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Does the efficiency of working capital management and environmental, social, and governance performance affect a firm's value? Evidence from the United States

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Abstract. *This study evaluates the efficiency of U.S. firms' working capital management (WCME) by employing the data envelopment analysis technique (DEA). This study uses regression analysis to examine the impact of WCME and environmental, social, and governance (ESGP) performance on U.S. firm value. This study uses a data sample consisting of 964 firm-year observations from a longitudinal panel collected from 2016 to 2019. Endogeneity issues and the employment of additional analyses for robustness were considered. The results indicated that most firms under investigation were relatively inadequate regarding WCME and required correctional efforts by decision-makers to accomplish most reasonable efficiency, directly related to enhancing firm sales and net income. Additionally, the results reveal significant and positive influences of WCME and ESGP on firm value. The implications of this study would push decision-makers to employ the most reasonable procedures and strategies to improve the activities of a firm's WCM and ESG to boost its value and excel in the business environment.*

Keywords: *Data envelopment analysis, Efficiency, Environmental, ESG, Governance, Performance, Social, WCM, United States, Working capital management.*

JEL Classification: *C61, M21, M41, O16, Q56.*

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Introduction. Firms that want to excel in their current business environment and develop rapidly should seek to manage and use their available resources efficiently. This is because the business environment is undergoing rapid changes. The management of working capital appears to have attracted significant interest in accounting and finance research, as empirical evidence indicates (Habib & Kayani, 2022; Habib & Mourad, 2022). WCM is a fundamental feature of a successful firm because it directly affects firm performance (Habib & Mourad, 2022; Tewolde, 2002). Poor decisions regarding a firm's working capital are also directly responsible for many distressed firms (Habib & Kayani, 2022). This is even more surprising, considering the significant role of inefficient or inadequate WCM in the demise of many firms (Alshubiri, 2011; Habib & Kayani, 2022). The body of academic research indicates that for a firm to ensure its continued operational and financial viability, it is essential to formulate an effective working capital strategy, as working capital significantly impacts the safety of a firm's finances and operations (Habib & Mourad, 2022; Zimon, 2021; Zimon & Tarighi, 2021). In addition, the connection between ESGP as sustainable development and corporate finance has enticed investors, decision-makers, and other information users as a crucial means of enhancing firm value (Chouaibi & Zouari, 2022; Malik, 2015; Rezaee, 2016). Moreover, firms that prioritize investments in ESG can boost their earnings and long-term sustainability, reduce costs, increase productivity, minimize risk potential, provide opportunities to generate revenue, and provide other benefits (Eccles et al., 2014; Malik, 2015; Rezaee, 2016).

This study's motivation emanates from the economic prospects and market characteristics of the United States. The U.S. is a highly developed country, and during the current rapid change in the environment, technology, supply chains, and competition, it is more critical than ever for regulators, management, and investors to have a firm grasp of their decisions. Therefore, concerns regarding firms' WCM efficiency and ESG performance, which may affect their competitiveness and value, are growing. Thus, this study aims to evaluate the efficiency of WCM in listed U.S. firms. Additionally, this study explores the influence of WCM efficiency and ESG performance on firm value. In this study, the DEA method was used to assess the efficiency of WCM in U.S. firms. In addition, this study uses regression analysis to explore the influence of WCM efficiency and ESG performance on U.S. firm value. This study uses a data sample of 964 firm-year observations from a longitudinal panel gathered between 2016 and 2019. In addition, endogeneity problems and additional analyses to strengthen the robustness are considered. The outcomes indicated that most firms were relatively inefficient in terms of WCM and required corrective efforts by decision-makers to achieve the most reasonable efficiency. Furthermore, this study demonstrates that WCM and ESGP significantly affect firm value.

This study is needed so that regulators, government officials, and investors can learn more about the status of WCME in U.S. firms. It also provides a detailed look at the factors that affect firm value, such as WCM efficiency and ESG performance. Based on the results of this study, firms' decision-makers should adapt and employ the necessary means and strategies to deal with the inefficient aspects of WCM and ESG practices to ensure that a firm works well and increases its value. The implications of this study would push decision-makers to use the most appropriate methods and strategies to improve a firm's WCM and ESG activities to enhance its value and excel in the business environment. Based on the above, this study aims to investigate the following:

RQ1. On an average, are there significant differences in firms' WCME over the study period?

RQ2. Does the efficiency of WCM significantly affect firm value?

RQ3. Does the performance of ESG significantly affect firm value?

The remainder is organized as follows. Section 2 illustrates a literature review, followed by Section 3, which illustrates the methodology and research methods employed, followed by Section 4, which illustrates and discusses the results, and Section 5, which illustrates the synopsis and conclusions.

1. Literature Review. WCM is necessary for a business's success (Deloof, 2003; Tran et al., 2017). In addition, Akinlo (2012) confirms a positive association between WCM and Nigerian firms' financial performance. Wasiuzzaman (2015) confirms that working capital is negatively associated with Malaysian firms' financial performance. Dalci and Ozyapici (2018) documented a positive connection between WCM and financial performance. Soukhakian and Khodakarami (2019) investigate the connection between WCME and Iranian industrial firms' financial performance. They confirm a positive relationship between WCME and financial performance. Altaf (2020) explores the effect of WCME on the performance of the Indian hospitality sector and reveals a non-monotonic relationship between WCME, financial performance, and firm value. In addition, WCM can assist with peril control and improve firm value (Boisjoly et al., 2020). Furthermore, Wang et al. (2020) confirm that WCME is negatively associated with Pakistani firms' financial performance. Chamberlain and Aucouturier (2021) demonstrate a positive connection between WCM, performance, and the value of European firms. Aldubhani et al. (2022) show a positive connection between WCME and firms' financial performance in Qatar. Jaworski and Czerwonka (2022) confirm a nonlinear connection between Polish firms' working capital and financial performance.

In addition, the connection between ESGP as sustainable development and corporate finance has enticed investors, decision-makers, and other information users as a crucial means of enhancing firm value (Chouaibi & Zouari, 2022; Malik, 2015; Rezaee, 2016). Further, the growth of sustainability initiative disclosures over the past few decades can be largely attributed to the social pressure placed on businesses to publicly report their sustainability performance and associated risks (Grimaldi et al., 2020). In addition, Aouadi and Marsat (2018) confirm a positive link between ESGP and firm value. Fatemi et al. (2018) confirm the positive moderating influence of ESG disclosure on the linkage between ESGP and firm value. Abdi et al. (2021) confirm a positive connection between ESG disclosure and firm value. Fuente et al. (2021) demonstrate a positive connection between ESGP and firm value in the U.S. from 2009 to 2018. Wong et al. (2021) confirm a positive relationship between ESG disclosure and Malaysian firms' values. Based on prior evidence, this study hypothesizes the following:

H1. On average, there were significant differences in the firms' WCME over the study period.

H2. The WCME has a positive and significant effect on firm value.

H3. The ESGP has a positive and significant effect on firm value.

2. Methodology and research methods

2.1 Data Description. The sample includes all U.S. non-financial firms for which all study variables are known. This study excludes the financial industry because of its nature (McAlister et al., 2016; Palomino-Tamayo et al., 2020). The study uses 2016-2019 data to test the hypotheses. Data were collected from Standard and Poors DataStream and firm websites that published financial statements (when available). The initial sample included 618 firms. Following Habib and Mourad (2022); Portela et al. (2004); Shahwan and Habib (2020), negative values confine the ability of the basic DEA models. Thus, 377 firms are excluded. Finally, the study includes 241 firms and 964 firm-year observations in a longitudinal panel.

2.2 Efficiency of WCM. DEA, as a non-parametric technique, was selected to evaluate WCME because of its unique features for continuous improvement, as it concentrates on the soundest practices of firms under examination rather than traditional approaches that depend on central-tendency measures (Cooper et al., 2007; Habib & Shahwan, 2020; Mourad et al., 2021; Mourad et al., 2022; Shahwan & Habib, 2021; Tone, 2016). The literature reinforces our selection of previously employed variables in a similar nomological context, ensuring measure validity. The DEA models developed by Habib and Kayani (2022); Habib and Mourad (2022) were used to assess WCME. Accordingly, this study used net income and net sales as outputs, and payable, inventory, cost of goods sold, and receivable as inputs. Following Habib and Kayani (2022); Habib and Mourad (2022), the WCME can be mathematically estimated by solving the following model:

$$\begin{aligned} &\max\ \theta_n \\ &\text{St}\quad -\theta_n\, y^t_{rn} + \sum_{j=1}^{N} \lambda_j\, y^s_{rj} \geq 0, \quad r = 1, \dots, m_o \\ &\qquad x^t_{in} - \sum_{j=1}^{N} \lambda_j\, x^s_{ij} \geq 0, \qquad i = 1, \dots, m_I \\ &\qquad \lambda_j \geq 0 \end{aligned} \tag{1}$$

where x^s_{in} (resp. y^s_{rn}) is the value of the i-th input (resp. r-th output) of the n-th DMU observed in period s, the λ_n are the weights corresponding to the n-th DMU.

2.3 Regression analysis model

Following DMUs' WCME assessment, this study employs regression analysis to specify the likely statistical influence of WCME and ESGP on firm value. Regression analysis can be mathematically estimated by solving the following model:

$$\text{Tobin's } Q_{it} = \beta_0 + \beta_1 \text{WCME}_{it} + \beta_2 \text{ESGP}_{it} + \beta_3 \text{Size}_{it} + \beta_4 \text{Age}_{it} + \beta_5 \text{Leverage}_{it} + \varepsilon_{it} \tag{2}$$

Where Tobin's Q represents firm value. WCME_{it} is WCM efficiency calculated by the adopted DEA model. ESGP_{it} is the performance score of ESG based on multiple sub-dimensions: environmental, social, and governance. The score ranges from 0 to 100, and a higher value indicates the best performance. Size_{it} is firm size computed by the natural log of firm sales. Age_{it} is firm age computed by the natural log of the period from the activity start to the current year. Leverage_{it} is firm leverage computed by the ratio of total debts to total assets; β_0 is a constant; β_i represents the regression coefficient; and ε_i are known by the Gaussian noises or errors.

3. Results

3.1 Results of the WCME model

Panel A of Table 1 summarizes the annual mean of WCME during the study period. Panel B illustrates a statistical test to verify the likelihood of substantial differences in DMUs' WCME during the analysis through the Wilcoxon signed-rank test using Stata/MP version 16.

Table 1. WCME scores summary and Wilcoxon test results

Panel A: WCME scores summary of annual means				
Year	2016	2017	2018	2019
Efficiency Scores	0.706	0.708	0.731	0.721

Table 1 (cont.). WCME scores summary and Wilcoxon test results

Panel B: Test results of the differences using Wilcoxon signed ranks test				
Wilcoxon Signed Test	Sig.	Null Hypothesis	In favor of	Decision
Period (2016-2017)	0.271	The median of differences between year_2016 and year_2017 equals zero.	Null	Retain the null hypothesis
Period (2017-2018)	< 0.001	The median of differences between year_2017 and year_2018 equals zero.	Year 2018	Reject the null hypothesis
Period (2018-2019)	< 0.001	The median of differences between year_2018 and year_2019 equals zero.	Year 2019	

Source: Compiled by the author.

The results of the WCME summary of the annual means indicate that WCM was approximately 70.6%, 70.8%, 73.1%, and 72.1% (on average) in 2016, 2017, 2018, and 2019, respectively. The number of efficient DMUs was approximately 44, 48, 50, and 47 (out of 241firms) during the study period, respectively. In addition, the differences using the Wilcoxon signed-rank test showed no substantial difference in DMUs' WCME at the 5% significance level between 2016 and 2017. Therefore, the null hypothesis that the median of the differences equals zero is retained. Moreover, the results show a substantial difference in WCM scores at the 5% significance level between 2017, 2018, and 2019. Therefore, the null hypothesis that the median of the differences equals zero is rejected. Thus, the outcome above suggests that H1 is somewhat supported. These findings are consistent with those of previous studies such as Habib and Kayani (2022); Habib and Mourad (2022). Furthermore, the adopted efficiency model findings demonstrated that most firms under investigation were relatively inadequate regarding WCME and required correctional efforts by decision-makers to accomplish most reasonable efficiency, directly related to enhancing firm sales and net income.

3.2 Results of the regression analysis model

Table 2 presents Pearson's correlation outcomes for the autonomous variables in this study.

Table 2. Correlation matrix between variables and variance inflation factor and tolerance values

Panel A: Correlation matrix between variables					
Variables	WCME	ESGP	Size	Age	Leverage
WCME	1.000				
ESGP	0.044	1.000			
Size	0.340**	0.353**	1.000		
Age	-0.130**	0.046	0.109**	1.000	
Leverage	-0.079*	0.142**	0.173**	0.120**	1.000
Panel B: Values of variance inflation factor and tolerance					
VIF	1.20	1.16	1.37	1.05	1.07
Tolerance	0.837	0.864	0.733	0.950	0.937

Notes: *p < 0.05; **p < 0.01.

Panel A of Table 2 illustrates the correlation matrix between variables. Panel B presents the variance inflation factor (VIF) and tolerance values, showing the scope to which, the illustrative variables are linked. The results show no autonomous variables with coefficients greater than 0.80. In addition, multicollinearity did not materialize among the autonomous variables, as the highest VIF value was 1.37. Table 3 summarizes the regression model results. This study employs random effects through regression analysis to evaluate the impact of WCM and ESGP on firm value.

Table 3. Random-effects regression analysis model

Num. of observation = 963			Wald chi2(5) = 22.58			
Num. of groups = 241			Prob > chi2 = 0.000			
Firm value	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
WCME	10.74428	4.74998	2.26**	0.024	1.43450	20.05407
ESGP	0.17267	0.04468	3.86***	0.000	0.08509	0.26025
Size	-1.94590	0.84563	-2.30**	0.021	-3.60331	-0.28849
Age	-1.25694	1.29839	-0.97	0.333	-3.80174	1.28785
Leverage	8.22680	5.64636	1.46	0.145	-2.83986	19.29347
_cons	15.80116	8.40648	1.88*	0.060	-0.67524	32.27755

Notes: *p < 0.1; **p < 0.05; ***p < 0.01.

Source: Compiled by the author.

The results reveal a significant and positive effect of WCM on firm value. This outcome suggests that H2 is supported. These findings are consistent with previous studies, such as Boisjoly et al. (2020); Chamberlain and Aucouturier (2021). In addition, the results reveal a significant and positive effect of ESGP on firm value. This outcome suggests that H3 is supported. These findings are consistent with those of previous studies, such as Abdi et al. (2021); Aouadi and Marsat (2018); Fatemi et al. (2018); Fuente et al. (2021); Wong et al. (2021). Furthermore, the results reveal a significantly negative effect of firm size on firm value at a significance level of 0.05. Moreover, firm age has a negative but insignificant effect on firm value. Additionally, firm leverage has a positive but insignificant effect.

3.3 Endogeneity issues and additional analyses

3.3.1 Omitted variable bias

Endogeneity is an essential concern, as it prevents causal claims (Wooldridge, 2012). This study adopted Ramsey's regression equation specification error test (RESET) to verify and diagnose the omitted variable bias. In the study model, the p-value for the omitted-variable test was 0.2903. Therefore, the results indicate that the model is sound.

3.3.2 Robustness tests

Robustness tests were performed using a generalized least squares (GLS) estimator with robust standard errors. Robust standard errors are an approach for getting unbiased standard errors of regression model coefficients (Mansournia et al., 2020). In practice, the GLS estimator provides superior inferences (Lu & White, 2014).

Table 4. GLS estimator regression with robust standard errors

Num. of observation = 963			Wald chi2(5) = 17.45			
Num. of groups = 241			Prob > chi2 = 0.003			
Tobin's Q	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf. Interval]	
WCME	10.74428	5.31271	2.02*	0.043	0.33157	21.1570
ESGP	0.17267	0.08419	2.05*	0.040	0.00767	0.33767
Size	-1.94590	0.65334	-2.98**	0.003	-3.22643	-0.66537
Age	-1.25694	1.25652	-1.00	0.317	-3.71968	1.20580
Leverage	8.22680	5.15091	1.60	0.110	-1.86880	18.32240
_cons	15.80116	11.46736	1.38	0.168	-6.67446	38.27677

Notes: *p < 0.05; **p < 0.01.

Source: Compiled by the author.

Table 4 illustrates the consequences of the robustness tests employing the GLS estimator. The results indicate that the coefficients of the WCME and ESGP variables are in the same direction and statistically significant as those of the fundamental analysis presented in Table 3. Therefore, the results indicated greater confidence in the integrity of the study results.

Conclusions, Discussion and Recommendations

Considering the current business environment and its rapid development, firms that want to excel in the business environment seek to manage and use their available resources, which are naturally limited, for optimal use. WCM is a major aspect of the business. Empirical evidence illustrates that WCM has garnered considerable interest in business research. As working capital affects a firm's security, the literature demonstrates that it is required to contain a good strategy for WCM (Habib & Mourad, 2022; Zimon, 2021; Zimon & Tarighi, 2021). Alshubiri (2011); Habib and Kayani (2022) confirm that inefficiency in WCM is responsible for a significant portion of the likelihood of financial distress and business failure. Therefore, WCME is important for firms' financial management because it affects performance (Tewolde, 2002). In addition, the connection between ESGP as sustainable development and corporate finance has enticed investors, decision-makers, and other information users as a crucial means of enhancing firm value (Chouaibi & Zouari, 2022; Malik, 2015; Rezaee, 2016).

This study uses 964 firm-year observations from a longitudinal panel collected from 2016 to 2019 to evaluate WCME using DEA. In addition, this study examines the impact of WCME and ESGP on firm value using regression analysis. The DEA results showed that WCME was approximately 70.6%, 70.8%,

73.1%, and 72.1% (on average) in 2016, 2017, 2018, and 2019, respectively. Most firms are relatively inefficient in terms of their WCM. They required corrective efforts by decision-makers to accomplish the most sensible efficiency, directly related to the enhancement of firm sales and net income, as the number of efficient firms was approximately 44, 48, 50, and 47 (out of 241 firms) during the study period. In addition, the results of the differences using the Wilcoxon signed-rank test showed no statistical difference in WCME scores between 2016 and 2017. In contrast, the results showed a statistical difference between 2017 and 2018, 2018 and 2019 in favor of 2018 and 2019, respectively. Hence, this implies that WCME in the medium sector improved over time. Additionally, the results reveal significant and positive influences of WCME and ESGP on firm value. These findings are consistent with those of previous studies such as (Abdi et al., 2021; Aouadi & Marsat, 2018; Fatemi et al., 2018; Fuente et al., 2021; Habib & Kayani, 2022; Habib & Mourad, 2022; Wong et al., 2021).

This study is required for regulators, administrations, and investors to expand their awareness of the status of WCME in U.S. firms throughout the study period. In addition, it offers an in-depth study of the factors that influence the value of a business, such as WCM efficiency and ESG performance. Given the study findings, firms' decision-makers should conceive the required means and strategies and address the inefficiency aspects of WCM and ESG practices to ensure that a firm works efficiently and increases its value. In addition, this examination concentrates on 241 U.S. firms (964 firm-year observations), and the findings are limited to 2016–2019. These findings can be generalized to other firms beyond the context of the United States based on the results of additional analyses and robustness. The forthcoming examination should include other elements such as intellectual capital, managerial ability, capital structure, and real earnings management, which are also notable features that may affect financial policy.

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