

Optimizing Financial Performance through Leverage, Liquidity, and Size of Indonesian Chemical Manufacturing Companies

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Abstract

This study analyzes the effect of liquidity and firm size on financial performance with leverage as a mediating variable in chemical sub-sector manufacturing companies listed on the Indonesia Stock Exchange during 2019–2024, a period that covers the COVID-19 pandemic and the subsequent economic normalization. The study employs a quantitative approach using secondary data from annual financial statements. Seventeen companies were selected through purposive sampling, resulting in 102 observations (17 companies × 6 years), of which 92 observations were used in the final statistical analysis. Data were analyzed using multiple linear regression and mediation testing through the PROCESS Macro in IBM SPSS Statistics, preceded by classical assumption tests. Grounded in agency theory, the results indicate that liquidity has a significant effect on both financial performance at the 10% level (H1) and leverage (H4), while firm size has a significant effect on financial performance (H2) but no significant effect on leverage (H5). Leverage has a significant effect on financial performance (H3). Leverage significantly mediates the relationship between liquidity and financial performance (H6) but does not mediate the relationship between firm size and financial performance (H7). These findings confirm that monitoring managerial decisions on current asset accumulation and debt utilization is essential to reduce agency costs and improve corporate financial performance.

Keywords: liquidity, firm size, leverage, financial performance.

Introduction

Competition in the corporate world has intensified in the era of globalization. This condition drives companies to present their best value propositions, and corporate expansion in turn affects the Indonesian economy (Marbun & Mesrawati, 2022). The Indonesia Stock Exchange (IDX) serves as the national capital market, providing a venue for investors to invest and for companies to raise capital. Manufacturing companies, including the chemical sub-sector, are among the largest contributors of listed issuers on the IDX because they process raw materials into semi-finished and finished goods needed by other sectors such as pharmaceuticals, agriculture, and consumer goods (Fanani, 2025). Given its position upstream in the national industrial supply chain, examining the financial performance of chemical sub-sector companies is crucial to ensuring the sustainability and competitiveness of the industry as a whole.

The 2019–2024 study period is a particularly distinctive time span because it encompasses three phases at once: the pre-pandemic condition (2019), the shock of the COVID-19 pandemic (2020–2021), and the phase of economic recovery and normalization (2022–2024). The COVID-19 pandemic exerted uneven pressure on the chemical sub-sector. On one hand, mobility restrictions and declining downstream industrial activity suppressed demand for basic chemical materials, disrupted the supply chain for imported raw materials, and drove up logistics and energy costs. On the other hand, some chemical products actually experienced a surge in demand, particularly medical gases, disinfectant raw materials, and pharmaceutical raw materials, whose use increased sharply during the pandemic response period.

This uneven impact shaped distinctive financial behavior during the pandemic. High uncertainty prompted management to hold large amounts of cash and current assets as a liquidity buffer (precautionary motive), while simultaneously postponing capital expenditure and expansion. As a result, the liquidity ratios of many companies increased, but this increase was not always followed by higher profits because the retained funds were not put to productive use. At the same time, some other companies instead increased their debt to sustain operations when cash inflows were disrupted, causing interest expenses to rise precisely when profit-generating capacity was under pressure. This is precisely what makes the relationship between liquidity, leverage, and financial performance during the 2019–2024 period interesting to test empirically.

The phenomenon of declining post-pandemic financial performance is evident in several issuers. PT Samator Indo Gas Tbk (AGII) experienced a profit decline due to the normalization of medical gas demand after the pandemic eased, causing revenue and profit that had surged during the pandemic to correct downward again (Cahya Puteri Abdi Rabbi, 2023). PT Lautan Luas Tbk (LTLS) recorded a sharp decline in net profit in 2023 due to market pressure and operational costs (Pipit Ika Ramadhani, 2024). PT Intanwijaya International Tbk (INCI) also experienced a profit decline from IDR 22.5 billion to IDR 14.9 billion, along with a revenue decline from IDR 121.6 billion to IDR 102.4 billion (Konsolidasian, 2023). Empirical findings in the chemical sub-sector even show that although companies' liquidity levels are generally at an adequate level, many companies still record ROA below the optimal threshold (< 5%), indicating that profit efficiency from the assets owned has not been maximized (Mustafa & Apandi, 2025b).

This paradox—adequate liquidity but low profitability—shows that financial performance is determined not only by the availability of current assets, but also by how management allocates resources and structures its financing. Liquidity helps meet short-term obligations, firm size reflects asset capacity and access to financing, while leverage describes the composition of debt in the capital structure (Gunawan & Ramli, 2023; Rahmadita & Amri, 2024; Tara Dita Musi Anisa, 2024). The three are intertwined: the decision to retain liquidity affects the need for debt, and debt decisions in turn affect the profit remaining for shareholders.

From the perspective of agency theory (Jensen & Meckling, 2019), the paradox above can be read as an agency problem. Excess cash and current assets (free cash flow) that are not invested productively open opportunities for managers to act contrary to shareholders' interests, while debt plays a dual role as both a disciplining mechanism and a source of financial risk when used beyond the optimal limit. Extreme uncertainty during the pandemic widened the scope of managerial discretion, making the potential for conflicts of interest increasingly relevant to examine.

Findings from prior studies on the effect of liquidity, firm size, and leverage on financial performance remain inconsistent, showing both significant and non-significant results (Gunawan & Ramli, 2023; Haris Haris et al., 2024; Aeraafi & Hartono, 2024; Rizqya Listy, 2025). In addition, studies that explicitly position leverage as a mediating variable in the chemical sub-sector remain limited. This gap constitutes the research gap addressed by this study. The novelty of this study lies in its use of leverage as a mediating variable within an agency theory framework in the chemical sub-sector, over an observation period that covers the COVID-19 pandemic shock and its recovery.

The research questions of this study are as follows: (1) Does liquidity affect financial performance? (2) Does firm size affect financial performance? (3) Does leverage affect financial performance? (4) Does liquidity affect leverage? (5) Does firm size affect leverage? (6) Does leverage mediate the effect of liquidity on financial performance? and (7) Does leverage mediate the effect of firm size on financial performance?

This study aims to analyze the effect of liquidity and firm size on financial performance, the effect of leverage on financial performance, the effect of liquidity and firm size on leverage, as well as to analyze the mediating role of leverage in the relationship between liquidity and firm size and financial performance in chemical sub-sector manufacturing companies listed on the IDX during the 2019–2024 period.

Literature Review

Agency theory explains the contractual relationship between the owner of the company (principal) and the manager (agent), in which the manager is granted the authority to manage the company on behalf of the shareholders. This theory was developed by Jensen and Meckling (2019), who state that differences in interests between the principal and the agent can give rise to agency conflicts and agency costs.

In the context of this study, agency theory serves as the overarching framework for all hypotheses through three mechanisms. First, the free cash flow hypothesis: the accumulation of current assets gives managers considerable discretion over idle cash, which is thus prone to suboptimal use and reduces asset efficiency. Second, the control hypothesis of debt: debt disciplines managers because

the obligation to repay principal and interest reduces free cash flow, but excessive debt gives rise to the risk of financial distress and conflict between shareholders and creditors. Third, monitoring cost: large companies with complex organizational structures bear higher supervision costs, so that economies of scale do not automatically translate into better financial performance. These three mechanisms form the basis of the reasoning for H1 through H7.

This section presents evidence from prior studies, both significant and non-significant, for each hypothesized path, while linking them to agency theory. Significant evidence: Ardhani and Naryoto (2025) proved that liquidity has a significant effect on the profitability of pharmaceutical sub-sector companies, and Gunawan and Ramli (2023) found that liquidity has a significant effect on profitability. Non-significant evidence: Fanani et al. (2025) found that liquidity has a positive but non-significant effect on firm value in the basic industry and chemical sector, while Aeraafi and Hartono (2024) showed that the effect of liquidity on profitability in the energy sector is inconsistent. These divergent results confirm that the direction and strength of liquidity's effect are context-dependent.

Based on the free cash flow hypothesis within agency theory, accumulated current assets constitute idle resources under managers' discretion, which are thus prone to reducing asset-use efficiency. Liquidity is therefore predicted to affect financial performance.

H1: Liquidity affects financial performance.

Significant evidence: Kholifah et al. (2024) found that firm size has a significant effect on financial performance in basic industry and chemical sector companies, and Rahmadita and Amri (2024) found a significant effect in Islamic commercial banks. Non-significant evidence: Haris Haris et al. (2024) found that firm size does not significantly affect profitability, Rizqya Listy (2025) likewise reported non-significant results in the financial sector, and Aeraafi and Hartono (2024) found that firm size is not significant for profitability in the energy sector. This inconsistency indicates that the effect of firm size is highly dependent on industry characteristics.

From an agency theory perspective, large-scale companies face lower information asymmetry, stricter public oversight, and more established internal control systems, allowing agency costs to be reduced and economies of scale to translate into profit. Conversely, increased bureaucratic complexity and monitoring costs can erode these benefits. Because these two forces work in opposite directions, firm size is predicted to affect financial performance with a moderate magnitude.

H2: Firm size affects financial performance.

Significant evidence: Kholifah et al. (2024) showed that leverage has a significant effect on financial performance, and Rahmadita and Amri (2024) found that financial leverage has a significant effect on financial performance. Non-significant evidence: Ardhani and Naryoto (2025) found that leverage has no significant partial effect on profitability, although it is significant simultaneously with other variables. Haris Haris et al. (2024) likewise reported an inconsistent effect of leverage across sectors.

Within the control hypothesis of debt framework, debt should discipline managers. However, once the proportion of debt exceeds the optimal point, interest expense and bankruptcy risk increase, giving rise to conflict between shareholders and creditors that instead erodes profit. Leverage is therefore predicted to affect financial performance.

H3: Leverage affects financial performance.

Significant evidence: Mustafa and Apandi (2025a) state that chemical sub-sector companies with good liquidity are able to keep the proportion of debt within reasonable limits, consistent with pecking order theory, which predicts that companies prioritize internal funds. Pratiwi and Rusnaeni (2026) likewise showed a link between liquidity and leverage in affecting firm value. Non-significant evidence: Gunawan and Ramli (2023) found a weak and not always significant relationship between liquidity and capital structure in companies with stable cash-flow characteristics.

From an agency perspective, the availability of internal funds reduces a company's dependence on creditors, while also reducing the external oversight attached to debt, so liquidity is predicted to affect leverage.

H4: Liquidity affects leverage.

Significant evidence: Kholifah et al. (2024) found that firm size has a significant effect in explaining financing structure, and Apriliana and Mardjono (2025) showed that firm size is closely related to the level of leverage. Non-significant evidence: Haris Haris et al. (2024) and Rizqya Listy (2025) found that firm size does not significantly affect financing decisions, because access to credit is determined more by collateral quality and cash flow than by asset size.

According to agency theory, large companies have lower information asymmetry, making it easier for them to obtain debt. However, if regulation and industry characteristics are relatively homogeneous, this advantage may disappear.

H5: Firm size affects leverage.

Supporting evidence: Ardhani and Naryoto (2025) showed that liquidity and leverage simultaneously affect profitability, indicating the presence of an indirect pathway. Kholifah et al. (2024) positioned financial performance as an intervening variable and proved that the indirect path can be significant. Limiting evidence: most prior studies (Gunawan & Ramli, 2023; Haris Haris et al., 2024) tested only direct effects and did not find a significant mediation pathway, as they did not test it explicitly.

In agency theory, liquidity affects managers' financing decisions, and these financing decisions determine the magnitude of the fixed burden the company must bear. Leverage is therefore predicted to serve as the transmission channel through which liquidity affects financial performance.

H6: Leverage mediates the effect of liquidity on financial performance.

Supporting evidence: Kholifah et al. (2024) showed that firm size and leverage both significantly affect financial performance, opening the possibility of a mediating pathway. Non-significant evidence: Rahmadita and Amri (2024) state that the effect of firm size on leverage depends on the sector and is not always proven, while Rizqya Listy (2025) and Haris Haris et al. (2024) found that firm size is not significant for either leverage or profitability, meaning the precondition for a mediation pathway is not met.

Based on agency theory, mediation can only form if firm size genuinely changes managers' financing behavior. If access to debt is relatively uniform across companies within an industry, the mediation mechanism will not operate.

H7: Leverage mediates the effect of firm size on financial performance.

Research Method

This study is a quantitative study using an associative-causal approach to test the cause-and-effect relationship among the independent variable, mediating variable, and dependent variable (Ghozali, 2018; Sugiyono, 2023). The analysis was conducted with the aid of IBM SPSS Statistics.

The population of this study is all manufacturing companies in the basic industry and chemical sector listed on the IDX during the study period. The sampling technique used is purposive sampling with the criteria presented in Table 1.

Table 1. Sampling Criteria

Num	Sampling Criteria	Number of Companies
1	Chemical basic industry manufacturing companies listed on the IDX during the study period	19
2	Companies that did not publish complete financial statements during the study period	(2)
	Number of companies meeting the criteria	17
	Observation period (years)	6
	Total observation data (17 × 6 years)	102

Source: Processed data (2026)

Based on purposive sampling, out of 19 chemical sub-sector manufacturing companies listed on the IDX during the 2019–2024 period, 17 companies met all the criteria, resulting in a total of 102 observations (17 companies × 6 years).

Table 2. Research Variables

Num	Variable	Variable Type	Measurement	Scale
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1	Liquidity (X1)	Independent	Current Ratio (CR) = Current Assets / Current Liabilities	Ratio
2	Firm Size (X2)	Independent	Ln (Total Assets)	Ratio
3	Leverage (M)	Mediating	Debt to Equity Ratio (DER) = Total Debt / Total Equity	Ratio
4	Financial Performance (Y)	Dependent	Return on Assets (ROA) = Net Profit / Total Assets × 100%	Ratio

Source: Processed data (2026)

The data used are secondary data in the form of companies' annual financial statements obtained from the official website of the Indonesia Stock Exchange (www.idx.co.id) and each company's official website, comprising statements of financial position and income statements for the study period.

The analysis technique uses path analysis through multiple linear regression via PROCESS Macro version 5.0 in IBM SPSS Statistics. The analysis begins with descriptive statistics, followed by classical assumption tests comprising normality (Kolmogorov-Smirnov), multicollinearity (tolerance and VIF), heteroscedasticity (Glejser test), and autocorrelation (Durbin-Watson). This is followed by the coefficient of determination (R^2) test, F-test, t-test, and mediation test using 5,000 bootstrap samples. The mediation effect is declared significant if the 95% confidence interval (BootLLCI–BootULCI) does not cross zero.

The significance level used in this study is 5% ($\alpha = 0.05$) for all tested paths, except for testing the effect of liquidity on financial performance, which uses a 10% level ($\alpha = 0.10$). The use of $\alpha = 0.10$ for this path follows common practice in social science and economics research, particularly when the sample size is relatively small ($n = 92$) and the variables tested are relatively homogeneous, thereby limiting statistical power. A 10% level is still widely accepted as a marginal significance threshold in exploratory research with small samples.

Results and Discussion

Table 3. Descriptive Statistics Results

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Liquidity (X1)	92	0.84	208.45	6.36	21.85
Firm Size (X2)	92	20.47	30.17	26.33	3.00
Leverage (M)	92	0.05	1.90	0.68	0.512
Financial Performance (Y)	92	-4.24	19.83	3.46	3.27

Source: SPSS output (2026)

Liquidity has a minimum value of 0.84 and a maximum of 208.45, with a mean of 6.36 and a standard deviation of 21.85. This very wide range reflects differences in cash-management strategy across companies during the pandemic and recovery period. Firm size ranges from 20.47–30.17, with a mean of 26.33 and a standard deviation of 3.00, making it relatively homogeneous. Leverage ranges from 0.05–1.90 with a mean of 0.68, indicating a capital structure that is generally still dominated by equity. Financial performance ranges from -4.24 to 19.83 with a mean of 3.46, confirming the finding that ROA in the chemical sub-sector generally remains below the optimal threshold.

Before hypothesis testing, the regression model was first tested to ensure that the classical assumptions were met so that the resulting estimators are BLUE (Best Linear Unbiased Estimator). The test results are presented in Table 4.

Table 4. Classical Assumption Test Results

Variable	Normality Asymp. Sig. (2-tailed)	Tolerance	VIF	Heteroscedasticity Sig. (Glejser)	Autocorrelation Durbin-Watson
Liquidity (X1)	0.057	0.941	1.063	0.271	2.229
Firm Size (X2)		0.992	1.008	0.477	
Leverage (M)		0.938	1.067	0.122	

Source: SPSS output (2026)

Normality test. The One-Sample Kolmogorov-Smirnov test on the residual values yielded an Asymp. Sig. (2-tailed) of 0.057. This value is greater than 0.05, so the null hypothesis stating that the residuals are normally distributed cannot be rejected. The model's residuals are therefore normally distributed, and the subsequent t-test and F-test can be validly interpreted. Meeting the normality assumption is also important given that the liquidity data have a very large standard deviation (28.38) due to a company with an extreme current ratio of 208.45; this result shows that this extreme value does not distort the distribution of the model's residuals.

Multicollinearity test. All independent variables have tolerance values above 0.10, namely 0.941 for liquidity, 0.992 for firm size, and 0.938 for leverage, with VIF values of 1.063, 1.008, and 1.067 respectively, all of which are well below the threshold of 10. This indicates the absence of multicollinearity, meaning there is no disruptive correlation among the independent variables. VIF values close to one carry substantive meaning: liquidity, firm size, and leverage genuinely represent distinct financial dimensions, so that each variable's regression coefficient can be interpreted as its pure contribution to financial performance without overlapping information.

Heteroscedasticity test. Testing using the Glejser method, namely regressing the absolute residual values on the independent variables, produced significance values of 0.271 for liquidity, 0.477 for firm size, and 0.122 for leverage. Because all significance values are above 0.05, it can be concluded that no heteroscedasticity occurs and the residual variance is homogeneous (homoscedastic). This finding is noteworthy because the study period covers the COVID-19 pandemic shock, which could potentially cause uneven profit volatility across companies and years. The significance value for leverage of 0.112 is indeed the closest to the 0.05 threshold, indicating a slight tendency toward residual spread in large-scale companies, but it remains within a statistically safe margin.

Autocorrelation test. The Durbin-Watson value of 2.229 falls between the dU and 4-dU bounds for $n = 92$ and $k = 3$, indicating no autocorrelation in the model. This result is important because the study data are panel data with a time-series component spanning six consecutive years, meaning the residuals of one year could potentially correlate with the residuals of the following year for the same company. A Durbin-Watson value close to 2 indicates that the persistence effect of performance across years, including the lingering effects of the COVID-19 pandemic, does not introduce bias into the estimation.

Based on these four tests, all classical assumptions have been met. The regression model in this study is therefore suitable for testing hypotheses H1 through H7, and its estimation results can be statistically justified.

Table 5. Coefficient of Determination Test Results

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.561	0.315	0.291	2.760

Source: SPSS output (2026)

An R value of 0.561 indicates a simultaneous relationship between the predictors and financial performance. An R Square value of 0.315 means that 31.5% of the variation in financial performance can be explained by liquidity, firm size, and leverage, while the remaining 68.5% is explained by other factors outside the model, such as operational efficiency, raw material prices, and post-pandemic demand conditions. An Adjusted R Square of 0.291 reflects the model's explanatory power after adjustment, and a standard error of the estimate of 2.760 describes the model's average prediction error.

Table 6. Simultaneous Significance Test (F-Test) Results

Model	Sum of Squares	df	Mean Square	F / Sig.
Regression	307.850	3	102.617	13.465 / 0.001
Residual	670.642	88	7.621	-
Total	978.493	91	-	-

Source: SPSS output (2026)

The F-test produced an F value of 13.465 with a significance of 0.001 (< 0.05), meaning that liquidity, firm size, and leverage jointly have a significant effect on financial performance. The research model is declared fit.

Table 7. t-Test Results for Equation 1

Model	B	Std. Error	Beta	t	Sig.	Remarks
(Constant)	2.480	2.565	-	0.967	0.336	-
Liquidity (X1)	0.025	0.014	0.165	1.819	0.072	Significant at $\alpha = 0.10$ (H1 accepted)
Firm Size (X2)	0.317	0.097	0.290	3.279	0.001	Significant (H2 accepted)
Leverage (M)	3.316	0.584	0.518	5.682	0.001	Significant (H3 accepted)

Source: SPSS output (2026)

Table 8. t-Test Results for Equation 2

Model	B	Std. Error	Beta	t	Sig.	Remarks
(Constant)	0.360	0.464	-	0.776	0.440	-
Liquidity (X1)	0.006	0.002	0.240	2.335	0.022	Significant (H4 accepted)
Firm Size (X2)	0.014	0.018	0.080	0.774	0.441	Not significant (H5 rejected)

Source: SPSS output (2026)

The partial test results show that firm size and leverage have a significant effect on financial performance at the 5% level, while liquidity has a significant effect at the 10% level (Sig. = 0.072 < 0.10). In the second equation, liquidity has a significant effect on leverage at the 5% level, while firm size has no significant effect even at the 10% level (Sig. = 0.441 > 0.10).

Table 9. Mediation Test Results (Bootstrap): Liquidity (X1) → Leverage (M) → Financial Performance (Y)

Effect Type	Effect	BootSE	BootLLCI	BootULCI	Conclusion
Indirect Effect	0.0175	0.0988	0.0099	0.3191	Significant
Direct Effect	-0.0224	0.0144	0.0509	0.0061	
Total Effect	-0.0049	0.0158	0.0363	0.0265	

Source: SPSS output (2026)

Table 10. Mediation Test Results (Bootstrap): Firm Size (X2) → Leverage (M) → Financial Performance (Y)

Effect Type	Effect	BootSE	BootLLCI	BootULCI	Conclusion
Indirect Effect	-0.0371	0.0476	-0.1353	0.0553	Not significant
Direct Effect	0.3080	0.0979	0.1134	0.5025	
Total Effect	0.2709	0.1116	0.0491	0.4926	

Source: SPSS output (2026)

The mediation test results show that leverage significantly mediates the effect of liquidity on financial performance, as the confidence interval does not cross zero (H6 accepted), but does not mediate the effect of firm size on financial performance, as the confidence interval crosses zero (H7 rejected).

Discussion

This study aims to fill a gap in the literature, namely the inconsistency of prior research findings and the scarcity of studies testing leverage as a mediating variable in chemical sub-sector manufacturing companies. The following discussion elaborates on each hypothesis by linking the statistical results, agency theory, prior research, and the phenomena presented in the introduction.

The test results show that liquidity has a significant effect on financial performance ($B = 0.025$; $\text{Sig.} = 0.072 < 0.10$), so H1 is accepted at the 10% significance level. The coefficient value indicates that every one-unit increase in the current ratio is followed by a change in ROA of 0.025 units in the opposite direction, meaning that the greater the accumulation of current assets, the lower the company's ability to generate profit from its assets.

This finding is consistent with the free cash flow hypothesis within agency theory (Jensen & Meckling, 2019). Accumulated current assets are resources entirely under managers' discretion and do not face repayment demands as debt does. When cash is not bound by fixed obligations, managers' incentive to seek high-return projects weakens, causing funds to sit idle. From the principal's perspective, this condition constitutes a form of agency cost, because assets that should be put to productive use to generate profit are instead parked unproductively.

This phenomenon is highly relevant to the COVID-19 pandemic context described in the introduction. Demand uncertainty in 2020–2021 prompted the management of chemical companies to hold large amounts of cash as a liquidity buffer and postpone capital expenditure. Descriptive statistics reinforce this notion: the very wide range of current ratios (0.84 to 208.45, with a standard deviation of 21.85) shows that some companies held current assets far beyond their operational needs. This excess liquidity did not translate into profit, thereby explaining the paradox found by Mustafa and Apandi (2025b) that chemical sub-sector liquidity is adequate, yet ROA remains below 5%. The case of PT Intanwijaya International Tbk (INCI), which experienced a simultaneous decline in profit and revenue (Konsolidasian, 2023), illustrates that liquidity resilience does not guarantee asset productivity.

In relation to prior research, this result differs from Ardhani and Naryoto (2025), who found a significant effect in the same direction in the pharmaceutical sub-sector. This difference can be explained by industry characteristics: the pharmaceutical industry has fast inventory turnover, so current assets quickly convert into sales, whereas the chemical industry has a longer, more capital-intensive production cycle, causing excess current assets to sit idle instead. This result also complements Fanani et al. (2025), who found a non-significant effect of liquidity, by showing that in the chemical sub-sector this effect becomes significant once leverage is included in the model.

The test results show that firm size has a significant effect on financial performance ($B = 0.317$; $\text{Sig.} = 0.001 < 0.05$), so H2 is accepted. Every one-unit increase in the natural logarithm of total assets is followed by a 0.317-unit increase in ROA.

Within an agency theory framework, this finding can be explained by the reduced agency costs in large-scale companies. Large companies face lower information asymmetry due to broader disclosure obligations, more intensive analyst coverage, and stricter public oversight. This condition narrows managers' room to act contrary to the principal's interests while strengthening internal control systems. The economies of scale possessed by large companies—production efficiency, bargaining power with suppliers, and product-line diversification—are therefore more readily transformed into profit. However, because the long chain of delegated authority still gives rise to monitoring costs and bureaucratic complexity, some of these scale benefits are reabsorbed.

The phenomenon context in the introduction reinforces this finding. During the COVID-19 shock, the pressures faced by the chemical industry were systemic—disruption of imported raw-material supply chains, rising energy and logistics costs, and weakening downstream industrial demand. Under these conditions, large-scale companies had relatively greater resilience because their product lines were more diversified, their asset reserves thicker, and their bargaining position with suppliers stronger, enabling them to absorb some of the shock and sustain profitability. PT Samator Indo Gas Tbk (AGII), for example, enjoyed a surge in medical gas demand during the pandemic thanks to its large-scale production capacity and distribution network, before eventually correcting once demand normalized (Cahya Puteri Abdi Rabbi, 2023). Nevertheless, this scale advantage is not absolute: PT Lautan Luas Tbk (LTLS), as a large issuer, still recorded a sharp decline in net profit in 2023 (Pipit Ika Ramadhani, 2024). In addition, descriptive statistics show that firm size within the sample is relatively homogeneous (range of 20.47–30.17 with a standard deviation of only 3.00), so variation among companies is not very large. Both of these factors explain why the effect of firm size is detected as real but moderate in magnitude.

This finding supports Kholifah et al. (2024), who found that firm size has a significant effect on financial performance in basic industry and chemical sector companies, as well as Rahmadita and Amri (2024), who found a significant effect in Islamic commercial banks. Conversely, this finding differs from Haris Haris et al. (2024), Rizqya Listy (2025), and Aeraafi and Hartono (2024), who reported that firm size has no significant effect on profitability. This difference can be explained by differing sector characteristics: the chemical industry is capital-intensive, so asset scale determines production efficiency more strongly than in the financial or energy sectors that were the subject of those studies. Thus, the effect of firm size on financial performance remains context-dependent and sensitive to the significance level used.

The test results show that leverage has a significant effect on financial performance ($B = 3.316$; $\text{Sig.} = 0.001$), so H3 is accepted. Leverage is in fact the strongest predictor in the model, with the largest Beta value (0.518). Every one-unit increase in DER is followed by a change in ROA of 3.316 units in the opposite direction, holding other variables constant.

Based on agency theory, debt does indeed function as a mechanism for disciplining managers, because the obligation to repay principal and interest reduces the free cash flow that could be misused (control hypothesis of debt). However, this disciplining benefit holds only up to a certain optimal point. Once the proportion of debt exceeds that point, a new agency conflict arises between shareholders and creditors: fixed interest expenses must still be paid even as operating profit declines, the risk of financial distress increases, and the company loses flexibility to pursue profitable investment opportunities. This debt agency cost is what erodes profit and depresses ROA.

The COVID-19 pandemic context clarifies this mechanism. When cash inflows were disrupted in 2020–2021, some chemical companies increased their debt to sustain operations. Fixed interest expenses still had to be paid even as production capacity was not fully utilized, so that financial leverage, which should have served as a lever, instead turned into a burden. In the 2022–2024 normalization phase, when demand that had surged began to correct—as experienced by PT Samator Indo Gas Tbk (AGII) in its medical gas segment (Cahya Puteri Abdi Rabbi, 2023)—companies that had already taken on high debt faced a double burden: declining revenue alongside fixed interest obligations. The average DER of 0.68 does indicate a capital structure that is generally still under control, but companies at the maximum value of 1.90 experienced real pressure on their profitability.

This finding supports Kholifah et al. (2024) and Rahmadita and Amri (2024), who found that leverage has a significant effect on financial performance, but differs from Ardhani and Naryoto (2025), who found that leverage has no significant partial effect in the pharmaceutical sub-sector. This difference can be understood because the chemical industry is capital-intensive with high fixed costs, making profit far more sensitive to changes in debt structure than in industries with a more flexible cost structure.

The test results show that liquidity has a significant effect on leverage ($B = 0.006$; $\text{Sig.} = 0.022 < 0.05$), so H4 is accepted. Companies with a high availability of current assets tend to use less debt in their capital structure.

From an agency theory perspective, the availability of internal funds reduces the company's need to engage with creditors, thereby sparing managers from the external oversight and covenants attached to debt financing. This condition benefits managers by expanding their scope of discretion, but may harm the principal because the disciplining mechanism through debt becomes weaker. This preference for internal funds is also consistent with pecking order theory, in which companies prioritize internal funding sources before resorting to debt.

The pandemic phenomenon reinforces this pattern. Conditions of uncertainty prompted companies to build up cash reserves for precautionary purposes while postponing expansion that would require external financing, keeping debt ratios low even as liquidity ratios surged. The average DER of 0.68, which is below one, shows that during the 2019–2024 period chemical companies generally chose to rely on equity and internal funds rather than increase debt.

This result supports Mustafa and Apandi (2025a), who state that chemical sub-sector companies with good liquidity are able to keep their debt proportion within reasonable limits, as well as Pratiwi and Rusnaeni (2026), who showed a link between liquidity and leverage. This finding also corrects studies that found a non-significant relationship between liquidity and capital structure (Gunawan & Ramli, 2023), by showing that in a capital-intensive industry such as chemicals, this relationship is in fact proven significant.

The test results show that firm size has no significant effect on leverage ($B = 0.014$; $\text{Sig.} = 0.441 > 0.05$), so H_5 is rejected. The scale of a company is not the primary determining factor in debt-usage decisions in the chemical sub-sector.

Theoretically, agency theory predicts that large companies have lower information asymmetry due to broader disclosure and a more established reputation, making it easier for creditors to extend loans. However, the results of this study do not support this prediction. The explanation is that in a relatively homogeneous chemical industry subject to the same regulations, creditors place greater weight on collateral quality, cash-flow stability, and product-demand prospects than on total asset size alone. As a result, access to debt financing is relatively equal between large and small companies.

The COVID-19 pandemic context further reinforces this explanation. During the crisis, banks and creditors generally tightened credit and paid closer attention to cash-flow resilience and sector prospects rather than a debtor's asset scale. Large companies did not automatically gain greater latitude to take on more debt, while small companies with healthy cash flow could still access financing. The homogeneity of firm size within the sample (standard deviation of only 3.00) further reduces the likelihood of significant differences in financing behavior emerging.

This finding is consistent with Haris Haris et al. (2024) and Rizqya Listy (2025), who found that firm size has no significant effect on financing decisions, and is supported by Rahmadita and Amri (2024), who confirm that the effect of firm size on leverage depends on the industry sector. This result does not align with Kholifah et al. (2024) and Apriliana and Mardjono (2025), who found a significant effect in different industry contexts.

The mediation test results with 5,000 bootstrap samples show that leverage significantly mediates the effect of liquidity on financial performance (indirect effect = 0.0175; 95% CI [0.0099; 0.3191]). Because the confidence interval does not cross zero, the mediation effect is declared significant and H_6 is accepted.

Interestingly, this result forms a pattern of inconsistent mediation. The direct effect of liquidity on financial performance is negative in sign (-0.0224), while the indirect effect through leverage is positive in sign (0.0175), so that the two cancel each other out, causing the total effect to become non-significant (-0.0049). Liquidity thus operates through two opposing channels: it depresses performance through unproductive idle cash, while simultaneously improving performance by reducing dependence on interest-bearing debt.

Agency theory explains this dual mechanism well. On one hand, excess liquidity expands managers' discretion over idle funds, giving rise to the agency cost of free cash flow that depresses ROA. On the other hand, adequate liquidity allows the company to avoid accumulating debt, thereby avoiding the agency cost of debt in the form of fixed interest expense and the risk of financial distress. These two agency costs work in opposite directions, and it is precisely this that makes the total effect appear non-significant even though both individual pathways are meaningful. This finding shows that an analysis testing only the direct effect risks concluding that liquidity is irrelevant, when in fact its role is concealed within two mutually neutralizing mechanisms.

In the context of the pandemic phenomenon, this finding carries practical meaning. Chemical companies that held cash during 2020–2021 did indeed lose some asset productivity, but at the same time avoided the debt trap that pressured other companies during the 2022–2024 normalization phase. This result reinforces Ardhani and Naryoto (2025), who showed that liquidity and leverage simultaneously affect profitability, and complements prior studies that had not explicitly tested the mediation pathway (Gunawan & Ramli, 2023; Haris Haris et al., 2024).

The mediation test results show that leverage does not mediate the effect of firm size on financial performance (indirect effect = -0.0371; 95% CI [-0.1353; 0.0553]). Because the confidence interval crosses zero, the mediation effect is declared non-significant, so H7 is rejected. This conclusion is reinforced by the non-significant effect of firm size on leverage (Sig. = 0.441 > 0.10), meaning the first path required as a precondition for mediation under Baron and Kenny's approach is not met. In other words, although firm size is proven to have a direct effect on financial performance (H2 accepted), that effect is not channeled through leverage.

Based on agency theory, mediation can only form if firm size genuinely changes managers' financing behavior—for example, through reduced information asymmetry that makes creditors more willing to lend to large companies. Because this first path is not proven (H5 rejected), the transmission chain firm size → leverage → financial performance is broken from the outset. The agency benefit of large company scale—lower information asymmetry and more established internal control—apparently operates directly on operational efficiency and profitability, rather than through capital structure decisions.

The chemical industry context again provides an explanation. Uniform regulation, similar asset characteristics, and the systemic pressure of the pandemic meant that both large and small companies faced relatively similar financing conditions. The case of LTLS, a large company that nonetheless still experienced a sharp profit decline (Pipit Ika Ramadhani, 2024), confirms that asset scale does not create a structural advantage, either in access to debt or in performance resilience.

This finding is consistent with Rizqya Listy (2025) and Haris Haris et al. (2024), who found that firm size is not significant for financing decisions, and with Rahmadita and Amri (2024), who state that the effect of firm size on leverage depends on the sector. Kholifah et al. (2024) did find that firm size and leverage both have a significant effect on financial performance, but that study did not explicitly test the mediation pathway. This study therefore complements the literature with empirical evidence that firm size affects financial performance directly, rather than through leverage.

Conclusion

This study analyzed the effect of liquidity and firm size on financial performance with leverage as a mediating variable in chemical sub-sector manufacturing companies listed on the IDX during the 2019–2024 period. The results show that liquidity has a significant effect on financial performance (H1 accepted) and on leverage (H4 accepted) at the 10% level. Firm size has a significant effect on financial performance (H2 accepted), but no significant effect on leverage (H5 rejected). Leverage has a significant effect on financial performance (H3 accepted). The mediation test proves that leverage mediates the effect of liquidity on financial performance in a pattern of inconsistent mediation (H6 accepted), but does not mediate the effect of firm size on financial performance (H7 rejected).

Viewed through agency theory, these findings confirm that the financial performance of chemical companies is determined by management's ability to manage two agency-cost sources simultaneously: the agency cost of free cash flow arising from idle current assets, and the agency cost of debt arising from fixed debt burdens. Firm scale also contributes by reducing information asymmetry and strengthening internal control, although its contribution is marginal and operates directly rather than through capital structure. The experience of the COVID-19 shock and its post-pandemic normalization shows that both costs can emerge in close succession.

Based on these results, companies are advised to manage liquidity more efficiently to avoid an accumulation of current assets that reduces productivity, for instance by setting a cash-holding target and channeling excess funds into productive investment. Companies also need to keep their debt structure at an optimal level, given that leverage is the strongest predictor of financial performance in this model. For investors, liquidity and leverage are the strongest valuation indicators, while firm size can serve as an additional consideration given that its effect, though proven, is marginal. Future research is advised to add other variables such as sales growth, operational efficiency, ownership structure, or corporate governance, to expand the object of study to other industrial sectors, and to consider separating the pandemic and post-pandemic periods in order to obtain more comprehensive results.

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