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Influence of Cash Flow on Operational Efficiencu of Firms in Vietnam: Examining The Medlating Effect of State Ownership

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Abstract

This study examines the impact of cash flow on operational efficiency among non-financial firms listed on the Vietnam stock market from 2010 to 2019. Findings show that operating cash flow significantly enhances operational efficiency, as indicated by ROA and ROE, with a more pronounced effect in firms with state ownership. To control for endogeneity, the analysis employs the two-stage least squares and Generalized Method of Moments, confirming the robustness of results across variations in firm size, firm age, and estimation methods. Positive effects are also observed from investment opportunities and firm growth, while firm size and firm leverage negatively affect performance. The study underlines the role of cash flow in improving efficiency and suggests practical recommendations for regulators and managers.

Keywords: Investment opportunities, Cash flow, Stock market, Operational efficiency

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Introduction

The efficiency with which firms manage their operations plays a critical role in their financial health and market appeal, drawing the attention of both investors and corporate leaders [1, 2]. Enhanced operational efficiency is vital to ensuring corporate resilience and long-term growth, making it a key metric in investment decision-making. Accordingly, executives consistently seek strategies to optimize their firm's operational outcomes. This study investigates the determinants of operational efficiency, a subject central to modern corporate finance research.

Defined as the financial inflow and outflow over a specific timeframe [3], or as a system reflecting how a firm's cash flow portrays performance [4], the ability to manage cash resources is fundamental to sustaining business operations. Firms strive to maintain a positive cash flow, essential not only for covering short-term obligations but also for supporting strategic decisions and boosting firm performance. Effective cash flow oversight allows firms to meet financial objectives while minimizing costs.

Despite the extensive literature exploring the relationship between cash flow and operational efficiency, empirical findings—both in global and Vietnamese contexts—remain inconsistent. Moreover, many prior studies have overlooked the role of intermediating elements such as state ownership or governance models. This paper addresses that gap by evaluating how cash flow influences operational efficiency among Vietnamese firms, and whether state ownership acts as a mediating factor in this relationship.

The analysis is based on financial data from 502 non-financial companies listed on the Ho Chi Minh stock exchange over the 2010–2019 period, excluding sectors like banking, insurance, real estate, and securities due to their complex regulation and

structure. Utilizing the fixed-effects model, validated by the Hausman test, the findings reveal a positive link between cash flow and operational efficiency.

Further, the role of firm ownership is explored to understand whether it modifies the effect of cash flow on operational efficiency. In Vietnam, although the environment for investment is relatively stable, elevated corruption levels have led to advantages for politically connected entities in accessing investment opportunities. As such, firms with state ownership may exhibit a stronger link between cash flow and performance efficiency under these conditions.

To mitigate issues of endogeneity arising from reverse causality or omitted variable bias, the study applies two-stage least squares and the generalized method of moments. By treating all firm-level predictors as endogenous and using lagged values as instruments, the analysis confirms the consistency of results: cash flow maintains a significant positive impact on operational efficiency.

To further verify whether the findings are influenced by sample homogeneity or whether state ownership genuinely mediates the main relationship, a propensity score matching approach is employed. Treated firms (with state ownership) are matched to control firms (without state ownership) based on variables such as firm size, firm age, firm leverage, and the market-to-book ratio. Post-matching analysis still indicates that state ownership enhances operational efficiency, and the interaction term between cash flow and state ownership remains significantly positive, reinforcing the mediator effect.

This research makes several contributions. First, it adds to the literature exploring how cash flow influences operational efficiency. Second, it deepens insight into the role of state ownership in shaping firm performance. Third, it applies robust econometric techniques, including two-stage least squares and generalized method of moments, to address endogeneity. Finally, the study offers policy implications for both corporate decision-makers and regulators focused on improving operational efficiency.

The remainder of the paper is organized as follows: Section 2 reviews prior literature and formulates hypotheses; Section 3 details the research methodology; Section 4 reports descriptive statistics and primary empirical findings; Section 5 presents robustness checks; Section 6 provides managerial recommendations; and Section 7 concludes the study.

Literature review and hypotheses development

Cash flow theories

The theoretical underpinnings of the connection between cash flow and corporate outcomes lie primarily in agency theory and the free cash flow hypothesis. Agency theory emphasizes conflicts between firm managers and shareholders [5], often resulting from the separation of ownership and control. In practice, executives may not always align their decisions with shareholder interests, potentially leading to value erosion [6]. The resources spent monitoring management actions, along with misaligned strategies, are known as agency costs, which arise when interests diverge between principals and agents.

Expanding on these concerns, free cash flow theory argues that when firms hold surplus cash flow, managers might divert these resources toward self-serving ventures with marginal or negative value [7, 8]. Rather than maximizing shareholder value, executives could initiate unnecessary investments, reducing firm worth. Jensen (1986) elaborated on this concept by asserting that excessive liquidity may tempt managers to expand the firm's scale beyond its optimal point[8]. In contrast, financial constraints—or a lack of cash flow—can inhibit such inefficient behavior [9].

To counteract the downsides of surplus liquidity, capital structures incorporating higher levels of debt can impose financial discipline. Debt obligations limit the managerial freedom to misuse resources, acting as a control mechanism to curb unproductive investments. Consequently, cash flow becomes a determinant of operational efficiency, with financial leverage offering a potential solution to mitigate overinvestment.

Influence of cash flow on operational efficiency

The association between cash flow and a firm's operational efficiency has been widely examined, yet the outcomes reported across studies are inconsistent. While a number of researchers identify a direct and favorable relationship between cash flow and firm performance, others observe either a negligible or unstable connection between these variables.

For instance, Adelegan (2003) empirically investigated how cash flow correlates with dividend policy within the Nigerian stock market, utilizing an ordinary least squares regression model based on data from 63 firms spanning 1984 to 1997[10]. His findings indicate that cash flow plays a decisive role in influencing dividend shifts and firm efficiency. Similarly, Tsuji [11] examined companies in the electrical equipment sector listed on the Tokyo Stock Exchange from 2009 to 2011, and his analysis demonstrated varying degrees of association between cash flow and business performance, highlighting cash flow's utility in forecasting future equity returns.

Frank and James [12] explored this relationship within Nigeria’s hospital and media sectors, applying Pearson correlation and descriptive statistical tools. Their analysis revealed a significant and positive connection between cash flow and net earnings, reinforcing the idea that cash flow contributes meaningfully to corporate output. Likewise, Ogbonnaya *et al*. (2016) assessed listed banking institutions across emerging markets, concluding that cash flow derived from operations positively enhances

financial outcomes, although cash flows from investment and financing activities showed a weaker and adverse effect[13]. In another study, Elahi *et al*. (2021) examined 20 Pakistani banks over the 2011–2019 period and concluded that operating cash flows significantly improve financial resilience[14].

Conversely, several investigations report adverse or negligible effects of cash flow on operational metrics. Hong *et al*. (2012) scrutinized free cash flow among Chinese real estate firms from 2006 to 2011 and discovered a negative link to firm performance, particularly when surplus free cash flow led to inefficient capital allocation[15]. Ashtiani (2005) also identified an inverse but statistically insignificant correlation between investment efficiency, profitability, and cash flow among publicly traded firms on the Tehran Stock Exchange[16]. Supporting this trend, Watson and Wells (2005) noted a statistically significant and negative association between cash flow and operational performance[17]. Research by Mazloom *et al*. [18] and Farber *et al*. [19], which deployed multivariate regression techniques using Iranian stock data from 2003 to 2011, confirmed a negative and meaningful relationship between firm value and cash flow.

In the Vietnamese context, Thanh and Ha [20] analyzed the impact of banking affiliations on market performance using data from 465 companies between 2007 and 2010. Their study revealed that stronger banking relationships coincided with decreased business efficiency, and cash flow was inversely related to the return on equity. This indicates a detrimental influence of cash flow on the performance of Vietnamese listed firms.

Based on these insights, we formulate the following hypothesis:

H1: Cash flow has an impact on firm operational eficiency in Vietnam

State ownership as a mediator between cash flow and operational efficiency

Within Vietnam's transitional economy, state-owned enterprises (SOEs) continue to play a prominent socio-economic role by representing government interests, generating employment, and contributing to social welfare. However, these responsibilities may clash with managerial incentives such as promotions or bonuses (2007), potentially resulting in inefficient resource allocation or improper cash flow management. The easier access to capital and lenient budget constraints associated with SOEs [21, 22] could encourage excessive spending or weaken operational discipline.

Muda *et al*. [23] examined the effect of ownership structures on Walmart's operational outcomes, emphasizing how governance frameworks can influence business success. In the Vietnamese setting, Nhung and Okuda (2015) argue that SOEs enjoy greater access to funding and tend to be more profitable compared to non-state counterparts[24]. These advantages suggest that state ownership could significantly shape how cash flow translates into operational efficiency.

Therefore, we advance the following hypothesis:

H2: State ownership has a positive impact on a firm's cash flow–operational efficiency relationship

Research design

Sample

This study focuses on a dataset comprising 502 non-financial firms publicly traded on the Ho Chi Minh Stock Exchange. Industries such as banking, insurance, real estate, and securities are deliberately excluded due to their distinctive financial structures and regulatory environments. In particular, financial institutions are omitted because their reporting frameworks and capital structures, notably their typically elevated leverage ratios, differ significantly from those in non-financial sectors [25]. All financial information utilized in this research is sourced from the StoxPlus database.

Models and variable construction

To investigate how cash flow influences the operational efficiency of enterprises within the Vietnamese stock market, we develop and utilize the following analytical models:

Main empirical models

$$ROA_{it} = \delta_0 + \delta_1 * Cashflow_{it} + \delta_2 * Firm\ size_{it} + \delta_3 Firm\ growth_{it} + \delta_4 * Market - to - book_{it} + \delta_5 * Firm\ leverage_{it} + \gamma_i + \lambda_t + \epsilon_{it} \quad (1)$$

$$ROE_{it} = \delta_0 + \delta_1 * Cashflow_{it} + \delta_2 * Firm\ size_{it} + \delta_3 Firm\ growth_{it} + \delta_4 * Market - to - book_{it} + \delta_5 * Firm\ leverage_{it} + \gamma_i + \lambda_t + \epsilon_{it} \quad (2)$$

The study evaluates Firm performance as the dependent variable, employing two distinct metrics: returns on assets (ROA) and returns on equity (ROE). ROA is calculated by dividing net income by total assets, while ROE is obtained from the ratio of net income to total equity.

The primary independent variable in the analysis is Firm cash flow, defined as the ratio of annual market-derived cash flow to the firm's total assets.

To ensure robustness, the model integrates several control variables: Firm size, Market-to-Book, Firm growth, and Firm leverage. Firm size is expressed as the natural logarithm of total assets [Ln(total assets)]. The Market-to-Book ratio is

computed by dividing the firm's market value by its book value. Firm growth is gauged by the yearly rate of change in total assets, using the formula (TAt − TAt−1) / TAt−1. Firm leverage is measured by the ratio of total leverage to total assets.
In addition, the model incorporates firm fixed effects to account for time-invariant unobserved differences across firms and year fixed effects to adjust for temporal fluctuations across different years.

Empirical results

Descriptive statistics and correlation analysis

Table 1 presents summary statistics for all variables used in the empirical analysis, including the mean, standard deviation, and the minimum and maximum values, providing a comprehensive view of the data distribution.

Table 1. Summary statistics

	Obs.	Std. Dev.	Mean	Minimum	First quartile	Median	Third quartile	Maximum
ROA	5584	0.07	0.07	-0.07	0.02	0.05	0.10	0.30
ROE	5584	0.13	0.14	-0.17	0.05	0.13	0.21	0.53
Firm cash flow	5531	0.14	0.06	-0.27	-0.03	0.05	0.13	0.42
Firm size	5606	1.43	12.98	10.01	12.04	12.89	13.91	16.49
Firm growth	5003	0.32	0.16	-0.26	-0.02	0.09	0.24	1.55
Market-to-Book	4555	0.58	0.73	0.13	0.34	0.55	0.91	2.82
Firm leverage	5606	0.23	0.50	0.06	0.32	0.52	0.68	0.89

Note: The table provides a detailed overview of the descriptive statistics for each variable employed in the analysis. It includes the total Number of Observations, Standard Deviation, Mean, Minimum, Maximum, and the values at four sample quantiles. The two principal dependent variables—ROA and ROE—are defined as the ratios of net income to total assets and net income to total equity, respectively. The set of control variables comprises Firm size, Firm growth, Market-to-Book, and Firm leverage, each quantified based on established financial formulas as described earlier in the model specification.

Table 1 presents the summary statistics for the variables used in this study, including their mean, standard deviation, minimum, and maximum values. The data reveal that, over the period from 2010 to 2019, the average ROA for non-financial firms listed on the Vietnam stock market stands at 7.00%, while the mean ROE reaches 14%. This indicates that, on average, a company generates a post-tax profit of 7 VND for every 100 VND invested in assets, with a peak value reaching 30. Similarly, the average return on equity is 14 VND per 100 VND of equity, with the highest observed figure being 53. The average Firm cash flow is 0.06, signifying that operating cash flow represents 6% of total assets for these companies during the same period. Additionally, the mean Firm leverage ratio is 0.50, suggesting that firms typically finance half of their assets through debt. **Table 2** outlines the correlations among the variables included in models (1) and (2) as follows:

Table 2. Pairwise correlations

Panel A: Correlation matrix for the first model						
Variables	(1)	(2)	(3)	(4)	(5)	(6)
(1) ROA	1.000					
(2) Cash flow	0.373***	1.000				
(3) Firm size	-0.071***	-0.014	1.000			
(4) Firm growth	0.186***	-0.194***	0.084***	1.000		
(5) Market-to-book	0.329***	0.149***	0.164***	0.109***	1.000	
(6) Firm leverage	-0.436***	-0.193***	0.330***	0.064***	-0.140***	1.000
Panel B: Correlation matrix for the second model						
Variables	(1)	(2)	(3)	(4)	(5)	(6)
(1) ROE	1.000					
(2) Cash flow	0.286***	1.000				
(3) Firm size	0.060***	-0.014	1.000			
(4) Firm growth	0.249***	-0.194***	0.084***	1.000		
(5) Market-to-book	0.266***	0.149***	0.164***	0.109***	1.000	
(6) Firm leverage	-0.037***	-0.193***	0.330***	0.064***	-0.140***	1.000

Note: This table presents the correlation matrix displaying relationships among the variables used in the analysis. The primary dependent variables are ROA and ROE, calculated as net income over total assets and net income over total equity, respectively. The control variables include Firm size, Firm growth, Market-to-Book, and Firm leverage. Statistical significance at the 10 percent, 5 pecent, and 1 percent thresholds is denoted by *, **, and ***, respectively.

Table 2 presents the correlation matrices for the variables used in models (1) and (2), where Panel A corresponds to the first model and Panel B to the second. The analysis shows that all correlation coefficients between variable pairs remain below an

absolute value of 0.8, indicating that multicollinearity is not a concern within these models. Thus, it is unnecessary to remove any variables, confirming the robustness of the proposed model.

Effect of cash flow on firm operational efficiency

This part of the study examines the influence of cash flow on how efficiently firms operate. The main outcome measures considered are Return on Assets and Return on Equity. Models (1) and (3) analyze the full dataset, while models (2) and (4) exclude the largest 10% of firms to avoid skewing results due to their dominant size. The detailed findings are presented in **Table 3** below:

Table 3. The effect of cash flow on firm operational efficiency

Dependent variable	ROA		ROE	
	(1) Full sample	(2) Exclude 10% largest firm	(3) Full sample	(4) Exclude 10% largest firm
Cash flow	0.058***	0.055***	0.105***	0.102***
	(0.008)	(0.008)	(0.016)	(0.016)
Firm size	-0.006	-0.006	-0.002	-0.003
	(0.004)	(0.004)	(0.008)	(0.009)
Firm growth	0.055***	0.059***	0.104***	0.109***
	(0.004)	(0.005)	(0.009)	(0.01)
Market-to-book	0.02***	0.02***	0.04***	0.039***
	(0.003)	(0.003)	(0.005)	(0.006)
Firm leverage	-0.152***	-0.149***	-0.146***	-0.133***
	(0.013)	(0.014)	(0.025)	(0.027)
Constant	0.212***	0.209***	0.233**	0.249**
	(0.043)	(0.051)	(0.092)	(0.107)
Observations	4325	3844	4325	3844
R-squared	0.305	0.306	0.248	0.253
Year dummy	Yes	Yes	Yes	Yes

Note: This table examines how state ownership influences cash flow and the efficiency of firm operations. The dependent variables analyzed are ROA and ROE, which represent net income relative to total assets and total equity, respectively. The model accounts for control variables including Firm size, Firm growth, Market-to-Book, and Firm leverage. Reported figures in parentheses are robust standard errors, adjusted for clustering at the firm level. Significance levels are indicated by *, **, and *** corresponding to 10 percent, 5 percent, and 1 percent, respectively.

Firm cash flow

The coefficient for Firm cash flow (δ1) in model 1 is 0.058, showing significance at the 1% threshold, whereas in model 3, this coefficient increases to 0.105, also highly significant at 1%. These findings confirm that operating cash flow exerts a statistically meaningful and favorable influence on both return on assets and return on equity for non-financial companies listed on Vietnam's stock exchange. Therefore, a higher ratio of operating cash flow tends to improve a company's operational effectiveness. This conclusion is supported by previous research including Adelegan (2003), Frank and James (2014), and Ogbonnaya, Ekwe, and Uzoma (2016)[10, 12, 13]. However, the observed relationship diverges from outcomes reported in studies on the Tehran Stock Exchange by Ashtiani [16], those by Watson and Wells [17], Mazloom, Azarberahman, and Azarberahman [18] focusing on equity income, investigations of Chinese real estate companies by Hong, Shuting, and Meng (2012), and Tsuji (2013) regarding the Tokyo Stock Exchange[11, 15].

Firm size

The Firm size variable reveals negative coefficients in both models 1 and 3, measured at -0.006 and -0.002, respectively. Despite these values, firm size does not demonstrate a statistically significant effect on the performance of Vietnam's non-financial firms. This aligns with findings from Ha-Brookshire (2009), who reported no impact of firm size on operational efficiency[26]. Thus, evidence relating firm scale to operational performance remains inconclusive and appears to vary depending on the sector involved.

Market-to-book

Positive coefficients characterize the market-to-book variable in both models, with values of 0.02 in model 1 and 0.04 in model 3, both significant at the 1% level. This indicates that the availability of investment opportunities strongly and positively influences income generated from assets and equity within Vietnam's non-financial listed firms.

Firm growth

Firm growth rates register positive Beta coefficients of 0.055 and 0.104 in models 1 and 3, respectively, with high statistical significance at the 1% level. This suggests that companies experiencing rapid growth tend to enhance their operational efficiency. As such, both investment opportunities and growth trajectories positively contribute to the operational outcomes of Vietnam's non-financial firms. This observation corresponds with findings in international studies such as those by Amidu (2007), Onanjiri and Korankye (2014), and Gill *et al*. (2011)[27–29].

Firm leverage

The debt ratio, representing Firm leverage, shows negative coefficients (-0.152 in model 1 and -0.146 in model 3), both significant at the 1% level, implying that increased leverage adversely affects operational efficiency. Hence, non-financial companies in Vietnam's stock market that rely more heavily on debt financing tend to exhibit diminished operational performance. This finding aligns with research by Amidu [27] and Dogan and Topal [30], who studied ROA as the dependent variable. Contrarily, some studies, including Sunday and Partners (2015) on ROA, Priya and Nimalathasan (2013), Dogan and Topal (2014) on ROE, and Gupta and Raman (2020) focusing on firm output, report positive relationships between leverage and operational efficiency[30–32].

Given the presence of a few firms with exceptionally high values, the largest 10% were excluded to construct models 2 and 4. The outcomes of these models closely resemble those from models 1 and 3, confirming the robustness of the findings in terms of economic significance.

Validity test

This section examines potential issues of autocorrelation, heteroskedasticity, and multicollinearity within the applied models. The Wooldridge test, performed via the xtserial command, is employed to detect autocorrelation. Variance changes in the fixed effects model (FEM) are evaluated using the xttest3 command. Multicollinearity is assessed through the variance inflation factor (vif) command in STATA.

Table 4. Validity test

Panel A: Autocorrelation test	
Wooldridge test for autocorrelation in panel data H_0: no first-order autocorrelation	
Model 1	**Model 2**
F(1, 542) = 140.465 Prob > F = 0.0000	F(1, 542) = 99.369 Prob > F = 0.0000
Panel B: Heteroskedasticity test	
Modified Wald test for groupwise heteroskedasticity in the fixed effect regression model H_0: sigma(i)^2 = sigma^2 for all i	
Model 1	**Model 2**
chi2 (601) = 5.9e+35 Prob>chi2 = 0,0000	chi2 (502) = 2.4e+33 Prob>chi2 = 0,0000
Panel C: Multicollinearity test	
VIF	**1/VIF**
Firm cash flow	1.34	0.74
Firm size	8.29	0.14
Firm Market-to-book	1.40	0.71
Firm growth	1.46	0.68
Firm leverage	7.38	0.13
Mean VIF	4.27	

The findings presented in **Table 4** reveal several key diagnostic results. The Wooldridge test (Panel A) yields a Prob > F value of 0.000, which is below the 0.05 significance threshold, indicating that autocorrelation is present in both models. Regarding heteroskedasticity, the Modified Wald test (Panel B) results for models 1 and 2 show Prob > chi2 values of 0.000, also below 0.05, leading to the rejection of the null hypothesis of homoscedasticity; thus, heteroskedasticity is evident in both models. Additionally, the variance inflation factors (VIFs) for the independent variables (Panel C) remain under the critical value of 10, suggesting no multicollinearity concerns within the models. Overall, the evidence from **Table 4** confirms the presence of

both autocorrelation and heteroskedasticity in the two models. Consequently, the cluster and robust commands in STATA are applied to the fixed effects model (FEM) to address and correct these issues.

Impact of firm ownership on operational efficiency and firm cash flow

This section focuses on exploring how firm ownership influences the relationship between cash flow and operational efficiency. The hypothesis posits that state-owned firms may benefit from certain advantages compared to other firms, particularly in the Vietnamese context [33]. To evaluate this, a dummy variable named State ownership is introduced, assigned a value of 1 if the firm's shares are held by the government, and 0 otherwise. The interaction term between Cash flow and State ownership is included to assess how cash flow's effect on operational efficiency varies for firms under state ownership. A positive coefficient on this interaction term would indicate that the influence of cash flow on efficiency is stronger for government-owned firms. This relationship is examined using the following specified models:

$$ROA_{it} = \delta_0 + \delta_1 * Cashflow_{it} + \delta_2 * Goverment\ ownership + \delta_3 * Cashflow * Government\ ownership + \delta_4 * Firm\ size_{it} + \delta_5 * Firm\ growth_{it} + \delta_6 * Market - to - book_{it} + \delta_7 * Firm\ leverage_{it} + \gamma_i + \lambda_t + \epsilon_{it} \quad (3)$$

$$ROE_{it} = \delta_0 + \delta_1 * Cashflow_{it} + \delta_2 * Goverment\ ownership + \delta_3 * Cashflow * Government\ ownership + \delta_4 * Firm\ size_{it} + \delta_5 * Firm\ growth_{it} + \delta_6 * Market - to - book_{it} + \delta_7 * Firm\ leverage_{it} + \gamma_i + \lambda_t + \epsilon_{it} \quad (4)$$

The findings are presented in **Table 5** as outlined below:

Table 5. The impact of state ownership and cash flow on operational efficiency

Dependent variable	ROA		ROE	
	(1) Fixed effect	(2) Fixed effect	(3) Full sample	(1) Fixed effect
Cash flow	**0.058*** **	**0.048*** **	**0.105*** **	**0.098*** **
	(0.008)	**(0.01)**	**(0.016)**	**(0.022)**
State ownership		**0.041*** **		**0.055*** **
		(0.006)		**(0.012)**
Cash flow*State ownership		**0.124*** **		**0.207*** **
		(0.03)		**(0.059)**
Firm size	-0.006	0.002**	-0.002	0.007***
	(0.004)	(0.001)	(0.008)	(0.002)
Firm growth	.055***	0.051***	0.104***	0.098***
	(0.004)	(0.004)	(0.009)	(0.009)
Market-to-book	0.020***	0.024***	0.04***	.046***
	(0.003)	(0.003)	(0.005)	(0.005)
Firm leverage	-0.152***	-0.141***	-0.146***	-0.069***
	(0.013)	(0.008)	(0.025)	(0.014)
Constant	0.212***	0.088***	0.233**	0.067**
	(0.043)	(0.015)	(0.092)	(0.029)
Obs.	4325	4325	4325	4325
Year dummy	Yes	Yes	Yes	Yes

Note: This table provides an analysis of how state ownership influences cash flow and operational efficiency. The dependent variables used are ROA and ROE, which represent net income divided by total assets and total equity, respectively. The principal explanatory variables consist of Cash flow and State ownership, with additional control factors including Firm size, Firm growth, Market-to-book, and Firm leverage. The table reports robust standard errors that are clustered at the firm level, shown in parentheses. Statistical significance is indicated by symbols *, **, and ***, denoting confidence levels of 10 percent, 5 percent, and 1 percent, respectively.

Table 5 demonstrates that State ownership positively influences operational efficiency, as reflected in ROA and ROE metrics. Firms with government ties often benefit from lower borrowing costs and greater access to investment opportunities. In times of financial difficulty, such companies are also more likely to receive capital injections [34]. Additionally, the impact of cash flow on operational efficiency is notably stronger for firms linked to the state.

Two-stage least squares and generalized method of moments

To address potential endogeneity caused by the bidirectional relationship between cash flow and operational efficiency, the two-stage least squares (2SLS) approach is utilized, following Joher *et al*. [35]. While increased cash flow can drive

improvements in operational efficiency, it is also plausible that firms with superior efficiency generate excess cash that can be reinvested. To mitigate this reverse causality, lagged values of Cash flow—specifically the first and second lags—are employed as instrumental variables. These lagged variables directly influence Cash flow but are presumed not to directly affect other model variables [36]. The models below capture this reciprocal dynamic between operational efficiency and cash flow.

$$ROA_{it} = \delta_0 + \delta_1 * Cashflow_{it} + \delta_2 * Firm\ size_{it} + \delta_3 Firm\ growth_{it} + \delta_4 * Market - to - book_{it} + \delta_5 * Firm\ leverage_{it} + \gamma_i + \lambda_t + \epsilon_{it} \quad (5)$$

$$Cash\ flow_{it} = \delta_0 + \delta_1 * ROA_{it} + \delta_2 * Firm\ size_{it} + \delta_3 Firm\ growth_{it} + \delta_4 * Market - to - book_{it} + \delta_5 * Firm\ leverage_{it} + \gamma_i + \lambda_t + \epsilon_{it} \quad (6)$$

$$ROE_{it} = \delta_0 + \delta_1 * Cashflow_{it} + \delta_2 * Firm\ size_{it} + \delta_3 Firm\ growth_{it} + \delta_4 * Market - to - book_{it} + \delta_5 * Firm\ leverage_{it} + \gamma_i + \lambda_t + \epsilon_{it} \quad (7)$$

$$Cash\ flow_{it} = \delta_0 + \delta_1 * ROA_{it} + \delta_2 * Firm\ size_{it} + \delta_3 Firm\ growth_{it} + \delta_4 * Market - to - book_{it} + \delta_5 * Firm\ leverage_{it} + \gamma_i + \lambda_t + \epsilon_{it} \quad (8)$$

Additionally, to explore the influence of cash flow on operational efficiency, we utilize the generalized method of moments (GMM). Originally formulated by Arellano and Bond (1991), this approach applies first-differencing to the equations to remove endogeneity issues[37]. Later, Blundell and Bond (1998) enhanced this method with the system GMM, which combines regressions in levels and first differences, leveraging lagged differences as valid instruments to strengthen estimation. In our study, every firm-level variable is assumed to be strictly endogenous[38]. To capture the dynamic characteristics and address potential endogeneity stemming from reverse causation or omitted factors, the model includes lagged endogenous variables as regressors.

$$ROA_{it} = \delta_0 + \delta_1 * ROA_{i,t-1} + \delta_2 * Cash\ flow_{it} + \delta_3 * Firm\ size_{it} + \delta_4 Firm\ growth_{it} + \delta_5 * Market - to - book_{it} + \delta_6 * Firm\ leverage_{it} + \gamma_i + \lambda_t + \epsilon_{it} \quad (9)$$

$$ROE_{it} = \delta_0 + \delta_1 * ROE_{i,t-1} + \delta_2 * Cash\ flow_{it} + \delta_3 * Firm\ size_{it} + \delta_4 Firm\ growth_{it} + \delta_5 * Market - to - book_{it} + \delta_6 * Firm\ leverage_{it} + \gamma_i + \lambda_t + \epsilon_{it} \quad (10)$$

To verify the model specification, we utilized the Hansen test. Additionally, we applied the Arellano and Bond test for zero autocorrelation to assess whether the first-differenced residuals lack second-order serial correlation. The outcomes of these tests are presented in **Table 6**.

Table 6. Two-stage least square and Generalized method of moments

	ROA			**ROE**		
	(1) *Fixed effect*	*(2)* *2SLS*	*(3)* *GMM*	*(4)* *Fixed effect*	*(5)* *2SLS*	*(6)* *GMM*
L.ROA			0.282*			
			(0.149)			
L.ROE						0.237
						(0.173)
Cash flow	**0.058*** **	**0.864*** **	***0.355*** **	**0.107*** **	**1.505*** **	***0.553****
	(0.008)	**(0.071)**	***(0.123)***	**(0.016)**	**(0.125)**	***(0.259)***
Firm size	-0.004	-0.001	-0.078*	0.002	-0.000	-0.079
	(0.004)	(0.001)	(0.044)	(0.008)	(0.002)	(0.093)
Firm growth	0.057***	0.121***	0.107	0.107***	0.226***	0.306**
	(0.004)	(0.011)	(0.069)	(0.009)	(0.020)	(0.153)
Market-to-book	0.020***	0.000	0.033	0.04***	0.000	0.027
	(0.003)	(0.000)	(0.028)	(0.005)	(0.000)	(0.064)
Firm leverage	-0.152***	-0.038***	-0.049	-0.145***	0.121***	-0.251
	(0.013)	(0.012)	(0.153)	(0.025)	(0.022)	(0.338)
Constant	0.212***	0.028*	1.037*	0.233**	-0.041	1.166
	(0.043)	(0.015)	(0.529)	(0.092)	(0.027)	(1.236)
Obs.	4325	3961	4319	4325	3961	4319
Adjusted R^2	0.305	0.247		0.248	0.215	
p-value(AR2)			0.313			0.325

p-value(Hansen test)			0.458			0.144
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes

Note: This table presents the effect of cash flow on operational efficiency, analyzed through a two-stage least squares approach. The primary dependent variables include ROA and ROE, calculated as net income divided by total assets and total equity, respectively. The control variables incorporated are Firm size, Firm growth, Market-to-book ratio, and Firm leverage. Fixed effect models are employed in Models (1) and (4), supported by the Hausman test results. Models (2) and (5) utilize the two-stage least squares technique, while Models (3) and (6) implement GMM estimation. Reported standard errors are robust and clustered at the firm level, with values shown in parentheses. Statistical significance is denoted by *, **, and *** for the 10 percent, 5 percent, and 1 percent levels, respectively.

Addressing the endogeneity concern, the Two-stage least squares results displayed in **Table 6** reveal that the coefficient for the cash flow variable (δ1) is 0.864 in model 2 and 1.505 in model 4, both significant at the 1% level. This indicates a positive relationship between cash flow and the two performance metrics—return on assets and return on equity—for non-financial firms listed on Vietnam's stock exchange. In other words, an increase in the company's operational cash flow ratio corresponds with enhanced operational efficiency (In validity assessments not shown here, the F test for the excluded exogenous variables is significant, indicating that the instruments used do not directly influence operational efficiency, while the LM tests verify that the model is properly identified, confirming the appropriateness of our model implementation).

Regarding model validity, the Hansen and Arellano-Bond tests were conducted, and both yielded insignificant results, supporting the robustness of our models [39]. The GMM estimation results in **Table 6** show the cash flow coefficient (δ1) as 0.355 in model 3, significant at the 1% level, and 0.553 in model 6, significant at the 5% level. These findings confirm that operational cash flow positively and significantly influences return on assets and return on equity for the non-financial firms listed on Vietnam's stock market. These outcomes align with those obtained from the Fixed effect models in models (1) and (4), reinforcing that higher operational cash flow ratios lead to improved operational efficiency.

Additional tests

Additional analyses were conducted to exclude alternative factors, such as firm age or size differences. The findings remain consistent across these supplementary tests, further validating that cash flow exerts a positive effect on operational efficiency.

Table 7. Additional tests

Dependent variable	***ROA***		***ROE***		***ROA***		***ROE***	
	(1) Young firm	*(2) Old firm*	*(3) Young firm*	*(4) Old firm*	*(5) Small firm*	*(6) Large firm*	*(7) Small firm*	*(8) Large firm*
Cash flow	***0.05****	***0.062****	***0.085****	***0.117****	***0.055****	***0.057****	***0.091****	***0.118****
	(0.01)	***(0.011)***	***(0.022)***	***(0.022)***	***(0.011)***	***(0.011)***	***(0.021)***	***(0.027)***
Firm size	-0.008	-0.003	-0.009	0.006	0.004	-0.011**	0.012	-0.006
	(0.005)	(0.005)	(0.013)	(0.009)	(0.007)	(0.005)	(0.013)	(0.011)
Firm growth	0.054***	0.055***	0.106***	0.1***	0.076***	0.041***	0.135***	0.081***
	(0.007)	(0.006)	(0.014)	(0.012)	(0.007)	(0.005)	(0.014)	(0.011)
Market-to-book	0.022***	0.018***	0.042***	0.037***	0.02***	0.022***	0.029***	0.053***
	(0.004)	(0.004)	(0.009)	(0.007)	(0.004)	(0.004)	(0.007)	(0.009)
Firm leverage	-0.131***	-0.166***	-0.116***	-0.167***	-0.151***	-0.157***	-0.145***	-0.144***
	(0.018)	(0.017)	(0.042)	(0.03)	(0.019)	(0.018)	(0.036)	(0.037)
Constant	0.224***	0.187***	0.305*	0.149	0.09	0.291***	0.067	0.299**
	(0.066)	(0.06)	(0.156)	(0.116)	(0.078)	(0.066)	(0.141)	(0.151)
Firm fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1641	2684	1641	2684	2220	2105	2220	2105
R-squared	0.269	0.307	0.208	0.255	0.298	0.312	0.249	0.237

Note: This table illustrates how cash flow affects operational efficiency, with ROA and ROE as the primary dependent variables, calculated by dividing net income by total assets and total equity, respectively. The analysis includes control variables such as Firm size, Firm growth, Market-to-book ratio, and Firm leverage. Models (1) through (4) examine differences in operational efficiency between young and mature firms, while Models (5) to (8) focus on the comparison between small and large firms. Standard errors, which are robust and clustered at the firm level, appear in parentheses. Significance levels are indicated by *, **, and ***, representing 10 percent, 5 percent, and 1 percent, respectively.

The coefficients for the cash flow variable (δ1) presented in **Table 7** indicate that cash flow exerts a positive and statistically significant influence on both ROA and ROE across young and old companies, as well as small and large firms. Notably, the cash flow coefficients for older firms surpass those of younger firms. Likewise, large firms exhibit higher cash flow coefficients compared to smaller firms. This suggests that cash flow's impact on firm performance is more pronounced in

larger enterprises than in smaller ones, while its effect is comparatively weaker in younger companies than in their older counterparts.

Recommendations

Operational efficiency shows a positive association with the ratio of operating cash flow to total assets. Therefore, to enhance operational efficiency, firms should carefully manage and increase their operating cash flow relative to their total assets. Additionally, investment opportunities and company growth are significant positive contributors to operational efficiency. However, consistent with life cycle theory, these factors fluctuate depending on the firm's stage of development. During early and growth phases, companies often have abundant investment opportunities to expand their customer base and explore new markets. Consequently, maintaining a higher level of cash reserves is advisable to support investment, development, and asset growth, which in turn boosts operational efficiency. As firms mature, investment opportunities decline and market competition intensifies, leading to reduced efficiency in asset and equity utilization. At this stage, firms should consider lowering cash reserves by distributing dividends to shareholders, which can help stabilize investor confidence. Lastly, minimizing excessive debt usage is crucial for operational efficiency, as high leverage tends to undermine it. Managers should strive to identify an optimal debt structure tailored to their firms to maximize efficiency.

Conclusion

This study investigates the influence of cash flow on the performance of non-financial firms listed on Vietnam's stock market over the period 2010-2019. Findings demonstrate that operating cash flow positively affects operational efficiency, measured through returns on assets (ROA) and returns on equity (ROE). Furthermore, investment opportunities (Market-to-Book) and asset growth (Firm growth) contribute positively to firm performance, whereas larger firm size (Firm size) and higher leverage (Firm leverage) negatively impact operational efficiency. Based on these empirical insights, the paper offers strategic recommendations for firms to enhance their operational efficiency, thereby increasing firm value and attracting investors. It is also important to explore how ownership structure, especially government involvement, may mediate the relationship between cash flow and firm performance.

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