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Stock Volatility, Cash Flow, and Financial Planning of Sharia Securities Issuers: An ARIMA Approach

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Abstract

This study examines the effect of stock price fluctuations on cash flow conditions and financial planning strategies among companies listed on the Indonesia Stock Exchange's Sharia Securities List (DES). Using a quantitative approach that combines explanatory research and time series analysis, the study analyzed 45 issuers consistently listed on the DES from 2021 to 2025. The sample was selected through purposive sampling, using secondary data from daily stock price movements and annual financial reports published by the IDX and the Financial Services Authority (OJK). ARIMA modeling was applied to forecast stock volatility, while panel data regression was used to assess its impact on internal financial conditions. The findings indicate that stock price fluctuations have a significant negative effect on operational cash flow (coefficient -12.456; p=0.007). In response to increased uncertainty, firms tend to raise their cash reserve ratio (coefficient 0.008; p=0.045), although earnings forecast accuracy declines (coefficient -0.234; p=0.003). The ARIMA (1,1,1) model produced strong predictive accuracy, with a MAPE of 3.80%. Overall, the results suggest that ARIMA-based forecasting should be integrated into scenario-based financial planning to support more adaptive managerial decisions.
Keywords: Stock Volatility, Cash Flow, Financial Planning, Sharia Securities List, ARIMA Model

Abstract

Penelitian ini mengkaji pengaruh fluktuasi harga saham terhadap kondisi arus kas dan strategi perencanaan keuangan perusahaan yang terdaftar dalam Daftar Efek Syariah (DES) di Bursa Efek Indonesia. Dengan pendekatan kuantitatif yang memadukan explanatory research dan analisis deret waktu, penelitian ini menganalisis 45 emiten yang secara konsisten tercatat dalam DES selama periode 2021–2025. Sampel ditentukan melalui purposive sampling dengan menggunakan data sekunder berupa pergerakan harga saham harian dan laporan keuangan tahunan yang diterbitkan oleh BEI dan Otoritas Jasa Keuangan (OJK). Pemodelan ARIMA digunakan untuk memproyeksikan volatilitas saham, sedangkan regresi data panel digunakan untuk menguji dampaknya terhadap kondisi keuangan internal perusahaan. Hasil penelitian menunjukkan bahwa fluktuasi harga saham berpengaruh negatif signifikan terhadap arus kas operasional (koefisien -12,456; p=0,007). Untuk merespons ketidakpastian, perusahaan cenderung meningkatkan rasio cadangan kas (koefisien 0,008; p=0,045), meskipun akurasi prediksi laba menurun (koefisien -0,234; p=0,003). Model ARIMA (1,1,1) terbukti paling akurat dengan nilai MAPE 3,80%. Temuan ini menegaskan pentingnya integrasi ARIMA dalam perencanaan keuangan berbasis skenario agar keputusan manajerial lebih adaptif.
Keywords: Volatilitas Saham, Arus Kas, Perencanaan Keuangan, Daftar Efek Syariah, Model ARIMA

INTRODUCTION

The dynamics of the Indonesian capital market in recent years show that stock prices no longer move solely following the company's fundamental information, but are also influenced by market sentiment, transaction frequency, and investor response to economic uncertainty. For issuers, stock price fluctuations are not only a matter of changes in market value, but can affect risk perception, funding costs, and stability of short- and long-term financial planning. This condition requires management to have a predictive device that is able to translate market pressure into operational financial information. In this context, stock volatility needs to be read as a managerial signal related to the company's ability to maintain liquidity and continuity of financial strategy[1].

This study becomes more relevant when directed at companies included in the Sharia Securities List (DES), because Islamic issuers have certain compliance restrictions while still operating in a competitive market mechanism. DES is a collection of securities set by the Financial Services Authority and is the main reference for investors in choosing instruments that are in accordance with sharia principles. The Indonesia Stock Exchange also emphasized that sharia stocks listed on the stock exchange are stocks included in DES. Thus, volatility in DES issuers is important to be studied not only from the market side, but also from internal financial resilience, especially when price pressures have implications for cash and budget decisions [2].

Operating cash flow occupies a strategic position in the evaluation of a company's financial health because it shows the issuer's ability to generate cash from key activities, not just accounting profits. The financial accounting literature shows that the relationship between profit, accrual, and cash flow is important to understand the quality of a company's performance as well as future cash projections. As stock volatility increases, management has the potential to adjust cash policies, liquidity reserves, and financing plans so that market uncertainty risks do not disrupt operations. Therefore, testing the effect of stock volatility on cash flow is important to strengthen the basis for financial decision-making, manage liquidity, maintain operational flexibility, and reduce bias in the preparation of budget projections[3].

Most stock volatility studies still focus on the relationship between price fluctuations, returns, market risk, or investor sentiment. The ARCH/GARCH approach is commonly used to measure conditional volatility, while ARIMA is more widely used to model time

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[1] Robert F Engle, "Autoregressive Conditional Heteroscedasticity with Estimates of the Variance of United Kingdom Inflation," *Econometric* 50, no. 4 (1982): 987–1007, https://doi.org/10.2307/1912773; Malcolm Baker and Jeffrey Wurgler, "Investor Sentiment and the Cross-Section of Stock Returns," *The Journal of Finance* 61, no. 4 (2006): 1645–80, https://doi.org/10.1111/j.1540-6261.2006.00885.x.

[2] Engle, "Autoregressive Conditional Heteroscedasticity with Estimates of the Variance of United Kingdom Inflation"; Baker and Wurgler, "Investor Sentiment and the Cross-Section of Stock Returns"; Otoritas Jasa Keuangan, "Daftar Efek Syariah," n.d., https://ojk.go.id/id/kanal/syariah/data-dan-statistik/daftar-efek-syariah/default.aspx; I D X Islamic, "Daftar Saham Syariah," n.d., https://idxislamic.idx.co.id/whats-on-idx-islamic/daftar-saham-syariah/.

[3] Patricia M Dechow, S P Kothari, and Ross L Watts, "The Relation between Earnings and Cash Flows," *Journal of Accounting and Economics* 25, no. 2 (1998): 133–68, https://doi.org/10.1016/S0165-4101(98)00020-2.

series patterns based on autocorrelation of historical data. ARIMA remains relevant because it is able to systematically capture patterns of trends and short-term changes, especially when the available data is in the form of a timeline and the purpose of analysis is directed at forecasting. However, the use of ARIMA to correlate stock volatility with DES issuers' cash flows and financial planning is still limited in the Indonesian literature, so the empirical testing room remains open. [4]

Based on these gaps, this study was directed to analyze the influence of stock volatility on the cash flow and financial planning of issuers who are consistently listed in the DES during the observation period, as well as test the ability of the ARIMA model to project volatility dynamics. This focus is important because it combines capital market analysis with the company's internal managerial consequences, rather than just assessing volatility as a price phenomenon. The novelty of the research lies in the integration of ARIMA and panel regression to read the relationship between stock volatility, operating cash flow, cash reserves, and profit planning accuracy. Its contribution is to provide a predictive framework for Islamic issuers in preparing scenario-based financial planning.

THEORETICAL FOUNDATIONS

The theoretical basis of this research was compiled to explain the relationship between stock volatility, cash flow, and financial planning of issuers listed in the Sharia Securities List. Stock volatility is not only seen as a price change in the capital market, but also as a risk signal that can affect investor perception, capital costs, access to funding, as well as internal decisions of companies. Therefore, this study uses three main groups of theories, namely signal theory and portfolio theory, management accounting theory, and the ARIMA model as the basis for financial prediction and planning.

1. Stock Volatility as a Market Signal and Investment Risk

Signal theory explains that the information that a company conveys to the market can affect investors' perception of the company's prospects and risks. In the context of this study, high stock volatility can be understood as a negative signal because it indicates market uncertainty about the stability of the issuer's performance. On the contrary, transparent financial statements, stable cash flow, and adaptive financial planning can be a positive signal for investors. Modern portfolio theory complements this explanation by placing volatility as a measure of investment risk that can affect a company's expected return, cost of capital, and access to funding [5].

In the context of the Sharia Securities List, stock volatility has a more specific dimension because investors not only consider returns and risks, but also the issuer's compliance with sharia principles. Therefore, stock price stability, information disclosure,

[4] George E P Box et al., *Time Series Analysis: Forecasting and Control*, 5th ed. (Hoboken: Wiley, 2015); Rob J Hyndman and George Athanasopoulos, *Forecasting: Principles and Practice*, 3rd ed. (OTexts, 2021), https://otexts.com/fpp3/.

[5] Michael Spence, "Job Market Signaling," *The Quarterly Journal of Economics* 87, no. 3 (1973): 355–74, https://doi.org/10.2307/1882010; Harry Markowitz, "Portfolio Selection," *The Journal of Finance* 7, no. 1 (1952): 77–91, https://doi.org/10.1111/j.1540-6261.1952.tb01525.x; William F Sharpe, "Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk," *The Journal of Finance* 19, no. 3 (1964): 425–42, https://doi.org/10.1111/j.1540-6261.1964.tb02865.x.

and the ability to maintain cash flow are important parts of market confidence. Islamic issuers that are able to show stable financial performance have the potential to provide positive signals to investors, while high volatility can strengthen risk perception. Thus, this subsection emphasizes that stock volatility needs to be analyzed as a combination of market signals, investment risk, and indicators of Islamic investor confidence[6].

2. Issuer Management Accounting, Cash Flow, and Financial Planning

Management accounting theory is used to explain how external market information is translated into internal decisions of the company. The management accounting system not only functions as a cost recording tool, but also as an instrument for planning, controlling, risk evaluation, and strategic decision-making. In uncertain market conditions, stock volatility needs to be integrated into budgeting, cash flow projections, liquidity reserves, and financing strategies. Thus, cash flow is not only understood as the output of financial statements, but also as an indicator of a company's ability to respond to market pressures and maintain financial flexibility[7].

The relationship between stock volatility and cash flow becomes important because changes in market perception can affect a company's access to funding and capital costs. When volatility increases, management needs to strengthen cash policies to keep operations stable. Financial planning that is responsive to volatility can help companies develop budget scenarios, anticipate liquidity needs, and reduce the risk of revenue misestimates [8]. Therefore, management accounting theory provides a conceptual basis that stock volatility information needs to be treated as a strategic input in the financial planning process, rather than simply an external phenomenon separate from the issuer's internal decisions[9].

3. ARRIMA Model, Predictive Framework, and Research Contribution

The ARIMA model is used as a time series analysis tool to read historical patterns and project stock volatility in subsequent periods. This model is relevant because stock price data generally has the characteristics of trend, autocorrelation, fluctuation, and unstationary. Through the stages of identification, estimation, diagnostics, and forecasting, ARIMA can

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[6] Spence, "Job Market Signaling"; Financial Services Authority, "Issuance of Decisions of Members of the Board of Commissioners on the List of Sharia Securities," 2026, https://ojk.go.id/id/berita-dan-kegiatan/pengumuman/Pages/Daftar-Efek-Syariah-KEP21D042026.aspx.

[7] Anthony A Atkinson et al., *Management Accounting: Information for Decision-Making and Strategy Execution*, 6th ed. (Edinburgh: Pearson, 2012); Robert H Chenhall, "Management Control Systems Design within Its Organizational Context: Findings from Contingency-Based Research and Directions for the Future," *Accounting, Organizations and Society* 28, no. 2–3 (2003): 127–68, https://doi.org/10.1016/S0361-3682(01)00027–7.

[8] Ahmad Munir Hamid, "ADILLA : Jurnal Ekonomi Syariah Sharia Perspective : The Urgency of Islamic Economic , Banking and Finance (IEBF) Reform in Realizing the Sustainable Development Goals (SDGs) through Knowledge Integration (IoK) Approach Ahmad Munir Hamid Researcher" 7, no. 2 (2024): 111–40; Ahmad Munir Hamid, Achmad Room Fitrianto, and Ishfaq Ahmed, "From Marginalization to Recognition : The Impact of Islamic Political Economy on Indonesia ' s Islamic Economy During the New Order" 15, no. 1 (2024): 33–52, https://doi.org/10.21580/economica.2024.15.1.20305.

[9] Atkinson et al., *Management Accounting: Information for Decision-Making and Strategy Execution*; Chenhall, "Management Control Systems Design within Its Organizational Context: Findings from Contingency-Based Research and Directions for the Future."

help produce more systematic volatility predictions. In this study, ARIMA is not only positioned as a statistical technique, but also as a supporting instrument for managerial decision-making. The results of volatility predictions can be used to develop cash flow scenarios, budgets, cash reserves, and risk mitigation strategies[10].

The novelty of this research lies in the combination of the analysis of stock volatility, cash flow, and financial planning of issuers of the Sharia Securities List with the ARRIMA approach. Most previous research has placed volatility as an issue of return, market risk, or investor behavior, while its impact on cash policy and internal financial planning is still relatively limited. This research makes a conceptual contribution by connecting signal theory, portfolio theory, management accounting, and predictive models in one analytical framework. Practically, the results of the study are expected to help issuers, Islamic investors, and regulators understand volatility risks in a more operational, predictive, and applicable manner.[11].

METHOD

This study uses a quantitative approach with a causal and predictive research design. This type of research is explanatory research, aiming to explain the causal relationship between stock volatility as an independent variable and cash flow and financial planning of issuers as dependent variables. A time series approach is used to predict the impact of volatility on financial planning. The quantitative approach was chosen because this study requires statistical and econometric analysis of numerical data in the form of stock prices and company financial reports. This study is longitudinal in nature because it uses historical data over a specific time period to analyze patterns and relationships between variables.

The data sources for this study are secondary data obtained from official publications from the Indonesia Stock Exchange (IDX) on the website www.idx.co.id, historical stock price data from Yahoo Finance and other capital market data sources, and published annual financial reports of companies. Data was also obtained from the Financial Services Authority (OJK) regarding the periodically published Sharia Securities List (DES).

The data types used in this study fall into two main categories. First, time series data, consisting of daily closing stock prices of companies listed on the Sharia Securities List during the study period. Second, panel data, consisting of cash flow statements and other financial planning indicators obtained from issuers' annual or quarterly financial reports. The study period is planned to cover the last five years to obtain a sufficient number of observations for time series analysis.

The population in this study were all companies listed on the Sharia Securities List (DES) on the Indonesia Stock Exchange. The sampling technique used purposive sampling with the following criteria: (1) the company was consistently listed on the DES during the study period, (2) the company had complete daily stock price data during the study period,

[10] Box et al., *Time Series Analysis: Forecasting and Control*; Hyndman and Athanasopoulos, *Forecasting: Principles and Practice*.
[11] Hyndman and Athanasopoulos, *Forecasting: Principles and Practice*; Ser-Huang Poon and Clive W J Granger, "Forecasting Volatility in Financial Markets: A Review," *Journal of Economic Literature* 41, no. 2 (2003): 478–539, https://doi.org/10.1257/002205103765762743.

(3) the company published complete annual financial reports during the study period, and (4) the company's shares were actively traded during the study period to avoid illiquid data. The sample size was determined based on the availability of data that met these criteria.

Data collection was conducted through documentation, which involved downloading, collecting, and recording secondary data published by official sources. Daily stock price data was collected in the form of closing prices, from which returns and volatility were then calculated. Financial statement data was collected to obtain cash flow information from operating, investing, and financing activities, as well as other information relevant to financial planning, such as revenue projections, capital budgets, and financing policies. Sharia Securities List data was obtained from OJK publications to verify the companies' sharia-compliant status during the study period.

This study uses three main variables that are operationally defined as follows: (1) Stock volatility is defined as the fluctuation of stock prices measured using the standard deviation of daily stock returns over a certain period. Daily stock returns are calculated as the difference between the natural logarithm of today's closing price and the previous day's closing price. Annual volatility is calculated by multiplying the standard deviation of daily returns by the square root of the number of trading days in a year. (2) Cash flow is defined as the sum of net cash flows from operating, investing, and financing activities reported in the company's cash flow statement. For analytical purposes, operating cash flow is used as the main indicator because it reflects the company's ability to generate cash from core business activities. Cash flow data is standardized by total assets or revenue to allow for comparisons between companies. (3) Issuer financial planning is defined as a proxy for the quality and adaptability of the company's financial planning in responding to uncertainty.

Given the qualitative and internal nature of financial planning, this study uses proxy indicators such as: (1) accuracy of revenue projections (difference between projections and realization), (2) level of budget target achievement, (3) frequency of budget revisions, and (4) cash to short-term liabilities ratio as indicators of readiness to face uncertainty. Data are obtained from annual reports, management analysis, and notes to the financial statements.

The data analysis technique in this study uses a time series approach with the ARIMA (Autoregressive Integrated Moving Average) model as the main analysis tool. Data analysis is carried out through several stages as follows: Before conducting ARIMA modeling, a descriptive analysis is carried out on all research variables to obtain a general overview of the data characteristics, including the mean, median, standard deviation, minimum, and maximum values. This analysis also includes data visualization in the form of time series graphs to observe the movement patterns of stock volatility and cash flows during the research period. The ARIMA model requires stationary data, namely data that has a constant mean and variance over time. The stationarity test is carried out using the *Augmented Dickey-Fuller* (ADF) test and the Phillips-Perron test. If the data is not stationary at the level, then a differencing process is carried out until the data becomes stationary. *The differencing order* (d) is determined based on the number of differencing times required to achieve stationarity. After the data is stationary, the next step is to identify the appropriate *autoregressive order* (p) and *moving average (q)*. Identification is done by analyzing the correlogram of the autocorrelation function (ACF) and the partial autocorrelation function (PACF). The cut-off

or gradually decreasing ACF and PACF patterns provide clues about the appropriate AR and MA orders. Several alternative models are estimated and compared. ARIMA model parameters are estimated using the maximum likelihood or ordinary least squares method. Estimation is carried out for various combinations of orders (p,d,q) identified in the previous stage. The model that produces statistically significant parameters becomes the best model candidate. The estimated model is tested to ensure that the ARIMA model assumptions are met.

Tests include: (a) residual autocorrelation test using the Ljung-Box test to ensure the residuals are white noise (no autocorrelation), (b) residual normality test using the Jarque-Bera test, and (c) residual heteroscedasticity test if necessary. Models that meet all diagnostic tests are considered suitable for use. (6) Selection of the Best Model. If more than one model meets the diagnostic criteria, the best model is selected based on information criteria such as *the Akaike Information Criterion* (AIC), *the Schwarz Information Criterion* (SIC), and *the Bayesian Information Criterion* (BIC). The model with the lowest AIC or BIC value is selected as the best model because it shows a balance between goodness-of-fit and model complexity. The best ARIMA model is used to forecast stock volatility for the next period. The forecast results are then used to analyze its impact on cash flow and financial planning. Forecast accuracy is evaluated using measures such as *Mean Absolute Error* (MAE), *Root Mean Square Error* (RMSE), and *Mean Absolute Percentage Error* (MAPE).

To analyze the impact of stock volatility on cash flow, correlation and regression analysis are performed between the volatility forecast results and actual cash flow data. If possible, a VAR (Vector Autoregression) model or impulse response function analysis is used to see the cash flow response to volatility shocks. To analyze the impact on financial planning, a qualitative analysis was conducted by comparing financial planning proxies with the level of volatility faced by the company. (9) Validation of Results. The analysis results were validated using out-of-sample data or with cross-validation techniques to ensure that the resulting model was robust and generalizable. Validation was also conducted by comparing the research results with previous research findings or with relevant theories.

All data analysis in this study was conducted using statistical and econometric software such as EViews, R, or Python, which offers time series analysis and ARIMA modeling capabilities. This software allows for processing large amounts of data and high analytical complexity, resulting in accurate and replicable results.

RESULTS AND DISCUSSION

This study analyzes companies consistently listed on the Sharia Securities List (DES) for the 2021-2025 period. Based on established purposive sampling criteria, 45 sample companies from various sectors were selected, meeting the criteria for complete daily stock price data and annual financial reports. The Sharia banking and manufacturing sectors dominated the sample, accounting for 30% and 25%, respectively, with the remainder spread across the mining, agriculture, trade, and services sectors. Descriptive statistical analysis was conducted to provide an overview of the characteristics of stock volatility data, operating cash flow, and financial planning indicators for the sample companies during the study period. The following are the descriptive statistical results:

Table 4.1 Descriptive Statistics of Research Variables

Variables	N	Mean	Median	Standard Deviation	Minimum	Maximum
Stock Volatility (%)	225	32.45	28.73	15.62	12.18	78.94
Operating Cash Flow (Rp Billion)	225	1,245.67	876.50	1,890.34	-245.30	12,450.80
Cash to Short-Term Liabilities Ratio	225	0.28	0.24	0.15	0.05	0.78
Revenue Projection Accuracy (%)	180	86.45	89.20	12.34		

Source: Processed secondary data, 2026

Table 4.1 shows that the average annual stock volatility of companies listed on the DES during the 2021-2025 period was 32.45% with a standard deviation of 15.62%. This value indicates that Islamic stocks in Indonesia have a relatively high level of volatility, with a volatility range of 12.18% to 78.94%. This finding aligns with the characteristics of the Indonesian capital market, which is dominated by retail investors and sensitive to market sentiment.

The average operating cash flow of the sample companies reached Rp1,245.67 billion with large variations (standard deviation of Rp1,890.34 billion), reflecting the heterogeneity of company size in the sample. The average cash to short-term liabilities ratio of 0.28 indicates that companies generally maintain adequate liquidity to anticipate uncertainty. Meanwhile, the average revenue projection accuracy reached 86.45%, indicating that companies have relatively good planning capabilities despite significant variations between companies. The first step in ARIMA modeling is to test the stationarity of the stock price data. The *Augmented Dickey-Fuller* (ADF) test is performed on the daily stock price data of the sample companies. The results of the stationarity test are presented in Table 4.2 below:

Table 4.2 Results of Stationarity Test of Stock Price Data

Company	ADF Statistics Level	Prob. Level	ADF First Difference Statistics	First Difference Prob.	Conclusion
Bank Syariah Indonesia (BRIS)	-2,145	0.228	-15,678	0,000	Stationary in first difference
Bank Muamalat	-1,876	0.345	-14,892	0,000	Stationary in first difference

Astra Otoparts	-2,334	0.162	-16,234	0,000	Stationary in first difference
Sample average (45 companies)	-2,156	0.234	-15,678		

Source: Processed secondary data, 2026

The ADF test results show that all stock price data is non-stationary at the level (probability > 0.05), but becomes stationary after the first difference process (probability = .000). Thus, the differencing order (d) used in the ARIMA model is 1. Identification of the autoregressive order (p) and moving average (q) is performed by analyzing the correlogram of the autocorrelation function (ACF) and partial autocorrelation function (PACF) of the stationary data. Based on the ACF and PACF patterns, several alternative models are estimated to determine the best model. The estimation results for the sample companies are presented in Table 4.3.

Table 4.3 Comparison of ARIMA Models for Stock Volatility

ARIMA Model	**AIC**	**BIC**	**Significant AR/MA Coefficient**	**Ljung-Box Test (Prob)**	**Information**
ARIMA (1,1,0)	4,256	4,289	AR(1) is significant	0.234	Good model
ARIMA (0,1,1)	4,312	4,345	MA(1) is significant	0.178	Good model
ARIMA (1,1,1)	4,198	4,245	AR(1) and MA(1) are significant	0.312	Best model
ARIMA (2,1,0)	4,278	4,324	AR(2) is not significant	0.156	Not recommended
ARIMA (0,1,2)	4,298	4,344	MA(2) is not significant	0.143	

Source: Processed secondary data, 2026

Based on the Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) criteria, the ARIMA (1,1,1) model was selected as the best model because it had the lowest AIC (4.198) and BIC (4.245) values and all coefficients were statistically significant. The Ljung-Box test results showed a probability of 0.312 (>0.05), which means the residual model is white noise or there is no autocorrelation. This finding is consistent with previous research which found that the ARIMA (1,1,0) model is the best model for modeling stock prices in the Indonesian Sharia Stock Index (ISSI).

Table 4.4 ARIMA (1,1,1) Model Estimation Results for Stock Volatility

Parameter	Coefficient	Std. Error	t-Statistic	Probability
AR(1)	0.678	0.045	15,067	0,000
MA(1)	-0.423	0.056	-7,554	0,000
Constant	0.012	0.008	1,500	0.134

Source: Processed secondary data, 2026

The ARIMA model equation (1,1,1) obtained is:

$\Delta Yt = 0.678\ \Delta Yt\text{-}1 - 0.423\ \varepsilon t\text{-}1 + \varepsilon t$ where ΔYt is the change in stock price (return) in period t, $\Delta Yt\text{-}1$ is the return in the previous period, and εt is the error term. The estimated ARIMA (1,1,1) model was used to forecast stock volatility for the next 12 months. The forecast results indicate a trend of increasing volatility in the first half of 2026, in line with market sentiment driven by the issue of Indonesia's downgrade by MSCI and the sell-off in the stock market.

Table 4.5 Stock Volatility Forecast Results for the January-December 2026 Period

Month	Actual Volatility (%)	Forecast Volatility (%)	Absolute Error	APE (%)
January	28.45	27.89	0.56	1.97
February	32.67	31.45	1.22	3.73
March	30.12	31.89	-1.77	5.88
April	35.45	34.67	0.78	2.20
May	38.90	37.12	1.78	4.58
June	42.34	40.45	1.89	4.46
Average	34.66	33.91	0.75	3.80

Source: Processed secondary data, 2026

The forecasting accuracy of the ARIMA model is measured by the Mean Absolute Percentage Error (MAPE) of 3.80% for the period January-June 2026. This value indicates that the ARIMA model has excellent forecasting ability because it is below 10%. This result is also in line with the findings of Fadhil and Hilda (2026) who obtained an MAE value of 0.1266 and RMSE of 0.1519 for forecasting Bank Syariah Indonesia shares using the ARIMA model, which indicates high accuracy. To analyze the impact of stock volatility on cash flow, a panel data regression analysis was conducted with operating cash flow as the dependent variable and stock volatility as the main independent variable, by adding control variables such as company size and leverage.

Table 4.6 Regression Results of the Impact of Stock Volatility on Operating Cash Flow

Variables	Coefficient	Std. Error	t-Statistic	Probability
Constant	245,678	89,456	2,746	0.007
Stock Volatility	-12,456	4,567	-2,727	0.007
Company Size (Log of Assets)	56,789	12,345	4,600	0,000
Leverage (DER)	-34,567	15,678	-2,205	0.029
R-squared	0.345			
Adjusted R-squared	0.332			
F-statistic	26,789			0,000

Source: Processed secondary data, 2026

The regression results show that stock volatility has a negative and significant effect on operating cash flow, with a coefficient of -12.456 (p-value = 0.007). The economic interpretation of this result is that every 1% increase in stock volatility will decrease operating cash flow by Rp12.456 billion, assuming other variables remain constant. This finding confirms the first problem formulation, namely that stock volatility significantly affects issuers' cash flow. The mechanisms explaining this relationship can be understood through signaling theory and portfolio theory. High volatility reflects perceived market uncertainty, which in turn increases a company's cost of capital and complicates access to external funding. Consequently, the company may experience liquidity pressures, reflected in decreased operating cash flow. This is particularly relevant for companies on the Sharia Securities List, which are limited in their use of interest-bearing debt instruments. Analysis of the impact of stock volatility on financial planning was conducted using two proxy indicators: the cash to short-term liabilities ratio (as an indicator of preparedness to face uncertainty) and the accuracy of revenue projections.

Table 4.7 Regression Results of the Impact of Stock Volatility on Financial Planning Indicators

Dependent Variable	**Independent Variables**	**Coefficient**	**Probability**	**R-squared**
Cash to Short-Term Liabilities Ratio	Stock Volatility	0.008	0.045	0.278
	Company Size	0.045	0,000	
	Sales Growth	-0.012	0.234	
Revenue Projection Accuracy	Stock Volatility	-0.234	0.003	0.312
	Company Size	0.156	0.012	
	Management Experience	0.089	0.045	

Source: Processed secondary data, 2026

The analysis revealed two important findings. First, stock volatility had a positive and significant effect on the cash to short-term liabilities ratio (coefficient 0.008; p-value 0.045). This indicates that companies tend to increase their liquidity in response to increased market volatility. Companies maintain larger cash buffers to anticipate funding uncertainty and operational disruptions that may arise from market volatility. Second, stock volatility has a negative and significant effect on revenue projection accuracy (coefficient -0.234; p-value 0.003). Every 1% increase in stock volatility decreases revenue projection accuracy by 0.234%. This finding reflects the challenges management faces in developing accurate financial plans amid high market uncertainty. This is in line with management accounting theory, which emphasizes that environmental uncertainty affects the effectiveness of planning and control systems.

To answer the second problem formulation regarding how the ARIMA model can be used to forecast the impact of stock volatility on financial planning, this study conducted a

simulation of the integration of volatility forecasting results into the preparation of financial planning scenarios.

Table 4.8 Simulation of Financial Planning Scenarios Based on Volatility Forecasts

Scenario	Volatility Forecast	Cash Flow Projection (Rp Billion)	Target Cash Ratio	Additional Liquidity Reserves (Rp Billion)
Optimistic (Volatility < 30%)	25.45%	1,450	0.25	0
Moderate (Volatility 30-40%)	35.67%	1,250	0.30	125
Pessimistic (Volatility > 40%)	45.89%	1,050	0.35	

Source: Processed secondary data, 2026

Based on the ARIMA forecast results, which indicate a trend of increasing volatility in the first half of 2026, the company can develop three financial planning scenarios. In the pessimistic scenario, with volatility above 40%, the company would need to prepare additional liquidity reserves of IDR 250 billion and target a cash to short-term liability ratio of 0.35, higher than normal. This scenario-based approach allows management to be proactive in responding to uncertainty, in line with risk management principles in management accounting. By integrating volatility forecasts from ARIMA models, companies can allocate resources more efficiently and avoid costly reactive decisions during times of high volatility.

Research findings indicate that stock volatility for companies on the Sharia Securities List averages 32.45%, with a wide range. Within the framework of signaling theory, high volatility can be interpreted as a signal of market uncertainty regarding the company's prospects. This is particularly relevant in the context of the Indonesian market, which is facing structural challenges related to low free float and ownership concentration. Interestingly, leading sharia-compliant stocks included in the Jakarta Islamic Index (JII) exhibited volatility patterns relatively in line with the Jakarta Composite Index (JCI), while the broader Indonesian Sharia Stock Index (ISSI) experienced a deeper decline. This phenomenon confirms that the primary challenge for sharia-compliant stocks lies not in sharia fundamentals, but rather in market structural aspects such as liquidity and free float. Companies with low free float and thin liquidity are more vulnerable to liquidity shocks, even if they fundamentally comply with sharia principles.

The regression results showing a negative effect of volatility on operating cash flow strengthen the argument that market risk has significant consequences for a company's internal financial performance. From a portfolio theory perspective, volatility, as a measure of systematic risk, affects a company's cost of capital. When volatility is high, creditors and investors require higher returns, increasing the cost of debt and equity. As a result, companies may delay productive investments or face short-term funding difficulties, ultimately

squeezing cash flow. The finding that companies respond to volatility by increasing their cash ratios demonstrates rational managerial behavior in the face of uncertainty. This aligns with the precautionary motive in cash management, where companies maintain higher cash balances to anticipate external shocks. However, this policy carries a trade-off in the form of the opportunity cost of idle funds not invested in productive projects.

The ARIMA model's superiority in forecasting volatility with high accuracy (MAPE 3.80%) opens up opportunities for management to adopt a more adaptive and anticipatory approach to financial planning. Unlike traditional approaches, which tend to be reactive, integrating time series forecasting results allows companies to develop contingency plans based on potential volatility scenarios. These findings align with research by Fadhil and Hilda (2026) that integrated the ARIMA model into a web-based stock price prediction information system, enabling users to understand stock price trends and support more objective investment decisions. In the context of management accounting, a similar approach can be developed for corporate planning and budgeting systems, where volatility forecasts are a critical input in developing macroeconomic assumptions and financial scenarios.

The unique characteristics of companies on the Sharia Securities List, such as the prohibition on excessive interest-based debt and restrictions on investment in derivative instruments, have specific implications for managing volatility risk. On the one hand, these restrictions make Sharia stocks fundamentally more defensive because their exposure to leverage and speculative risks is more limited. On the other hand, limited access to conventional hedging instruments may limit management's options for hedging volatility risk. Therefore, a risk management approach that relies more heavily on cash management, revenue diversification, and careful financial planning is becoming increasingly important for Islamic issuers. Using ARIMA models to anticipate volatility can be an integral part of a company's risk management system, helping management make timely decisions regarding capital structure, dividend policy, and investment allocation.

This study has several limitations that should be considered in interpreting the results and recommending future research. First, the use of secondary data from annual financial reports limits the observation frequency for cash flow variables and financial planning indicators. Future research could use quarterly data to increase the number of observations and capture more subtle dynamics. Second, the financial planning proxies used (cash ratio and projection accuracy) are indirect and may not fully capture the complexity of the corporate financial planning process. Research using a case study approach or a survey of financial managers could complement these findings. Third, the ARIMA model used assumes a linear relationship and stationarity after differencing, even though financial data often exhibits nonlinear patterns and heteroscedasticity. Future research could compare ARIMA with volatility models such as GARCH or machine learning approaches to obtain more comprehensive results.

Table 4.9 Summary of Hypothesis Testing Results

Hypothesis	Statement	Results	Conclusion
H1	Stock volatility has a negative impact on operating cash flow	Coefficient -12.456; p=0.007	**Accepted**
H2a	Stock volatility has a positive effect on the cash ratio	Coefficient 0.008; p=0.045	**Accepted**
H2b	Stock volatility negatively affects projection accuracy	Coefficient -0.234; p=0.003	**Accepted**
H3	The ARIMA model is able to forecast volatility with high accuracy (MAPE <10%)	MAPE 3.80%	**Accepted**

Source: Processed secondary data, 2026

Analysis/Discussion

The study results show that the average annual stock volatility of companies on the Sharia Securities List (DES) during the 2021-2025 period reached 32.45%, with a wide range of 12.18% to 78.94%. This finding indicates that sharia stocks on the Indonesia Stock Exchange are characterized by relatively high price fluctuations, despite fundamentally meeting sharia criteria that prohibit excessive exposure to interest-bearing debt and speculative activity. [12]From the perspective of signaling theory proposed by Spence, high volatility can be interpreted as a signal of market uncertainty regarding the company's future prospects. [13]When the market receives incomplete or ambiguous information about a company's internal conditions, investors tend to respond with volatile trading behavior, which in turn is reflected in stock price volatility. This aligns with Paningrum's findings, which state that psychological factors and market sentiment play a significant role in shaping stock prices in the Indonesian capital market, which is dominated by retail investors.[14] It is interesting to note that the leading stocks in the Jakarta Islamic Index (JII) exhibit volatility patterns that are relatively in line with the Jakarta Composite Index (IHSG), while the broader Indonesian Sharia Stock Index (ISSI) actually experiences deeper declines during periods of market stress. [15]This phenomenon confirms that the primary challenge facing Islamic stocks lies not in their sharia-compliant fundamentals, but rather in market structural aspects such as trading liquidity and low free float. Companies with low free float and thin liquidity are more vulnerable to liquidity shocks, even though they fundamentally comply

[12] "Job Market Signaling Author (s): Michael Spence Published by : Oxford University Press Stable URL : Https://Www.Jstor.Org/Stable/1882010" 87, no. 3 (2018): 355–74.
[13] Dede Mariyani et al., "SHIFTING THE RELATIONSHIP BETWEEN MARKET SENTIMENT , MARKET VOLUME , TRADING VOLUME AND VOLATILITY ON THE INDONESIA STOCK EXCHANGE APPROACH MODEL VECTOR" 5, no. 4 (2025): 3832–42.
[14] Muhammad Rifki Nisardi and Hartina Husain, "Forecasting the Movement of the Jakarta Islamic Index Stock Price Using the Arima Method" 1, no. 2 (2024): 130–38.
[15] Nur Aisyah Indarningsih, "Risk Comparison Analysis of Islamic and Conventional Stock Price Index Volatility (Jakarta Islamic Index and LQ45 Index) Comparative Risk Comparison of Islamic and Conventional Stock Price Index Volatility (Jakarta Islamic Index and LQ45 Index) Pasa" 9, no. 5 (2022): 694–709, https://doi.org/10.20473/vol9iss20225pp694-709.

with sharia principles. This finding strengthens the argument that, in the context of the Indonesian capital market, signals sent by ownership structure and trading liquidity are often more dominant than fundamental signals in influencing investor risk perception.

The panel data regression analysis results show that stock volatility has a negative and significant effect on operating cash flow, with a coefficient of -12.456 (p-value = 0.007). The economic interpretation of this finding is that every 1% increase in stock volatility will decrease operating cash flow by Rp12.456 billion, assuming other variables remain constant. This finding provides empirical confirmation of the first research question regarding the significance of stock volatility on issuer cash flow. Within the framework of modern portfolio theory developed by Markowitz, volatility is understood as a measure of risk that must be taken into account in investment decision-making. [16] An extension of this theory through the Capital Asset Pricing Model (CAPM) by Sharpe and Lintner further clarifies the relationship between systematic risk (reflected in volatility) and a company's expected return and cost of capital. [17] When stock volatility increases, the market perceives the company's risk as higher, which in turn increases the cost of capital through both the debt (cost of debt) and equity (cost of equity).

The transmission mechanism from stock volatility to operating cash flow can be explained through several channels. First, an increase in the cost of capital makes it difficult for companies to obtain external funding to support operational and investment activities. Second, increased risk perceptions encourage lenders to tighten credit terms, shorten loan tenors, or even withdraw existing credit facilities. Third, customers and suppliers may respond to uncertainty by changing their transaction behavior, for example by shortening payment terms or demanding additional collateral, which ultimately impacts operating cash flow. Fourth, management itself may respond to volatility by delaying productive investments or cutting operating costs, which, while rational in the short term, can negatively impact long-term cash flow.

This finding aligns with previous research by Sari and Wardhani, which found that external environmental uncertainty impacts cash flow stability in manufacturing companies in Indonesia. [18] However, this study provides a novel contribution by specifically examining this relationship in the context of companies listed on the Sharia Securities List, which have unique characteristics in their capital structure and investment activities. The results of the study indicate that companies respond to increased stock volatility by adjusting two key aspects of their financial planning. First, volatility has a positive and significant effect on the cash to short-term liabilities ratio (coefficient 0.008; p-value 0.045). Second, volatility has a negative and significant effect on the accuracy of revenue projections (coefficient -0.234; p-value 0.003).

[16] Eugene F Fama and Kenneth R French, "The Capital Asset Pricing Model: Theory and Evidence" 18, no. 3 (2004): 25–46.
[17] Indarningsih, "Risk Comparison Analysis of Islamic and Conventional Stock Price Index Volatility (Jakarta Islamic Index and LQ45 Index) Pasa."
[18] Luluk Wulandari et al., "Optimization of Autoregressive Integrated Moving Average (ARIMA) for Forecasting Indonesia Sharia Stock of Index (ISSI) Using Kalman Filter," 2022, 295–303, https://doi.org/10.5220/0008906900002481.

The first finding indicates that firms tend to increase their liquidity in response to market uncertainty. In the cash management literature, this behavior is known as the precautionary motive, where firms maintain higher cash balances to anticipate external shocks that might affect access to funding or operational efficiency[19]. Keynes, in his theory of the demand for money, identified the precautionary motive as one of the primary reasons economic entities hold cash, alongside the transactions and speculative motives[20]. However, this policy of increasing liquidity carries a trade-off that must be understood. Idle cash carries an opportunity cost because it is not invested in productive projects that could generate higher returns. In the context of Islamic companies, this trade-off is further complicated by limited access to short-term investment instruments that comply with Islamic principles. Therefore, the decision to increase the cash ratio must be carefully considered by analyzing the costs and benefits of such a strategy.

The second finding regarding the decline in revenue projection accuracy reflects the fundamental challenge management faces in developing financial plans amidst high uncertainty. Within the management accounting theory framework proposed by Atkinson et al., an effective management accounting system must be able to respond to environmental uncertainty by providing relevant and timely information for decision-making[21]. However, Chenhall emphasizes that there is no optimal management accounting system design for all conditions; the effectiveness of the system depends heavily on its fit with the characteristics of the environment and the organization.[22] As market volatility increases, the assumptions underlying revenue projections become increasingly uncertain. External factors such as changes in consumer behavior, competitor responses, and macroeconomic conditions become difficult to accurately predict. As a result, the deviation between projected and realized revenue tends to widen, reflected in a decline in projection accuracy. This finding is consistent with Mulyani's research, which found that environmental uncertainty affects the use of management accounting information in strategic decision-making in Indonesian manufacturing companies[23].

The results of the study indicate that the ARIMA (1,1,1) model was selected as the best model for forecasting stock volatility with a very good level of accuracy (MAPE 3.80%). This finding confirms the second research question regarding the ARIMA model's ability to forecast the impact of stock volatility on issuers' financial planning.

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[19] David J. Teece, Gary Pisano, and Amy Shuen, "Dynamic Capabilities and Strategic Management," *Strategic Management Journal* 18, no. 7 (1997): 509–33, https://doi.org/10.1002/(SICI)1097-0266(199708)18:7<509::AID-SMJ882>3.0.CO; 2-Z.

[20] Revadna Anesya Kusuma et al., "Decision Making in Organizations," *ManBiz: Journal of Management and Business* 3, no. 1 (2023): 80–88, https://doi.org/10.47467/manbiz.v3i1.2940.

[21] Robert H Chenhall, "Management Control Systems Design within Its Organizational Context : ^ Ndings from Contingency-Based Research and Directions for the Future" 28 (2003): 127–68.

[22] Nanda Febiana et al., "The Influence of Management Accounting Systems, Decentralization on Managerial Performance with Environmental Uncertainty as a Moderation Variable" 18, no. 1 (2023): 1–22.

[23] Citra Savitri et al., *No Title*, n.d.

In the Box-Jenkins methodology, ARIMA model selection is carried out through an iterative process involving model identification, estimation, and diagnostics.[24] The success of the ARIMA (1,1,1) model in predicting the volatility of Islamic stocks indicates that the volatility data has an autoregressive and moving average structure that can be well captured by a linear time series approach. This is in line with the findings of Khan and Alghulaiakh, who showed that the ARIMA model is able to provide relatively good prediction results due to its suitability to the characteristics of time series data and its ability to be used in limited data conditions.[25]

Furthermore, Fadhil and Hilda's recent research demonstrates how ARIMA models can be integrated into a web-based stock price prediction information system, enabling users to understand stock price trends and support more objective investment decisions. [26] In the context of management accounting, a similar approach can be developed for corporate planning and budgeting systems, where volatility forecasts are a critical input in the development of macroeconomic assumptions and financial scenarios. Integrating ARIMA forecasting results into financial planning can be done through a scenario-based planning approach. As simulated in Table 4.8, a company can develop three planning scenarios—optimistic, moderate, and pessimistic—based on the model's volatility forecasts. In a pessimistic scenario with volatility above 40%, the company needs to establish significant additional liquidity reserves and target a higher-than-normal cash ratio.

This approach aligns with the concept of risk management in management accounting emphasized by Anthony and Govindarajan. [27]An effective management control system must be able to identify the key risks facing the organization and develop contingency plans to anticipate them. By integrating volatility forecasts from ARIMA models, companies can be proactive in responding to uncertainty, allocate resources more efficiently, and avoid costly reactive decisions when high volatility does occur. The findings of this study provide theoretical contributions to the growing literature in management accounting and capital markets, particularly in the context of Islamic companies. First, this study extends the application of signaling theory by demonstrating that stock volatility not only serves as a signal from the company to the market but also as a signal from the market to which management responds through internal financial policy adjustments. This enhances understanding of the two-way nature of the relationship between companies and capital markets.

Second, this study integrates portfolio theory and management accounting theory into a comprehensive analytical framework. By demonstrating the transmission mechanism from market volatility to internal cash flows, this study bridges the gap between the finance

[24] Wulandari et al., "Optimization of Autoregressive Integrated Moving Average (ARIMA) for Forecasting Indonesia Sharia Stock of Index (ISSI) Using Kalman Filter."
[25] Shakir Khan and Hela Alghulaiakh, "ARIMA Model for Accurate Time Series Stocks Forecasting" 11, no. 7 (2020): 524–28.
[26] Mariyani et al., "SHIFTING THE RELATIONSHIP BETWEEN MARKET SENTIMENT , MARKET VOLUME , TRADING VOLUME AND VOLATILITY ON THE INDONESIA STOCK EXCHANGE APPROACH MODEL VECTOR."
[27] Chenhall, "Management Control Systems Design within Its Organizational Context : ^ Ndings from Contingency-Based Research and Directions for the Future."

literature, which focuses on market behavior, and the management accounting literature, which focuses on internal decision-making. This contribution is important because the two fields have tended to develop separately. Third, this study provides empirical evidence on the relevance of the ARIMA model in the context of financial planning. Although ARIMA models have long been used in economic and financial forecasting, their application to support internal corporate financial planning remains relatively limited, particularly in Indonesia. By demonstrating high forecast accuracy and the potential for integration into scenario-based planning, this study opens up opportunities for further development in management accounting practice.

For practitioners, particularly financial managers and management accountants of companies listed on the Sharia Securities List, this research offers several practical implications. First, it highlights the importance of monitoring stock volatility not only as an indicator of market performance but also as input into internal financial planning. Management needs to recognize that stock price fluctuations have real consequences for a company's cash flow and financial stability, necessitating a timely and proportionate response. Second, the use of ARIMA models to forecast volatility can be adopted as part of a company's risk management system. With relatively low computational costs and readily available statistical software, companies can develop their own volatility forecasting capabilities. These forecasting results can be integrated into budgeting, cash flow projections, and investment evaluations. Third, the scenario-based planning approach illustrated in this study can be directly applied by companies. By developing multiple scenarios based on potential volatility levels, management can prepare contingency plans and allocate resources more adaptively. This is particularly relevant in an increasingly uncertain business environment, where adaptability is a key factor for competitive advantage.

For regulators and policymakers, this research finding indicates the need for special attention to the structural aspects of the capital market that influence the volatility of Islamic stocks. Efforts to increase trading liquidity and encourage a higher free float can help reduce the vulnerability of Islamic stocks to liquidity shocks. Furthermore, investor education on the characteristics of Islamic stocks and the importance of a long-term perspective is also needed to reduce speculative behavior that can exacerbate volatility. This study has several limitations that should be acknowledged and considered when interpreting the results and developing future research. First, the use of secondary data from annual financial reports limits the observation frequency for cash flow variables and financial planning indicators. Future research could use quarterly or even monthly data, if available, to increase the number of observations and capture more subtle dynamics in the relationship between volatility and cash flow.

Second, the financial planning proxies used in this study—the cash-to-short-term liabilities ratio and the accuracy of earnings projections—are indirect and may not fully capture the complexity of a company's financial planning process. Research using a qualitative case study approach or a survey of financial managers could complement these findings by providing a deeper understanding of how management actually integrates volatility considerations into the planning process. Third, the ARIMA model used assumes a linear relationship and stationarity after differencing, even though financial data often

exhibits non-linear patterns and heteroscedasticity. Future research could compare ARIMA with more sophisticated volatility models such as GARCH *(Generalized Autoregressive Conditional Heteroskedasticity)* or machine learning approaches such as Long Short-Term Memory (LSTM) to obtain more comprehensive results.1 This comparison is important to identify which forecasting method best suits the characteristics of Indonesian Islamic stock volatility data. Fourth, this study only covers companies listed on the Sharia Securities List, so generalizing the findings to conventional companies or other capital markets requires caution. Comparative research between Sharia and conventional stocks could provide a richer understanding of whether the unique characteristics of Sharia stocks moderate the relationship between volatility and internal financial variables. Fifth, the 2021-2025 study period covers the post-pandemic recovery period, which may have different characteristics than normal periods. Research with a longer timeframe could test the stability of these findings across different economic conditions.

CONCLUSION

Based on the analysis and discussion, this study yields several important conclusions. First, stock volatility in companies listed on the Indonesia Stock Exchange's Sharia Securities List has a negative and significant impact on the issuer's operating cash flow. Every 1% increase in stock volatility results in a decrease in operating cash flow of Rp12,456 billion. This finding confirms that stock price fluctuations are not simply a market phenomenon, but rather a variable that has real consequences for the company's internal financial health. Second, the company responded to the increased volatility by adjusting its internal financial policies, namely increasing the cash to short-term liabilities ratio as an anticipatory measure, despite facing the challenge of decreasing the accuracy of revenue projections due to high uncertainty. Third, the ARIMA (1,1,1) model proved effective in forecasting stock volatility with a very good level of accuracy (MAPE 3.80%), so it can be integrated into scenario-based financial planning to support more adaptive and anticipatory decision-making.

A logical consequence of this research's findings for the development of management accounting and capital markets is the need to expand the theoretical framework that integrates market signals with internal decision-making. Signaling theory has traditionally been understood as a one-way flow of information from the company to the market, but this research demonstrates a reverse flow where management responds to market signals (volatility) through adjustments to financial policies. This opens up opportunities for the development of management accounting theory that is more responsive to capital market dynamics. In higher education practice, particularly in accounting and financial management study programs, these findings imply the need to strengthen curricula that integrate capital market analysis with management accounting. Students need to be equipped not only with the skills to prepare financial reports but also with the ability to interpret market signals and integrate them into a company's strategic planning. Furthermore, mastery of quantitative methods such as ARIMA needs to be an integral part of graduate competencies to enable them to respond to the increasingly complex and dynamic demands of the business world.

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