sustainability disclosure quality is relevant to sustainability performance and organizational legitimacy (1), while sustainability reporting, accounting information comparability, and financing conditions have meaningful implications for financial outcomes (10, 18). These conditions make the Iranian capital market an important setting for examining whether ESG transparency produces tangible liquidity and flexibility benefits.

Although prior studies have investigated ESG disclosure in relation to firm value, financing costs, green innovation, cost of capital, and access to finance (5, 6, 9, 13, 14), fewer studies have simultaneously examined its implications for liquidity risk and financial flexibility. Research on cash holdings has generally concentrated on conventional financial determinants, governance arrangements, financial reporting quality, reputation risk, and financing constraints (11, 12, 15-17). Consequently, limited evidence is available regarding whether cash holdings strengthen or weaken the financial consequences of ESG disclosure quality. This gap is especially significant in emerging capital markets, where financial constraints, institutional conditions, disclosure practices, and economic uncertainty may cause ESG transparency and precautionary liquidity to interact differently from patterns observed in developed markets.

The present study contributes to the literature by integrating sustainability disclosure, liquidity management, and financial flexibility within a unified analytical framework. Rather than treating ESG reporting solely as a measure of corporate responsibility, the study conceptualizes disclosure quality as a financial risk-management mechanism capable of influencing access to capital, stakeholder confidence, and resilience against liquidity shocks. It also extends the cash-holding literature by examining cash as a contingent resource whose effectiveness depends on the quality of the firm's ESG information environment. This integrated approach can provide useful evidence for managers designing sustainability-reporting and liquidity policies, investors evaluating corporate resilience, creditors assessing repayment capacity, and regulators developing ESG disclosure standards for the Iranian capital market.

Accordingly, the aim of this study is to investigate the effect of ESG disclosure quality on liquidity risk and financial flexibility and to examine the moderating role of cash holdings in these relationships among companies listed on the Tehran Stock Exchange.

Methods and Materials

The present study is applied in terms of purpose and descriptive-correlational in terms of nature and research method. In this study, using audited secondary data and information disclosed through the Codal system and management discussion reports, the relationship between Environmental, Social, and Governance (ESG) disclosure quality, liquidity risk, and financial flexibility of companies listed on the Tehran Stock Exchange was examined. Furthermore, the moderating role of cash holdings in this relationship was investigated during the period from 2015 to 2023.

The statistical population of the study consisted of all companies listed on the Tehran Stock Exchange during the period 2015–2023. The research sample was selected using a systematic elimination method. Accordingly, companies were included in the final sample if they remained active on the stock exchange throughout the entire study period, had fiscal years ending in March, had access to the required data for calculating research variables, did not change their fiscal year or industry during the study period, and were not financial companies, banks, insurance firms, or financial intermediary institutions. These companies were excluded because their operational nature and financial structures differ significantly from those of other firms. After applying the mentioned restrictions, 95 companies were selected as the final sample. Considering the nine-year research period, the total number of observations used in the analysis was 855 firm-year observations.

The independent variable of the study was Environmental, Social, and Governance disclosure quality (ESGQ). This variable was measured based on three dimensions: environmental, social, and corporate governance, using content analysis. For this purpose, a checklist was developed based on the studies of Fatemi et al. (2018) and Pourghalmi Dafchahi et al. (2023). Each indicator was scored according to the level of information disclosure. Specifically, no disclosure was assigned a score of zero, qualitative disclosure received a score of one, and quantitative disclosure received a score of two. Finally, the total obtained score was divided by the maximum possible score to calculate the final ESG disclosure quality index, ranging from zero to one.

The first dependent variable was liquidity risk (LR). To measure this variable, the current ratio, quick ratio, cash-to-current-liabilities ratio, and operating cash flow-to-current-liabilities ratio were used. Subsequently, a composite liquidity risk index was extracted using principal component analysis (PCA). The second dependent variable was financial flexibility (FF). This variable was measured through a combination of indicators, including the ratio of free cash flow to total assets, debt capacity, and other indicators related to firms’ financing ability and liquidity position. The final financial flexibility index was also calculated using principal component analysis.

The moderating variable of the study was cash holdings (CASH), which was calculated as the ratio of cash and short-term investments to net operating assets. In robustness tests, the ratio of cash to total assets was also used as an alternative measure. To control for other factors affecting liquidity risk and financial flexibility, the control variables included firm size, profitability, financial leverage, growth opportunities, tangible assets ratio, firm age, retained earnings-to-total-assets ratio, and operating cash flow volatility.

First, descriptive statistics, including mean, median, standard deviation, minimum, and maximum values of the research variables, were calculated. In addition, the Pearson correlation matrix among the variables was presented to examine preliminary relationships and the possibility of multicollinearity. To determine the appropriate regression model, the Lagrange Multiplier (LM) test was initially conducted to select between pooled data and panel data models. Subsequently, if the panel model was confirmed, the Hausman test was employed to select between fixed-effects and random-effects models.

Considering the possibility of heteroscedasticity and autocorrelation in panel data, the final estimation of model coefficients was performed using the Generalized Least Squares (GLS) method. Furthermore, to examine the classical regression assumptions, the White test was used to assess heteroscedasticity, while the Durbin–Watson and LM tests were conducted to examine autocorrelation. To ensure the robustness of the findings, sensitivity analyses were performed using alternative measures of the main variables. All statistical analyses were conducted using Stata version 17 and EViews version 13, with the significance level set at 0.05.

The required financial data were extracted from audited financial statements, explanatory notes, and management discussion reports of companies listed on the Tehran Stock Exchange. ESG disclosure information was collected from annual reports, sustainability reports (where available), and announcements published through the Codal system. The research period covered 2015 to 2023, and a total of 855 firm-year observations from 95 companies were used for statistical analysis.

Findings and Results

Initially, the statistical characteristics of the research variables were examined. The results are presented in Table (1). As can be observed, the mean value of the ESG disclosure quality index in the studied sample was 0.342, with a standard deviation of 0.156, indicating a moderate to relatively low level of sustainability information disclosure among companies listed on the Tehran Stock Exchange. The minimum and maximum values of this index were 0.052 and 0.875, respectively, demonstrating substantial differences among companies regarding the quality of ESG reporting. The mean value of the composite liquidity risk (LR) index was 0.528, while the mean value of the composite financial flexibility (FF) index was 0.415. Furthermore, the average cash holding ratio among the sample companies was 0.187. The average financial leverage ratio was 0.524, and the mean return on assets (ROA) was calculated as 0.086. These findings indicate that the investigated companies differed in terms of financial characteristics, including capital structure, profitability, and cash retention policies.

Table 1. Descriptive Statistics of Research Variables

Variable	Mean	Standard Deviation	Minimum	Maximum	Median
Environmental, Social, and Governance Disclosure Quality	0.342	0.156	0.052	0.875	0.328
Composite Liquidity Risk	0.528	0.214	0.128	0.985	0.512
Composite Financial Flexibility	0.415	0.198	0.085	0.912	0.402
Cash Holdings	0.187	0.094	0.012	0.528	0.172
Firm Size	12.845	1.523	9.214	16.742	12.628
Profitability	0.086	0.072	-0.142	0.385	0.078
Financial Leverage	0.524	0.186	0.128	0.928	0.518
Growth Opportunities	0.142	0.198	-0.385	1.245	0.118
Tangible Assets Ratio	0.368	0.142	0.042	0.785	0.352
Firm Age	2.412	0.658	0.693	3.912	2.385
Retained Earnings to Total Assets Ratio	0.195	0.168	-0.218	0.685	0.182
Cash Flow Volatility	0.058	0.032	0.008	0.185	0.052

The results of Table 2 indicate that the mean ESG disclosure quality of the sample companies was 0.342, representing a relatively moderate and limited level of sustainability reporting among firms listed on the Tehran Stock Exchange. Moreover, the range of variation of this variable, from 0.052 to 0.875, indicates considerable differences among companies in terms of their attention to non-financial information disclosure and sustainability reporting. The mean value of the composite liquidity risk was 0.528, and the mean value of the composite financial flexibility index was 0.415, indicating differences among companies in their ability to manage financial obligations and withstand economic shocks. Furthermore, the average cash holding ratio was 0.187, suggesting that sample firms maintained a specific proportion of their assets in the form of cash. The standard deviation values also indicate an acceptable level of dispersion among companies regarding their financial and operational characteristics. The findings indicate a negative and significant relationship between ESG disclosure quality and liquidity risk (r = -0.312), suggesting that higher-quality ESG disclosures are associated with lower corporate liquidity risk. Moreover, a positive and significant relationship was observed between ESG disclosure quality and financial flexibility (r = 0.285). In addition, the positive correlation between cash holdings and financial flexibility (r = 0.452) highlights the role of cash reserves in enhancing firms' ability to cope with financial constraints. Furthermore, the correlation coefficients revealed that none of the correlations among the independent variables exceeded 0.80; therefore, the possibility of severe multicollinearity problems in the research models was rejected.

Table 2. Correlation Matrix of Research Variables

Variable	Disclosure Quality	Liquidity Risk	Financial Flexibility	Cash Holdings	Firm Size	Profitability	Financial Leverage	Growth Opportunities
Disclosure Quality	1.000	-0.312	0.285	0.198	0.425	0.368	-0.245	0.142
Liquidity Risk	-0.312	1.000	-0.428	-0.385	-0.198	-0.045	0.312	-0.085
Financial Flexibility	0.285	-0.428	1.000	0.452	0.312	0.485	-0.368	0.218
Cash Holdings	0.198	-0.385	0.452	1.000	0.158	0.285	-0.142	0.095
Firm Size	0.425	-0.198	0.312	0.158	1.000	0.385	-0.085	0.125
Profitability	0.368	-0.045	0.485	0.285	0.385	1.000	-0.312	0.168
Financial Leverage	-0.245	0.312	-0.368	-0.142	-0.085	-0.312	1.000	-0.058
Growth Opportunities	0.142	-0.085	0.218	0.095	0.125	0.168	-0.058	1.000

The results of Table 3 show that there is a negative relationship between environmental, social, and governance disclosure quality and liquidity risk, indicating that improved disclosure quality is associated with reduced liquidity risk. Furthermore, the positive relationship between ESG disclosure quality and financial flexibility suggests that companies providing higher-quality sustainability information have greater capacity to maintain and enhance financial flexibility. In addition, the highest correlation coefficient among the independent variables was below the critical threshold of 0.80; therefore, no serious multicollinearity problem exists among the explanatory variables, and their simultaneous inclusion in regression models is statistically acceptable.

Table 3. Results of Diagnostic Tests for Panel Data Models

Test	Test Statistic	df	p	Test Result
Limer F-test for Liquidity Risk Model	28.452	94, 748	0.001	Panel data model is more appropriate than pooled model

Limer F-test for Financial Flexibility Model	31.218	94, 748	0.001	Panel data model is more appropriate than pooled model
Hausman Test for Liquidity Risk Model	18.625	8	0.017	Fixed effects model is more appropriate
Hausman Test for Financial Flexibility Model	22.184	8	0.005	Fixed effects model is more appropriate
Wooldridge Test (Serial Correlation)	2.845	-	0.042	Serial correlation exists
White Test (Heteroskedasticity)	45.218	-	0.001	Heteroskedasticity exists
Breusch–Pagan Lagrange Multiplier Test	38.742	-	0.001	Individual firm effects confirmed

The results of the diagnostic tests presented in Table 3 indicate that, based on the Limer F-test, the use of panel data models is more appropriate than pooled ordinary least squares models for both liquidity risk and financial flexibility models. Furthermore, the Hausman test results indicate that the fixed effects model provides a better fit compared with the random effects model. On the other hand, the Wooldridge and White tests confirmed the presence of serial correlation and heteroskedasticity, respectively. Therefore, to obtain more efficient and reliable estimates, the Generalized Least Squares (GLS) method was employed for the final estimation of the models.

Table 4. Regression Results of the Effect of Environmental, Social, and Governance Disclosure Quality on Liquidity Risk

Variable	Coefficient	Standard Error	t-Statistic	Significance Level
Constant	1.245	0.185	6.730	0.000
Environmental, Social, and Governance Disclosure Quality	-0.328	0.092	-3.565	0.000
Firm Size	-0.085	0.028	-3.036	0.003
Profitability	-0.452	0.115	-3.930	0.000
Financial Leverage	0.385	0.082	4.695	0.000
Growth Opportunities	-0.068	0.045	-1.511	0.132
Tangible Assets Ratio	0.125	0.068	1.838	0.067
Firm Age	-0.042	0.032	-1.313	0.190
Retained Earnings to Total Assets Ratio	-0.198	0.078	-2.538	0.012
Cash Flow Volatility	0.312	0.095	3.284	0.001

The results presented in Table 4 indicate that the liquidity risk regression model is statistically significant, and the independent variables explain approximately 38.5% of the variations in firms' liquidity risk. The coefficient of ESG disclosure quality is -0.328 and is statistically significant at the one percent level; therefore, higher-quality ESG disclosure leads to a reduction in firms' liquidity risk. Furthermore, profitability and firm size had a decreasing effect on liquidity risk, whereas financial leverage and cash flow volatility increased liquidity risk. Accordingly, the first research hypothesis, which states that there is a negative and significant relationship between ESG disclosure quality and liquidity risk, is supported.

Table 5. Regression Results of the Effect of Environmental, Social, and Governance Disclosure Quality on Financial Flexibility

Variable	Coefficient	Standard Error	t-Statistic	Significance Level
Constant	-0.852	0.168	-5.071	0.000
Environmental, Social, and Governance Disclosure Quality	0.285	0.085	3.353	0.001
Firm Size	0.068	0.025	2.720	0.007
Profitability	0.528	0.108	4.889	0.000
Financial Leverage	-0.312	0.075	-4.160	0.000
Growth Opportunities	0.095	0.042	2.262	0.024
Tangible Assets Ratio	-0.085	0.062	-1.371	0.171
Firm Age	0.038	0.028	1.357	0.175
Retained Earnings to Total Assets Ratio	0.245	0.072	3.403	0.001
Cash Flow Volatility	-0.185	0.088	-2.102	0.036

The results of Table 5 indicate that the financial flexibility model is statistically significant, and approximately 41.2% of the variations in firms' financial flexibility are explained by the research variables. The coefficient of ESG disclosure quality is 0.285 and is significant at the one percent level, indicating that higher-quality ESG disclosure enhances firms' financial flexibility. Moreover, profitability had the strongest positive effect on financial flexibility, whereas higher financial leverage reduced financial flexibility. Therefore, the second research hypothesis, proposing that ESG disclosure quality has a positive and significant effect on financial flexibility, is supported.

Table 6. Results of Interactive Regression Examining the Moderating Role of Cash Holdings in the Relationship Between ESG Disclosure Quality and Liquidity Risk

Variable	Coefficient	Standard Error	t-Statistic	Significance Level
Constant	1.385	0.192	7.214	0.000
Environmental, Social, and Governance Disclosure Quality	-0.245	0.095	-2.579	0.010
Cash Holdings	-0.425	0.115	-3.696	0.000
Interaction Effect of ESG Disclosure Quality and Cash Holdings	-0.312	0.128	-2.438	0.015
Firm Size	-0.078	0.028	-2.786	0.006
Profitability	-0.412	0.112	-3.679	0.000
Financial Leverage	0.368	0.078	4.718	0.000
Growth Opportunities	-0.058	0.042	-1.381	0.168
Tangible Assets Ratio	0.115	0.065	1.769	0.077
Firm Age	-0.038	0.030	-1.267	0.206
Retained Earnings to Total Assets Ratio	-0.185	0.075	-2.467	0.014
Cash Flow Volatility	0.285	0.088	3.239	0.001

The results of Table 6 show that after introducing the interaction variable between ESG disclosure quality and cash holdings, the explanatory power of the model increased, with the coefficient of determination (R^2) rising from 0.385 in the baseline model to 0.428. The interaction coefficient was -0.312 and statistically significant at the five percent level, indicating the positive moderating role of cash holdings in the relationship between ESG disclosure quality and liquidity risk. In other words, in companies with higher levels of cash holdings, the reducing effect of ESG disclosure quality on liquidity risk becomes stronger. Furthermore, the independent coefficient of cash holdings was negative and significant, indicating that increased cash reserves directly reduce firms' liquidity risk. Therefore, the third research hypothesis is supported.

Table 7. Results of Interactive Regression Examining the Moderating Role of Cash Holdings in the Relationship Between ESG Disclosure Quality and Financial Flexibility

Variable	Coefficient	Standard Error	t-Statistic	Significance Level
Constant	-0.985	0.175	-5.629	0.000
Environmental, Social, and Governance Disclosure Quality	0.198	0.088	2.250	0.025
Cash Holdings	0.385	0.105	3.667	0.000
Interaction Effect of ESG Disclosure Quality and Cash Holdings	0.268	0.118	2.271	0.023
Firm Size	0.062	0.025	2.480	0.013
Profitability	0.485	0.105	4.619	0.000
Financial Leverage	-0.285	0.072	-3.958	0.000
Growth Opportunities	0.088	0.038	2.316	0.021
Tangible Assets Ratio	-0.072	0.058	-1.241	0.215
Firm Age	0.032	0.026	1.231	0.219
Retained Earnings to Total Assets Ratio	0.218	0.068	3.206	0.001
Cash Flow Volatility	-0.168	0.082	-2.049	0.041

The results of Table 7 indicate that adding the interaction effect between ESG disclosure quality and cash holdings increased the explanatory power of the financial flexibility model; accordingly, the coefficient of determination increased from 0.412 in the baseline model to 0.445. The interaction effect coefficient was 0.268 and statistically significant at the five percent level, indicating that cash holdings strengthen the positive relationship between ESG disclosure quality and financial flexibility. This finding suggests that companies that not only possess higher-quality ESG disclosures but also maintain an appropriate level of cash holdings have greater ability to secure financial resources, withstand economic shocks, and exploit investment opportunities. Furthermore, the independent coefficient of cash holdings was positive and significant, confirming its direct positive effect on increasing financial flexibility. Therefore, the fourth research hypothesis, proposing the positive moderating role of cash holdings in the relationship between ESG disclosure quality and financial flexibility, is supported.

Discussion and Conclusion

The present study examined the effect of Environmental, Social, and Governance (ESG) disclosure quality on liquidity risk and financial flexibility among companies listed on the Tehran Stock Exchange and further investigated whether cash holdings moderate these relationships. The findings showed that ESG disclosure quality had a negative and statistically significant effect on liquidity risk and a positive and statistically significant effect on financial flexibility. The results also demonstrated that cash holdings reduced liquidity risk, enhanced financial flexibility, and strengthened both relationships. More specifically, the negative interaction coefficient between ESG disclosure quality and cash holdings indicated that the risk-reducing effect of ESG disclosure became stronger in firms maintaining higher levels of cash reserves. Similarly, the positive interaction coefficient in the financial flexibility model showed that companies combining high-quality ESG disclosure with adequate cash holdings had a greater capacity to withstand financial shocks, secure resources, and respond to investment opportunities. These findings collectively indicate that ESG transparency and liquidity reserves operate as complementary financial resources rather than as independent mechanisms.

The first finding showed that ESG disclosure quality had a negative and significant effect on corporate liquidity risk. This result suggests that companies providing more complete, transparent, measurable, and decision-useful information about their environmental, social, and governance activities are less exposed to difficulties in meeting short-term financial obligations. One explanation is that higher-quality ESG disclosure reduces information asymmetry between corporate insiders and external capital providers. Investors, banks, suppliers, and other creditors are better able to assess the firm's risk profile when management communicates sustainability-related exposures, governance procedures, stakeholder policies, and risk-control mechanisms in a clear and credible manner. Reduced uncertainty can strengthen creditor confidence, facilitate access to financing, and lower the probability that the firm will face a severe shortage of funds during periods of operational or market pressure.

This finding is consistent with the argument that responsible corporate behavior and transparent reporting improve access to financial resources. Firms with stronger corporate social responsibility and more credible sustainability-related information are generally able to obtain finance under more favorable conditions because capital providers perceive them as less exposed to agency conflicts, stakeholder disputes, regulatory sanctions, and operational interruptions (5). Similarly, prior evidence has shown that corporate social responsibility can reduce the cost of capital by lowering investors' perceptions of non-financial and reputational risk (9). When financing becomes more accessible and less costly, firms are less likely to experience liquidity shortages or to rely on emergency borrowing, distressed asset sales, or reductions in essential operating expenditure.

The negative relationship between ESG disclosure quality and liquidity risk is also supported by recent evidence regarding ESG disclosure and financing costs. Higher-quality ESG information can reduce capital providers' uncertainty about the future consequences of environmental and social exposures and can therefore contribute to a lower cost of financing (6). Evidence from the Iranian capital market similarly indicates that ESG performance affects financing costs and that the availability of green financing can reinforce the financial benefits of sustainability-oriented activities (10). Accordingly, the liquidity benefit observed in the present study may arise partly because firms with more reliable ESG disclosure are able to preserve financing channels, negotiate more favorable contractual terms, and maintain stronger relationships with providers of financial resources.

Another explanation for this finding concerns organizational legitimacy and stakeholder confidence. ESG disclosure provides stakeholders with evidence regarding the firm's environmental conduct, treatment of employees and communities, ethical responsibilities, and governance arrangements. When disclosure is credible and consistent with actual practices, it can support organizational legitimacy and reduce the possibility of adverse reactions from customers, regulators, employees, lenders, or local communities (1). Such reactions can have direct liquidity consequences through declining sales, legal costs, regulatory penalties, contract termination, increased monitoring, or reduced access to credit. Therefore, high-quality ESG reporting can reduce liquidity risk not only by improving external financing conditions but also by lowering the probability of stakeholder-related cash-flow disruptions.

The role of corporate reputation further explains the observed reduction in liquidity risk. Reputation is a strategic intangible asset that influences the confidence of investors, creditors, employees, customers, and suppliers. When a firm is exposed to environmental controversies, social misconduct, or governance failures, reputational damage can increase financing difficulties and create uncertainty regarding future cash flows. Previous research has demonstrated that reputation risk is significantly related to corporate cash-holding policies, indicating that firms adjust liquidity reserves in response to expected stakeholder sanctions and possible restrictions on financing (11). Evidence from companies listed on the Tehran Stock Exchange also shows that the relationship between reputation risk and cash holdings depends on financial constraints and governance conditions (12). The present findings extend these results by showing that ESG disclosure quality can operate as a reputational protection mechanism that reduces liquidity exposure.

The second major finding indicated that ESG disclosure quality had a positive and significant effect on financial flexibility. This means that firms with higher-quality sustainability disclosure were better able to mobilize financial resources, respond to unexpected shocks, preserve investment capacity, and adapt their financing decisions to changing conditions. Financial flexibility depends not only on the amount of internal resources available to a firm but also on its ability to obtain external capital when required. Transparent ESG disclosure can improve this ability by reducing uncertainty about the firm's long-term risks, governance quality, and managerial reliability. As a result, investors and lenders may be more willing to maintain financial relationships with such firms during periods of economic uncertainty.

This result aligns with evidence that ESG disclosure contributes to firm value and improves the informational environment surrounding the firm. ESG performance creates greater economic value when it is supported by adequate disclosure because external stakeholders can more accurately identify and price the firm's sustainability strengths and risks (13). Similarly, the quality of ESG disclosure has been associated with corporate value, suggesting that the capital market rewards firms whose sustainability information is sufficiently credible and decision-useful (3). A stronger market valuation and improved credibility can increase financial flexibility by enhancing borrowing capacity, supporting equity financing, and reducing the cost of raising additional resources.

The positive relationship between ESG disclosure and financial flexibility can also be explained through managerial ability and long-term strategic orientation. High-quality ESG reporting requires managers to identify material sustainability risks, establish internal information systems, coordinate across organizational units, and communicate performance in a structured manner. Firms led by more capable managers are more likely to provide voluntary ESG disclosure and seek assurance because such managers recognize the economic relevance of sustainability information and are better able to integrate it into strategic decisions (7). By contrast, managerial myopia can reduce transparency when managers prioritize short-term accounting performance and avoid disclosing long-term environmental or social risks (8). Therefore, ESG disclosure quality may reflect broader managerial capabilities that also enhance financial planning, risk management, and resource allocation.

The findings may additionally be explained by the strategic role of ESG disclosure in developing adaptive organizational capabilities. The integration of ESG reporting with corporate social responsibility practices can support a green organizational culture and encourage green innovation (14). Firms with stronger sustainability-oriented cultures may be better prepared to respond to regulatory changes, shifts in consumer demand, environmental restrictions, and technological transitions. This adaptability can stabilize future cash flows and preserve financing capacity, thereby increasing financial flexibility. Moreover, investor-focused disclosure becomes more useful when it emphasizes financially material ESG issues. Ownership arrangements and investor incentives can affect whether firms disclose material sustainability information rather than broad and non-specific narratives (4). The positive financial flexibility effect observed in the present study may therefore reflect the value of more material and investor-relevant ESG reporting.

The third finding demonstrated that cash holdings had a negative and significant effect on liquidity risk. This result is consistent with the precautionary and transaction motives for holding cash. Cash provides firms with an immediately available source of finance that can be used to pay short-term liabilities, cover unexpected expenditures, maintain operating activities, and avoid costly emergency financing. When operating cash flows decline or access to credit becomes restricted, firms with adequate cash reserves are better able to meet their obligations without selling assets under unfavorable conditions. The result is consistent with the classical view that firms determine cash holdings in response to cash-flow uncertainty, investment opportunities, leverage, access to capital markets, and the availability of liquid substitutes (15).

The fourth finding showed that cash holdings had a positive and significant effect on financial flexibility. This indicates that firms with greater liquidity reserves have more freedom to respond rapidly to investment opportunities and economic shocks. Cash allows managers to finance positive-net-present-value projects without waiting for external capital, to maintain investment during periods of financial-market disruption, and to negotiate with lenders from a stronger position. This finding is especially meaningful in emerging markets, where firms may face unstable financing conditions and limited access to external capital. Nevertheless, the value of cash depends on how effectively it is governed. Large cash balances can create agency problems when managers use them for inefficient expansion or self-serving investments. Prior evidence indicates that governance structures significantly shape both the level and consequences of corporate cash holdings (16). Thus, cash enhances flexibility most effectively when accompanied by strong transparency and oversight.

The moderating analysis revealed that cash holdings strengthened the negative relationship between ESG disclosure quality and liquidity risk. This finding means that ESG transparency is more effective in reducing liquidity exposure when companies also maintain adequate cash reserves. ESG disclosure can improve confidence and access to external funds, but external finance may not always be immediately available, particularly during market shocks. Cash reserves provide direct and immediate protection, whereas ESG disclosure provides reputational and informational support. The combination of these resources creates a stronger defensive position than either resource alone. High-quality ESG disclosure reduces the probability that stakeholders will withdraw support, while cash holdings allow the firm to continue meeting obligations even if temporary disruptions occur.

This result also reflects the interaction between reporting quality and precautionary liquidity management. Financial statement comparability and financial reporting quality can influence cash-holding decisions because a more transparent information environment reduces financing frictions and improves the allocation of internal resources (17). Sustainability reporting and accounting information comparability are similarly associated with higher-quality and more persistent accounting outcomes (18). In firms with strong disclosure systems, cash holdings are more likely to be interpreted as legitimate strategic reserves rather than as resources available for managerial misuse. Consequently, the market may assign greater value to cash balances maintained by transparent firms.

The final finding indicated that cash holdings strengthened the positive effect of ESG disclosure quality on financial flexibility. Companies with both credible ESG disclosure and sufficient cash were more capable of responding to environmental changes, financing investments, and maintaining operations during periods of uncertainty. ESG disclosure strengthens external financing capacity, while cash holdings preserve internal financing capacity. Their combined effect creates a broader set of financing options and reduces dependence on any single source of capital. This complementary relationship is particularly valuable when firms must respond rapidly to unexpected opportunities or threats. A company may have a positive reputation and strong relationships with creditors, but an immediate investment opportunity can still be lost if external financing takes time. Cash reserves allow the firm to act without delay.

Overall, the findings demonstrate that ESG disclosure quality is not merely a symbolic or compliance-oriented reporting practice. It represents a strategic mechanism through which companies can reduce liquidity risk, strengthen stakeholder confidence, preserve access to finance, and enhance financial flexibility. However, the financial consequences of ESG transparency depend partly on the firm’s cash policy. Appropriate cash reserves complement the informational and reputational benefits of ESG disclosure and convert those benefits into greater resilience against financial shocks. Therefore, ESG reporting and liquidity management should be viewed as interconnected components of corporate financial strategy.

The present study was subject to several limitations. First, the sample was restricted to non-financial companies listed on the Tehran Stock Exchange, and the findings may not be generalizable to banks, insurance companies, private firms, or companies operating in other institutional environments. Second, ESG disclosure quality was measured through content analysis of publicly available reports, which may involve some degree of researcher judgment despite the use of a structured checklist. Third, corporate disclosures may not always reflect actual ESG performance, and some firms may engage in selective reporting or symbolic disclosure. Fourth, the study relied on secondary accounting and reporting data and therefore could not directly capture managerial motivations, investor perceptions, or creditor assessments. Finally, although several control variables and robustness procedures were used, the relationships may still be influenced by unobserved organizational, institutional, or macroeconomic factors.

Future studies should replicate the analysis in other emerging and developed capital markets to determine whether institutional quality, disclosure regulation, investor protection, and financing structures alter the observed relationships. Researchers could separately examine environmental, social, and governance disclosure rather than combining them into a single index, because each dimension may influence liquidity risk and financial flexibility through different mechanisms. Future research may also distinguish between symbolic and substantive ESG reporting by combining disclosure measures with actual sustainability-performance indicators. Additional studies could investigate the mediating roles of reputation, cost of capital, financial constraints, credit ratings, and information asymmetry. Dynamic panel models, natural experiments, and longitudinal designs could be used to strengthen causal interpretation. Interviews with managers, investors, lenders, and auditors could also provide deeper insights into how ESG disclosure affects liquidity and financing decisions.

Managers should integrate ESG reporting with financial risk management rather than treating it as a separate public-relations activity. Companies should establish internal systems for collecting reliable environmental, social, and governance data and should disclose both positive achievements and material risks through measurable and comparable indicators. Boards of directors should supervise ESG reporting and cash-management policies jointly to ensure that cash reserves are maintained at an appropriate level and are used for operational continuity and value-enhancing investments. Regulators should develop standardized ESG reporting requirements and industry-specific disclosure guidance for listed companies. Investors and creditors should incorporate ESG disclosure quality into liquidity analysis, credit assessment, and valuation models. Companies should also strengthen internal controls and independent assurance procedures to improve the credibility of sustainability reports and increase stakeholder confidence.

Acknowledgments

We would like to express our appreciation and gratitude to all those who helped us carrying out this study.

Authors' Contributions

All authors equally contributed to this study.

Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

All ethical principles were adheried in conducting and writing this article.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

Funding

This research was carried out independently with personal funding and without the financial support of any governmental or private institution or organization.

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