

Article

The Sustainability–Liquidity Nexus: Insight of ESG Disclosure and Working Capital from Saudi Listed Firms

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Abstract

This study investigates the influence of working capital determinants on ESG disclosure. Using data on Saudi listed firms for 2018–2022, we find that working capital is generally positively associated with a firm's ESG disclosure. Furthermore, we observe that the positive association between working capital and ESG disclosure exists predominantly in larger firms and during the COVID-19 pandemic. Additionally, we find that during the COVID-19 pandemic, firms exhibited superior equity, debt, and cash holdings, which enhanced sustainability reporting practices. Our research provides imperative evidence about the effect of working capital on ESG disclosure from a risk management and financial flexibility perspective in emerging markets.

Keywords: ESG; working capital; Saudi listed firms; COVID-19; sustainability quality**JEL Classification:** G30; G32; Q56

1. Introduction

In the wake of global economic disruptions and growing demands for responsible corporate conduct, the concept of financial efficiency has taken on renewed importance. Working capital is not merely an item listed on a corporate balance sheet, it is a vital indicator of organizational resilience, adaptability and long-term sustainability (Chen et al., 2011). One of the most practical ways to gauge this financial efficiency is by analyzing working capital, which is measured by a firm's short-term assets and liabilities which serves as key measure of liquidity and short-term financial health. Firms that operate their capital with high efficiency are better equipped to survive unexpected losses and well-prepared for any future red flags. Few recent studies (Deloof, 2003; Gill et al., 2010) document that good management of working capital contributes directly to enhancing financial performance. However, what if we insert another dimension for this statement regarding the environmental, social and governance (ESG)?

Over the last decade, ESG has evolved from being merely an icon of sustainability into a real measurement used to ensure whether corporations are committed with its social responsibility and sustainability. In the case of Saudi Arabia, it is notable that the country has undergone several economic transformations in recent years, driven largely by Vision 2030, which shed light on sustainable development. Within this context, the Saudi Capital Market Authority (CMA) paid special attention to ESG disclosures, considering their role in enhancing transparency and long-term value creation. Nevertheless, the



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integration of ESG into corporate financial decision-making, particularly working capital management remains underexplored. Given the importance of capital-intensive nature of many Saudi firms and region's unique institutional context, understanding how working capital management determinants affect the level of ESG disclosure is vital. In this regard, we offer valuable insight for policymakers and practitioners aiming to align corporate financial strategies with national sustainability goals. Financial efficiency, corporate ESG innovation are associated with several empirical evidence since past few decades and may be underscored to the five theoretical perspectives including: Resource-based view (RBV) theory and Stakeholder Theory.

This study uses a quantitative method based on secondary data collected from the annual reports of Saudi-listed companies on the stock market (Tadawul). It also incorporates financial information sourced from international platforms like S&P Global to examine how working capital factors affect Environmental, Social, and Governance (ESG) disclosures. The sample spans five years, from 2018 to 2022. This period aligns with the shift to IFRS standards, the introduction of new governance rules, and the effects of the COVID-19 pandemic. Initially, the raw data includes 1543 observations; however, after applying selection criteria and excluding financial institutions and firms with missing financial data, our final sample consists of 794 firm-year observations. We employ a binary content analysis method to categorize ESG elements, assigning a value of 1 for disclosures and 0 for non-disclosures, following the methods of [Michelon et al. \(2015\)](#) and [Khan et al. \(2013\)](#). Among the 794 firm-year observations, 220 actively disclosed ESG information (coded as 1), while the remaining observations were coded as 0, enabling us to utilize the full panel to examine the propensity of ESG disclosure.

This study addresses a specific gap in the research about ESG disclosures among Saudi-listed companies. It analyzes how working capital factors relate to the level of sustainable reporting. ESG reporting is still in its early stages, as noted by [Michelon et al. \(2015\)](#) and [Khan et al. \(2013\)](#). The importance of this study comes from the current phase the Kingdom is undergoing, particularly after the shift to IFRS standards mentioned by [Alruwaili et al. \(2023\)](#), and the updates to governance rules that have increased transparency and disclosure. The analytical approach used helps explain how elements of working capital, like liquidity and receivables management, influence sustainability reporting. This provides a better understanding of the disclosure dynamics in a changing regulatory and economic landscape. The potential findings highlight the need to strengthen governance and oversight structures. This will help companies develop more robust disclosure practices that meet global standards, aligning with the national economic transformation described in Vision 2030.

Examining the relationship between working capital factors and ESG disclosures highlights an important link between financial performance and sustainability. This research shows a gap in sustainability reporting among Saudi-listed companies, even with the shift to IFRS standards, as noted by [Alruwaili et al. \(2023\)](#). This link highlights how working capital components can improve disclosure and transparency. This, in turn, can boost investor confidence and enhance reporting quality. Following the binary content analysis methods used by [Michelon et al. \(2015\)](#) and [Khan et al. \(2013\)](#), the study offers a clear framework for understanding how operational and financial factors can support ESG disclosures. It also helps bring the Saudi market closer to international practices in an economy that is increasingly focusing on governance and sustainability.

Our contribution is threefold. First, we investigate the influence of working capital determinants on ESG disclosure from Saudi listed firms between 2018 and 2022, providing a timely evidence of recent sustainability practices across this region. While several studies investigate the role of corporate governance on ESG activities ([Almulhim & Metwally, 2025](#);

Hussainey et al., 2025), amidst COVID-19 period, the role of working capital in reshaping ESG disclosure remains unexplored. Second, we account for firm-level heterogeneity and COVID-19 as a moderating factor, providing new insight into how ESG behaviour varies across different operational environments. Thirdly, since the ESG and other environmental issues still emerged, we offer deep insight into undertaking subsequent enhancements of corporate governance codes in reshaping this mechanisms of environmental disclosure.

2. Theoretical Background and Research Hypothesis

A massive number of studies have already been conducted regarding the relationship between corporate governance mechanisms and working capital management, most of these studies highlighting the disparities existing primarily in developed as well as emerging markets. At developed markets, strong governance mechanisms board independence and financial expertise background are both positively associated with working capital efficiency. The studies by Vafeas and Vlittis (2019) and Lins et al. (2017) indicate that such characteristics allow firms to maintain better control over their strategic financial decisions in times of market uncertainty. In contrast, governance quality in emerging markets will be more heterogeneous as they are characterized with family ownership structures and boards less diversified due to the limitation of effective working capital practices (Issa et al., 2022; Safiullah & Shamsuddin, 2022).

From a theoretical point of view, the link between working capital efficiency and ESG disclosure can be primarily described using the Resource-Based View (RBV) theory and Stakeholder theory. According to the RBV theory, financial slack and liquidity are strategic resources that provide organizations with the organizational capacity to invest in sustainability infrastructure and ESG reporting. Complementarily, Stakeholder theory suggests that financially stable and liquid firms are better positioned to meet the non-financial demands of various stakeholders through transparent ESG reporting (Freeman et al., 2010; Hansen & Schaltegger, 2016). These two theories provide a focused and robust foundation for our hypothesis that superior working capital management is positively associated with ESG disclosure.

Indeed, the increased focus on Environmental, Social and Governance (ESG) practices has had an impact on working capital decisions. Recent research highlights the benefit of ESG integration on performance measures El Ghouli et al. (2011) and Fatemi et al. (2018), which find that companies with higher ESG disclosure optimize their liquidity and have lower financing cost. While in developed markets, ESG has embedded itself into the fabric of strategic financial planning, which has allowed these firms to mitigate risks and align with Investors & stakeholder's expectation (Deegan, 2002; Orlitzky et al., 2003). Yet, ESG strategies in developing markets are not adopted uniformly, often due to inconsistent regulation and lesser availability of capital, though it is demonstrated that financial flexibility and working capital efficiency can also benefit from such ESG initiatives (Wang et al., 2024). Based on prior arguments, our first hypothesis is stated as follows:

H1. *Firms with greater working capital efficiency and liquidity exhibit higher levels of ESG disclosure.*

In addition, working capital strategies are also influenced by firm size and market context. Bureaucratic inefficiencies within larger firms in more developed markets slow the overall processes needed for optimal working capital management (Morck et al., 1988; Konadu et al., 2022). This phenomenon is often due to the conglomerate discount, in which larger diversified firms experience reduced growth opportunities that drive down their value (Lang & Stulz, 1994). In contrast, smaller firms, especially in emerging markets are more agile and find ways to align their working capital practices through financial constraints and volatile market conditions (Verheyden et al., 2016). This setting underscores

the demand for customized solutions that factor both organizational scale and context-induced complexity.

Although several studies embarked across emerging market shed light on corporate governance mechanisms such as board size, frequency of meetings held, and financial expertise background it remains major factors in promoting positive working capital management. Liquidity tasks and management of short-term assets are positively correlated with frequent board meetings and directors with financial expertise (Vafeas & Vlittis, 2019; Klapper & Love, 2004). On the other hand, strong corporate governance by larger firms can ensure a diversity of perspectives but in an environment characterized by coordination challenges (which have been shown to be more severe in the context of emerging markets; Issa et al., 2022), this diversity may come at the cost of decision making efficiency. The Working capital management is deeply influenced by the leverage, return on assets (ROA), weighted average cost of capital (WACC) and financial slack. According to Naz et al. (2022) and Rajan and Zingales (1995), high leverage typically results in a lower efficiency in working capital management, as higher default risk strengthens the need for liquidity. It is consistent with the trade-off theory of capital structure that debt will provide positive tax benefits; at the same time, heavy leverage may raise risk of default, restricting their ability to keep working capital. Higher financing costs reduce the ability of firms to invest in short-term assets and retain liquidity (Demers et al., 2021), which aggravates these problems when they have higher WACC. Moreover, financial slack or excess cash reserves create a cushion that contribute to increased ability of the firm to cope with uncertainty and ensure efficient practice in working capital (Eccles et al., 2014).

From a theoretical standpoint, the relationship between working capital efficiency and ESG disclosure can be explained primarily through the Resource-Based View (RBV) and Stakeholder Theory. RBV posits that financial slack and liquidity constitute strategic resources that endow organizations with the capacity to invest in sustainability infrastructure and ESG reporting. Complementarily, Stakeholder Theory contends that financially stable and liquid firms are better positioned to address the non-financial demands of diverse stakeholders through transparent ESG reporting (Freeman et al., 2010; Hansen & Schaltegger, 2016). Together, these two theories provide a coherent and robust theoretical foundation for our hypothesis that superior working capital management is positively associated with ESG disclosure.

3. Research Design

3.1. Sample Selection

The paper examines the impact working capital determinants on ESG disclosure in Saudi Listed firms, employing various econometrics techniques described above. The present research used an empirical analysis based on Saudi Stock Market (TADAWUL) index sample, which includes companies of each industry. All data have been gathered through international platforms and via Tadawul website manually. Based on that, we gain the secondary source from international financial platforms such as (e.g., S&P global).

3.2. ESG Disclosure Constriction: Dependent Variable

Then, we open the annual reports listed in the Saudi stock market to confirm our data reliability. While the rest of variables were collected manually to capture the relation between working capital determinants and ESG disclosure across Saudi listed firms. Our final sample consists of 794 firm-year observations from Saudi listed firms, spanning five years from 2018–2022. We pick out this period due to several reasons. Initially, Saudi Arabia moved from U.S. GAAP to International Financial Reporting Standards (IFRSs) as a means of joining international harmonization (Alruwaili et al., 2023). Secondly, Saudi

Arabia implemented new financial reporting requirements in its corporate governance code in 2016. More importantly, this period encompasses the COVID-19 pandemic. Our initial raw data contains 1543 observations. After applying selection criteria, our final sample is 794 firm-year observations. To construct the ESG disclosure variable, we employ a binary content analysis approach following [Michelon et al. \(2015\)](#) and [Khan et al. \(2013\)](#), where each ESG disclosure item is coded as 1 if the firm disclosed it and 0 otherwise. Among the 794 observations, 220 firm-year observations correspond to active ESG disclosers (coded as 1), while the remaining 574 observations are non-disclosers (coded as 0). This approach allows us to utilize the full panel data and examine the propensity of ESG disclosure across all Saudi-listed firms. Figure 1 exhibits the ESG disclosure rate by year.

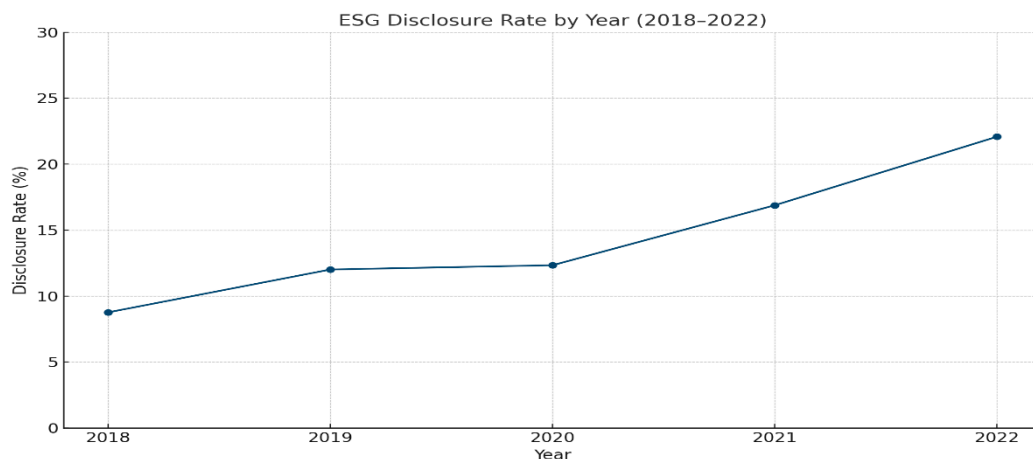


Figure 1. ESG disclosure rate by year. Note(s): our sample standards is based on the company that disclosed ESG in its annual reports. Moreover, we take into account all firms listed in Saudi Stock Market to conduct a thorough analysis of ESG from a different sector. Figure 1 preforms our trend of ESG disclosure across Saudi listed firms over 2018–2022.

Regarding our selection of ESG information across Saudi listed firms, we notice that among 220 observed disclose ESG and the rest was coded in 0 to fully mitigate any omitted values. Appendix C exhibits Criteria of ESG selection producers.

3.3. Independent, Control and Moderator Variables

Taking into account the control variable of this investigation such as firm size (*fsize*), and moderator variable (COVID-19), we select the following variables including *fwc*, *fequity*, *fcash*, and *fdebt* to capture this relation. These variables were theoretically grounded in stakeholder and resources-based views. In addition it was explained by unique empirical studies (e.g., [Khan et al., 2013](#); [Harun et al., 2020](#)) to point out the nexus in voluntarily sustainability reporting. The definition of all previous variables are presented in Appendix A.

3.4. Econometric Model Estimations

We start our baseline regression by the following equation:

$$ESG_{i,t} = \beta_0 + \beta_1 fsize_{it} + \beta_2 fdebt_{it} + \beta_3 fequity_{it} + \beta_4 fwc_{it} + \beta_5 fcash_{it} + \beta_6 COVID-19_{it} + \epsilon_{it} \quad (1)$$

In the prior equation, the dependent variable is ESG, while the independent variables are indicators of working capital determinants including *fwc*, *fdebt*, *fequity*, *fcash* and the rest of the variables is considered such as control variable (*fsize*) to mitigate any endogenous issues.

Following [Fu et al. \(2025\)](#), we capture this relation through applying diverse econometric analysis including Pooled OLS, Fixed Effects (FE), Random Effects (RE), Two-Stage Least Squares (2SLS), Panel Corrected Standard Errors (PCSEs), Logistic Regression, and one-step

dynamic GMM. The rationale for this multi-method approach is as follows: Pooled OLS provides a baseline estimate; FE and RE control for unobserved firm-level heterogeneity; Logistic Regression is appropriate given the binary nature of our dependent variable; and PCSEs address heteroscedasticity and cross-sectional dependence. To address potential endogeneity arising from reverse causality between working capital and ESG disclosure, we employ 2SLS and dynamic GMM estimators. For the 2SLS model, we utilize industry-peer averages of working capital determinants as instrumental variables (IVs). These instruments satisfy the relevance condition (correlated with firm-level working capital) and the exclusion restriction (industry-level averages are unlikely to directly affect a specific firm's ESG disclosure beyond their effect through the firm's own working capital). For the dynamic system GMM model, we use the second and deeper lags of the endogenous variables as internal instruments, following Arellano and Bond (1991). We report the Arellano-Bond AR(1) and AR(2) tests to check for serial correlation, and the Hansen J-test to confirm the validity of the overidentifying restrictions.

$$ESG_{i,t} = \alpha_i + \beta_1 fsize_{it} + \beta_2 fdebt_{it} + \beta_3 fequity_{it} + \beta_4 fwc_{it} + \beta_5 fcash_{it} + \beta_6 COVID-19_{it} + u_{it} \quad (2)$$

$$ESG_{i,t} = \alpha_i + \lambda_t + \sum_{\{k=1\}_k^{\{6\}} \beta X_{\{kit\}}} \quad (3)$$

$$ESG_{i,t} = \beta_0 + \sum_{\{k=1\}_k^{\{6\}} \beta X_{\{kit\}}} + \mu_i + u_{\{it\}} \quad (4)$$

$$ESG_{i,t} = \gamma ESG_{\{it-1\}} + \sum_{\{k=1\}_k^{\{6\}} \beta X_{\{kit\}}} + \mu_i + \epsilon_{\{it\}} \quad (5)$$

Thereby, our interactive model specification is presented as follows:

$$ESG_{i,t} = \beta_0 + \beta_1 fsize_{it} + \beta_2 COVID-19_{it} + \beta_3 (fsize_{it} \times COVID-19_{it}) + \epsilon_{it} \quad (6)$$

4. Results and Discussion

4.1. Descriptive Statistics

Table 1 reports the descriptive statistics. The ESG disclosure matrix ranges a minimum of 0 to a maximum value of 1 with standard deviation of 0.339, highlighting plausible nexus in ESG disclosure across Saudi listed firms. The mean value of *fwc* is 7.624, indicating that higher levels of working capital tends to disclose ESG information. On average 68.3% of the firm-year observations in our data fall within the COVID-19 period, capturing its effects on ESG disclosure behavior.

Table 1. Descriptive Statistics.

Variable	Obs	Mean	Std. Dev.	Min	Max
<i>ESG</i>	794	0.132	0.339	0	1
<i>fsize</i>	794	8.462	0.928	6	12
<i>fdebt</i>	794	7.503	1.173	5	11
<i>fequity</i>	794	8.193	0.908	6	12
<i>fwc</i>	794	7.624	0.835	3.89	11.15
<i>fcash</i>	794	7.18	0.923	3.99	10.9
<i>COVID-19</i>	794	0.683	0.466	0	1

4.2. Pairwise Correlations

Table 2 reports the effect of working capital determinants on ESG disclosure level. The results indicate the estimated coefficients of working capital indicators (*fdebt*, *fwc*, *fquity*, and *fcash*) on ESG are 0.381, 0.503, 0.519, and 0.507, all of which are significantly positive

at the 1% level. This reflects that working capital determinants significantly promote firm ESG disclosure, thus, we could confirm our hypothesis validation. It notable that there is a correlated link between *fsize* and ESG, suggesting that corporate with larger total assets tend to engage in higher ESG disclosure practices. Figure 2 displays the correlation heatmap to affirm the absence of any multicollinearity issues.

Table 2. Pairwise correlations.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) <i>ESG</i>	1.000						
(2) <i>fsize</i>	0.503	1.000					
(3) <i>fdebt</i>	0.381	0.759	1.000				
(4) <i>fequity</i>	0.519	0.883	0.684	1.000			
(5) <i>fwc</i>	0.503	0.762	0.575	0.771	1.000		
(6) <i>fcash</i>	0.507	0.799	0.656	0.783	0.808	1.000	
(7) <i>COVID-19</i>	0.035	−0.095	−0.123	−0.100	−0.039	−0.022	1.000

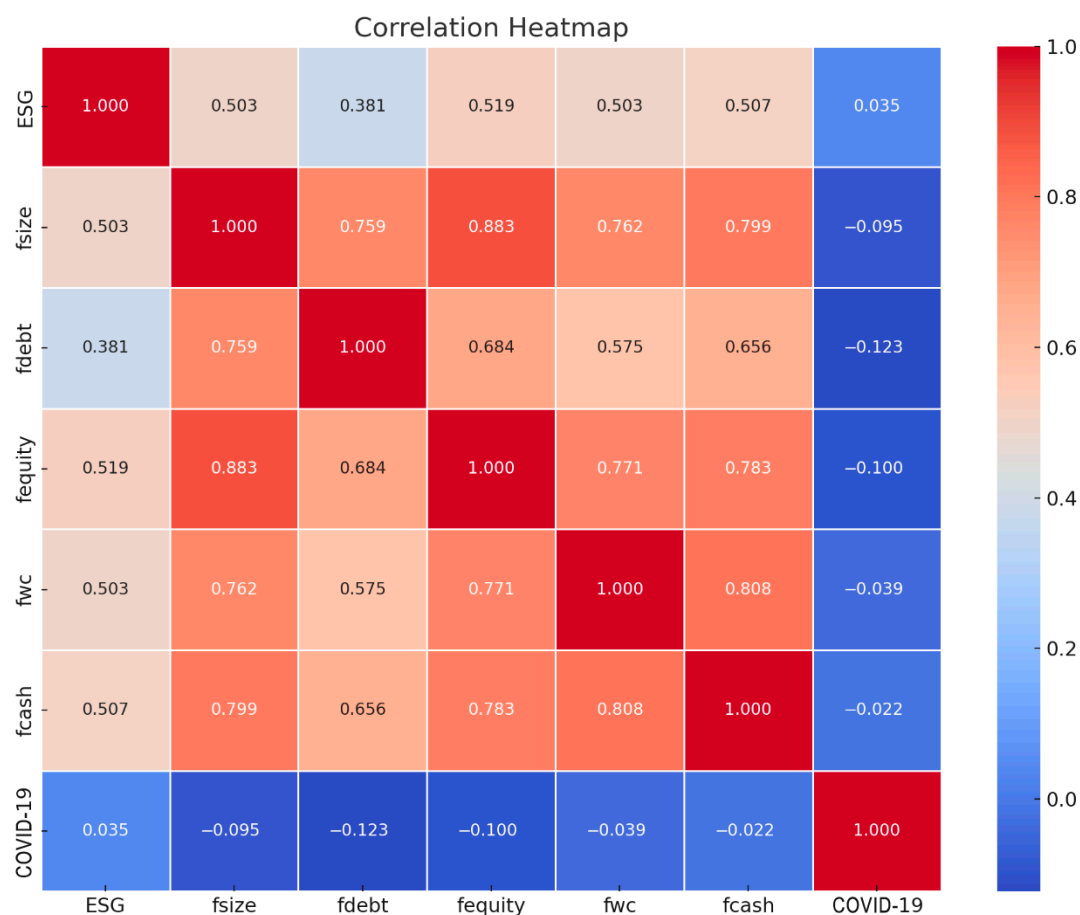


Figure 2. Correlation Heatmap.

5. Regression Analysis

As illustrated by Table 3, we empirically report the baseline regression model of working capital detriments on ESG level with diverse econometric analysis including Pooled OLS, Random Effect, Fixed Effect, 2SLS regressing, Logistics, and Panel Corrected Standards Errors (PCSEs) to solve any potential endogeneity issues. Our results confirms the absence of both unobserved heterogeneity and non-exogenous issues were observed. Importantly, we control for this relation by relying heavily on firm size (*fsize*) which is more common control variable in corporate governance literature to fully capture any

endogenous issues. In more details, larger firms tend to disclose more information about its activities as opposed to smaller firms (Alruwaili, 2025). The influence of *fequity*, *fwc*, and *fcash* is significantly positive on ESG disclosure, suggesting that stronger financially firms with greater liquidity and high equity tend to disclose more information about ESG which aligns with shareholder perspectives.

Table 3. Baseline Model Analysis.

	(1)	(2)	(3)	(4)	(5)
Variables	Pooled OLS Regression	Random Effect	Fixed Effect	2SLS Regression	PCSEs
<i>fdebt</i>	−0.004 (0.013)	0.003 (0.018)	0.001 (0.014)	−0.004 (0.013)	0.002 (0.015)
<i>fequity</i>	0.085 *** (0.025)	0.029 (0.040)	0.071 *** (0.027)	0.085 *** (0.025)	0.073 *** (0.025)
<i>fwc</i>	0.064 *** (0.022)	0.021 (0.023)	0.040 * (0.020)	0.064 *** (0.022)	0.063 *** (0.020)
<i>fcash</i>	0.054 ** (0.022)	−0.012 (0.025)	0.022 (0.021)	0.054 ** (0.021)	−0.005 (0.016)
<i>fsize</i>	0.031 (0.027)	0.051 (0.035)	0.061 ** (0.027)	0.031 (0.027)	0.062 *** (0.023)
COVID-19	0.053 ** (0.022)	0.077 *** (0.017)	0.061 *** (0.016)	0.053 ** (0.022)	0.018 (0.018)
Constant	−1.698 *** (0.102)	−0.685 (0.417)	−1.473 *** (0.140)	−1.698 *** (0.102)	−1.449 *** (0.124)
Observations	794	794	794	794	794
R-squared	0.310	0.054		0.310	0.110
Robust	No	Yes	No	No	Yes
Number of id		214	214		214

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

6. Additional Robustness Checks

Table 4 provides further robustness checks with more advanced econometric analysis one step dynamic GMM that developed by Arellano and Bond (1991), to handle endogenous regressors by using internal instruments. We further employ Fixed Effect with Driscoll-Kraay Standard errors to tackle potential heteroscedasticity, serial correlation, and cross-sectional dependence. Notably, and once we address endogeneity through GMM system, we find that larger firms tend to less disclose information about ESG. Comparing with the outcome of Pooled OLS, the result is less likely biased as pooled OLS does not control of unobserved heterogeneity. In Appendix B, we estimated both IV-2sls and GMM models that indicate that cash holdings *fcash* remain positively associated with ESG disclosure while significance of working capital disappear after instrumenting the endogenous. The over identification tests did not pass to reject the null hypothesis ($p = 0.367$), supporting the validity of the selected instruments. The Coefficient on the lagged ESG variable is positive and highly significant, indicating strong persistence in ESG disclosure practices among Saudi listed firms. Importantly, the Hansen test confirms instrument validity ($p = 0.384$), while the Arellano-Bond tests reveal significant first-order serial correlation (AR(1), $p = 0.009$) but no evidence of second-order serial correlation (AR(2), $p = 0.265$). Collectively, these findings suggest that the reported results are robust to alternative estimation techniques and are unlikely to be driven by reverse causality or omitted variable bias. In addition, Table 5 report the nexus relation among these variables in pre-post COVID-19 pandemic with Chew Test, confirming the less effect within corporate disclosure activities about ESG. The association between *fwc*, *fequity*, and *fcash* remains positive through three

periods addressed in this estimations, reflecting the strong corporate governance practices applied in the vast majority of Saudi listed firms.

Table 4. Robustness checks.

Variables	2SLS	GMM	Fixed Effect with Driscoll-Kraay Stander Errors
<i>ESG_1</i>	0.051 *** (0.014)	0.910 *** (0.075)	
<i>fsize</i>	−0.051 *** (0.011)	0.027 (0.046)	0.051 * (0.019)
<i>fdebt</i>	−0.011 ** (0.005)	0.005 (0.025)	0.003 (0.014)
<i>fequity</i>	−0.010 (0.010)	0.022 (0.054)	0.029 (0.039)
<i>fwc</i>	0.034 *** (0.009)	0.067 * (0.035)	0.021 (0.014)
<i>fcash</i>	0.016 * (0.009)	−0.049 (0.030)	−0.012 (0.018)
<i>COVID-19</i>	0.026 *** (0.009)	−0.033 (0.022)	0.077 * (0.032)
Constant	0.274 *** (0.050)	−0.530 (0.509)	−0.685 *** (0.087)
Observations	733	685	794
Number of id	212	211	
Robust	No	Yes	No
Number of groups			214

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

Table 5. Regression Model and Chow Test.

Variables	Full Sample (2018–2022)	Pre-COVID (≤ 2019)	Post-COVID (> 2019)
<i>fsize</i>	0.030 (0.027)	0.008 (0.044)	0.035 (0.035)
<i>fdebt</i>	−0.007 (0.013)	−0.007 (0.023)	−0.003 (0.017)
<i>fequity</i>	0.081 ** (0.025)	0.142 ** (0.042)	0.061 * (0.031)
<i>fwc</i>	0.064 ** (0.022)	0.019 (0.032)	0.091 ** (0.030)
<i>fcash</i>	0.059 ** (0.022)	0.069 * (0.034)	0.047 (0.028)
Constant	−1.642 *** (0.100)	−1.728 *** (0.171)	−1.655 *** (0.124)
R-squared	0.305	0.356	0.296
Observations	794	252	542
Chow Test $F(6, 782)$, p -value	1.614 ($p = 0.14$)	—	—

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

Figure 3 presents the interaction plots showing the moderating role of COVID-19 pandemic on the relation between working capital (*fwc*) and firm size (*fsize*), indicating that the positive relation of *fwc* was observed during the COVID-19 while the effect of *fsize* was slightly diminished during this pandemic. This suggest that greater liquidity enables firms sustainable its practices about environmental concerns such as ESG disclosure.

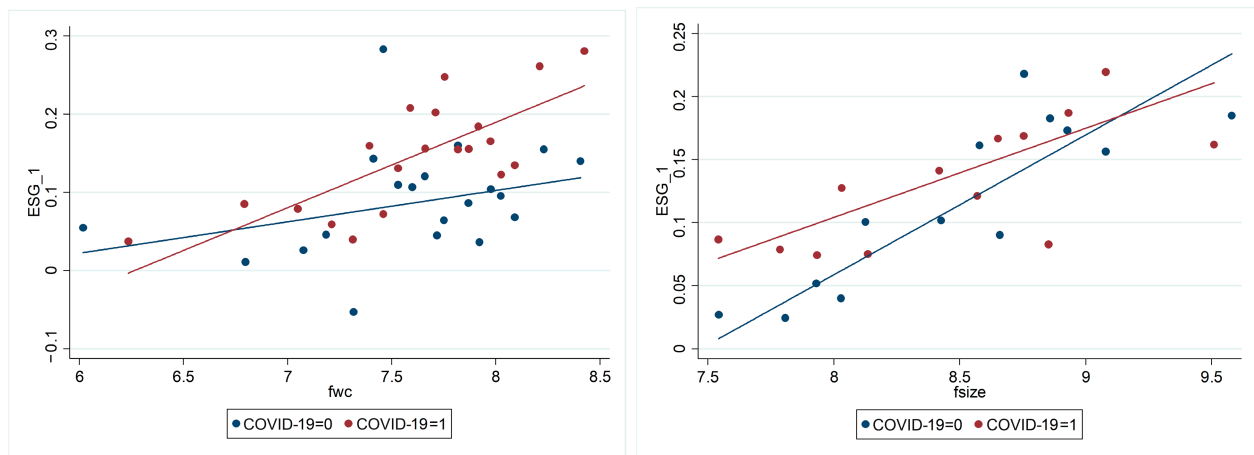


Figure 3. Interaction Plot of COVID-19 among *fwc* and *fsize*.

Corresponding to [Albuquerque et al. \(2020\)](#) and [Lavin and Montecinos-Pearce \(2022\)](#), we demonstrate that the association between working capital and ESG disclosure is more pronounced among larger firms and during the COVID-19 period. In other words, firms tend to leverage their liquidity for sustainability reporting, particularly under unexpected crisis conditions. To sum up, the more firms have strong ESG profiles, the more effectively they manage their working capital.

The findings of this study can be interpreted through two theoretical perspectives: the Resource-Based View (RBV) and Stakeholder Theory. From the RBV perspective, efficient working capital management signals the financial capabilities of the firm, particularly liquidity and financial slack, which serve as valuable and flexible resources that facilitate sustainability investments and ESG disclosure. Such resources prove especially critical during periods of crisis, such as the COVID-19 pandemic ([Hansen & Schaltegger, 2016](#); [Lins et al., 2017](#)).

Stakeholder Theory further contends that financially robust firms are better positioned to respond to stakeholder pressure by investing in sustainability initiatives and enhancing ESG disclosure transparency, particularly during periods of economic uncertainty ([Eccles et al., 2014](#)). The moderating role of COVID-19 observed in the results suggests that firms may increasingly rely on internal financial resources to absorb external shocks and sustain their ESG disclosure strategies.

7. Conclusions

In this investigation, we emphasize in place to point out the possible role of working capital determinants on ESG disclosure. In total of 796 observations of Saudi Listed firms were tested over 2018–2022 to capture the uniqueness of this association. We document that firms with higher levels of working capital efficiency and liquidity are positively associated with greater ESG disclosure. This study furnishes valuable insight and managerial implications for GCC policy makers: First, regulators are inclined to facilitate better corporate ESG reporting through establishing formal ESG disclosure indicators and guidelines. Second, Capital market authority (CMA) is encouraged to impose firms to establish sustainability committee with an independent member who hold at least a professional certification from global reporting initiative (GRI) to apply the best sustainability practices. Finally, it is suggested that the authority require a specific file for each annual reports that confirm the environmental information including: scope, content and format and publish these in its social media account to increase the investor's confidence.

The literature confirms several variation in governance practices, ESG integration, and financial constraints affecting working capital management between developed and emerging markets. This means that the strong governance and ESG initiatives characterize liquidity & cost of capital in developed markets; but emerging markets are different because they have weaker institution working, paired with a special ownership structure. Lastly, these factors e.g., firm size, and leverage influences working capital policies that show the need for a context specific market approach and also firm-specific dynamics. Subsequent research may investigate how digital transformation and/or innovations in financial technology influence working capital practices to help managers practice the optimization of working capital across a variety of market settings.

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Appendix A. Variable Definitions

The following table provides the definitions and measurement formulas for all variables used in this study.

Variable Name	Code	Definition/Formula	Source
ESG Disclosure	<i>ESG</i>	Binary variable: 1 if the firm discloses ESG information in its annual report, 0 otherwise.	Annual Reports (Tadawul)
Working Capital	<i>fwc</i>	Net Working Capital/Total Assets	S&P Global/ Annual Reports
Firm Debt	<i>fdebt</i>	Total Debt/Total Assets	S&P Global/ Annual Reports
Firm Equity	<i>fequity</i>	Total Equity/Total Assets	S&P Global/ Annual Reports
Firm Cash	<i>fcash</i>	Cash and Cash Equivalents/Total Assets	S&P Global/ Annual Reports
Firm Size	<i>fsize</i>	Natural logarithm of Total Assets	S&P Global/ Annual Reports
COVID-19 Dummy	<i>COVID-19</i>	Dummy variable: 1 for fiscal years 2020 and 2021, 0 otherwise.	Constructed by authors

Appendix B. Further Robustness Tests Using Lagged IV-2SLS and System GMM

Variables	(1) System GMM	(2) IV-2SLS
ESG_{t-1}	0.994 *** (0.077)	–
fwc	−0.293 (0.193)	−0.004 (0.081)
$fequity$	0.139 (0.159)	0.101 * (0.055)
$fcash$	0.050 (0.122)	0.203 *** (0.074)
$fdebt$	0.088 (0.108)	−0.044 (0.032)
$fsize$	−0.027 (0.142)	0.027 (0.051)
COVID-19	−0.005 (0.029)	–
Constant	0.332 (0.405)	−2.000 *** (0.182)
Observations	685	356
Number of Groups	211	–
Wald χ^2	610.76 ***	256.01 ***
Hansen Test (<i>p</i> -value)	0.384	0.367
Sargan Test (<i>p</i> -value)	0.105	–
AR(1) (<i>p</i> -value)	0.009	–
AR(2) (<i>p</i> -value)	0.265	–

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

Appendix C. Sample Selection Procedure and ESG Disclosure Items

Sample Selection Process	Firm-Year Observations
Initial sample of Saudi listed firms (2018–2022)	1543
Less: Financial institutions	500
Less: Firms with missing financial data	294
Final sample used in the analysis	794
ESG disclosure observations (coded as 1)	220
Non-disclosure observations (coded as 0)	574

Table A1. ESG Disclosure Items Evaluated.

Category	Disclosure Items
Environmental	1. Greenhouse gas emissions
	2. Energy consumption
	3. Water usage
	4. Waste management
	5. Environmental policies and management systems
Social	1. Employee health and safety
	2. Diversity and equal opportunity
	3. Training and educationModified
	4. Community engagement and development
	5. Human rights policies

Table A1. Cont.

Category	Disclosure Items
Governance	1. Board composition and independence 2. Executive compensation 3. Anti-corruption and bribery policies 4. Shareholder rights 5. Risk management practices

Note(s): these items were extracted from Capital IQ and Refinitiv platforms based on the secondary reliable score.

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