

EXCHANGE RATE VOLATILITY, FOREIGN DEBT, AND CASH FLOW ON HEDGING INTENSITY IN IDX INDUSTRIAL FIRMS

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Abstract

This study aims to examine the effect of Exchange Rate Volatility, Foreign Currency Debt, and Operating Cash Flow on FX Hedging Intensity. The population of this study consists of all industrial sector companies listed on the Indonesia Stock Exchange (IDX) during the period 2021–2025. The sample was selected using a purposive sampling technique, resulting in a total of 32 companies over 5 years (160 observations). This study employs a quantitative approach using multiple linear regression analysis, processed with SPSS version 25. The results show that Exchange Rate Volatility has no significant effect on FX Hedging Intensity. Foreign Currency Debt has a positive and significant effect on FX Hedging Intensity. Operating Cash Flow has a negative and significant effect on FX Hedging Intensity. Simultaneously, the three variables have a significant effect on FX Hedging Intensity.

Keywords: Exchange Rate Volatility, Foreign Currency Debt, Operating Cash Flow, FX Hedging Intensity.

A. INTRODUCTION

Economic globalization has driven increasingly intensive international trade, investment, and financing activities, ultimately heightening firms' exposure to foreign exchange risk. To manage this risk, companies adopt hedging strategies actions designed to protect financial positions from the impact of exchange rate fluctuations by taking offsetting positions in derivative instruments such as forward contracts, cross-currency swaps, currency options, and Domestic Non-Deliverable Forwards (Pratama & Imronudin, 2024; Bank Indonesia, 2018). The most fundamental theoretical basis for hedging was put forward by Smith and Stulz (1985) in Hedging

Theory, which states that in a world of market imperfections, hedging can increase firm value by reducing financial distress costs, lowering tax burdens through the convexity of the tax function, and mitigating underinvestment problems. Froot et al. (1993) affirm that hedging ensures sufficient internal cash flow to fund positive-value investments, thereby helping firms avoid dependence on costly external financing.

The 2021–2025 period was marked by heightened global economic uncertainty: the Russia–Ukraine conflict, which pushed U.S. inflation up to 9.1% in June 2022; aggressive increases in the Federal Funds Rate from 0.25% to 5.50%; and the depreciation of the Rupiah from an average of Rp14,308 per USD (2021) to as low as Rp16,350 per USD (2024), its weakest level since the 1998 crisis (Bank Indonesia, 2024, 2025). U.S. trade tariff policy in 2025 further strained global supply chains and increased the foreign-currency debt burden of Indonesian corporations, which rose from USD 197.3 billion (2021) to USD 221.7 billion (Q1 2025) (Bank Indonesia, 2025). Among all IDX sectors, the industrial sector consistently recorded the highest accumulation of foreign-currency liabilities, growing from USD 37.2 billion (2021) to USD 57.8 billion (Q1 2025), confirming that dependence on USD-denominated imported raw materials makes this sector both the most vulnerable and the most relevant object for studying FX hedging intensity (Indonesia Stock Exchange, 2025).

Exchange rate volatility, measured by the standard deviation of daily USD/IDR returns, is predicted within the frameworks of Hedging Theory (Smith & Stulz, 1985) and Foreign Exchange Exposure Theory (Adler & Dumas, 1984) to heighten transaction and translation exposure, thereby encouraging greater hedging intensity, although a number of studies have found inconsistent results (Chila & Desmiza, 2024; Yudha et al., 2023). Foreign currency debt, measured as the ratio of foreign-denominated liabilities to total liabilities, creates balance sheet exposure that theoretically drives firms to use FX derivative instruments more intensively (Fajri et al., 2023; Pratama & Imronudin, 2024). Operating cash flow, measured as the ratio of net operating cash flow to total assets, is predicted within Cash Flow Theory (Almeida et al., 2003) to strengthen

internal financing capacity for funding derivative instrument premiums, thereby encouraging higher hedging intensity.

1. Hedging Theory

The primary theoretical foundation of this study is Hedging Theory, developed by Smith and Stulz (1985). In a world of market imperfections such as taxation, bankruptcy costs, and information asymmetry, hedging is not merely an operational activity but a strategic decision that directly affects firm value. Smith and Stulz (1985) identify three main rationales for corporate hedging: it lowers the expected costs of financial distress by reducing the probability of default; it reduces the firm's tax burden, since a convex tax schedule means that firms with more stable earnings pay less tax on average than firms with volatile earnings; and it mitigates underinvestment problems arising from conflicts of interest between shareholders and creditors. In this study, Hedging Theory explains why firms with higher exchange rate volatility and greater foreign-currency debt exposure face a stronger incentive to hedge, while firms with strong operating cash flow possess greater internal financial capacity to fund the premiums of FX derivative instruments (Almeida et al., 2003; Halimah & Tiara, 2023).

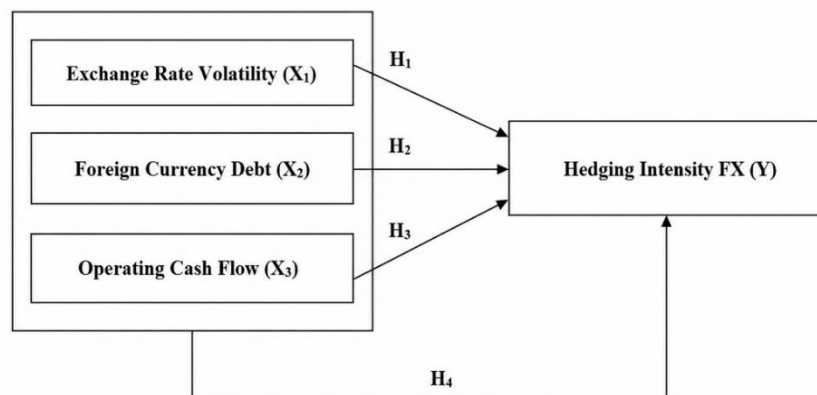
2. Foreign Exchange Exposure Theory

The second theoretical basis is Foreign Exchange Exposure Theory, introduced by Adler and Dumas (1984), which defines currency exposure as the sensitivity of firm value, measured through assets, liabilities, or cash flows, to unanticipated exchange rate movements. Adler and Dumas (1984) classify this exposure into three types: transaction exposure, arising from foreign-currency-denominated contracts such as foreign debt and import obligations; translation exposure, arising when the financial statements of foreign subsidiaries are consolidated into the parent company's functional currency; and economic exposure, reflecting long-term changes in a firm's competitive position due to permanent shifts in exchange rates. Together with Hedging Theory, this framework underlies the hypothesized effects of exchange rate volatility, foreign currency debt, and operating cash flow on FX hedging intensity in this study, with a firm's internal financing

capacity, as reflected in its operating cash flow, further shaping its ability to fund the FX derivative instruments used to manage such exposure (Almeida et al., 2003).

3. Conceptual Framework

The conceptual framework of this study builds on Hedging Theory and Foreign Exchange Exposure Theory, together with three relevant empirical studies. Chila and Desmiza (2024) examined the effect of cash flow volatility, foreign debt, and exchange rate on hedging decisions among IDX energy sector firms. Yudha et al. (2023) investigated the role of foreign debt and exchange rate on the hedging decisions of Indonesian state-owned enterprises. Fajri et al. (2023) mapped the determinants of both hedging decisions and hedging intensity among national manufacturing issuers. Based on these foundations, Exchange Rate Volatility (X₁), Foreign Currency Debt (X₂), and Operating Cash Flow (X₃) are positioned as the independent variables, while FX Hedging Intensity (Y) is positioned as the dependent variable, as illustrated in Picture 1.



Picture 1. Conceptual Framework

Source: Modified from Yudha et al. (2023), Chila & Desmiza (2024), and Fajri et al. (2023).

Most prior studies stop at treating the hedging decision as a binary variable (Yudha et al., 2023; Chila & Desmiza, 2024), whereas this study advances to the dimension of hedging intensity as a continuous measure, thereby capturing variation in the degree of protection that a binary

approach cannot reveal (Fajri et al., 2023). Based on the discussion above, the hypotheses of this study are formulated as follows:

H1: Exchange rate volatility affects FX hedging intensity in industrial sector companies listed on the IDX in 2021–2025.

H2: Foreign currency debt affects FX hedging intensity in industrial sector companies listed on the IDX in 2021–2025.

H3: Operating cash flow affects FX hedging intensity in industrial sector companies listed on the IDX in 2021–2025.

H4: Exchange rate volatility, foreign currency debt, and operating cash flow simultaneously affect FX hedging intensity in industrial sector companies listed on the IDX in 2021–2025.

B. METHOD

This study uses a quantitative approach with a causal research design to analyze the effect of Exchange Rate Volatility (X1), Foreign Currency Debt (X2), and Operating Cash Flow (X3) on FX Hedging Intensity (Y) among industrial sector issuers listed on the Indonesia Stock Exchange (IDX) during 2021–2025 (Sugiyono, 2023). The study population consists of 65 industrial sector companies based on the Jakarta Stock Industrial Classification (JASIC). The sample was determined using non-probability, purposive sampling based on the following criteria: (1) consistently listed on the IDX throughout 2021–2025; (2) continuously published audited financial statements and annual reports; (3) disclosed at least one foreign-currency derivative instrument in the Notes to the Financial Statements; (4) did not experience delisting or a change in sector classification; and (5) presented financial statements denominated in Rupiah. The selection process yielded 32 companies as the final sample, with a total of 160 observation units (32 companies × 5 years), consisting of secondary panel data sourced from annual financial statements, annual reports, and notes to financial statements published on www.idx.co.id, supplemented with daily USD/IDR exchange rate data from www.bi.go.id. The operational definitions of the research variables are presented in Table 1 below.

Table 1. Operational Definitions of Variables

Variable	Operational Definition	Measurement	Scale
Exchange Rate Volatility (X1)	A measure of the instability of USD/IDR exchange rate movements within one fiscal year (Chila & Desmiza, 2024)	Step 1: Calculating Exchange Rate Returns $R_t = \frac{Kurs_t - Kurs_{t-1}}{Kurs_{t-1}}$ Step 2: Calculating Volatility $\sigma = \sqrt{\frac{\sum (R_t - \bar{R})^2}{n-1}}$	Ratio
Foreign Currency Debt (X2)	The proportion of a company's financial obligations denominated in foreign currency (Pratama & Imronudin, 2024)	$\frac{foreign\ debt}{Total\ Foreign\ Currency\ Liabilities}$ $\frac{Total\ Liabilities}{Total\ Liabilities}$	Ratio
Operating Cash Flow (X3)	A company's internal financing capacity from operating activities (Fajri et al., 2023)	$\frac{Operating\ Cash\ Flow = Net\ Cash\ Flow\ from\ Operating}{Total\ Assets}$	Ratio
FX Hedging Intensity (Y)	The degree of use of foreign-currency derivative instruments as a proxy for exchange-rate exposure protection (Fajri et al., 2023)	$\frac{Intensitas\ Hedging = Notional\ Value\ of\ FX\ Derivatives}{Total\ Assets}$	Ratio

Source: Various references, processed by the researchers (2026)

C. RESULTS AND DISCUSSIONS

The research object consisted of 32 industrial sector issuers listed on the IDX during 2021–2025, yielding 160 panel data observation units. Descriptive statistical analysis was used to describe the characteristics of the data distribution across all research variables, based on the mean, standard deviation, maximum, and minimum values (Ghozali, 2023). The results of the descriptive statistical test are presented in Table 2.

Table 2. Descriptive Statistics Results

	Descriptive Statistics				
	N	Minimum	Maximum	Mean	Std. Deviation
Exchange Rate Volatility	160	.0028	.0038	.0033	.0004
Foreign Currency Debt	160	.0000	.9004	.0928	.1801
Operating Cash Flow	160	-.3092	.4111	.0714	.1066
FX Hedging Intensity	160	.0000	.1083	.0036	.0133
Valid N (listwise)	160				

Source: IBM SPSS Statistics 25 output, processed data (2026).

Based on Table 2, Exchange Rate Volatility shows an average of 0.0033 within a very narrow range (0.0028–0.0038), since its value is identical across all companies within the same year and varies only between years. Foreign Currency Debt shows high variation among companies, averaging 9.28% with a range of 0%–90.04%. Operating Cash Flow averages 7.14%, with a negative minimum value (-30.92%) indicating that some companies experienced a deficit in operating cash flow in certain years. FX Hedging Intensity averages only 0.36% with a relatively larger standard deviation (1.33%), indicating that most companies do not engage in hedging, while a small proportion hedge at a high intensity (maximum 10.83%).

Prior to hypothesis testing, the classical assumption tests confirmed that the regression model was free from normality, multicollinearity, heteroscedasticity, and autocorrelation problems, using 120 observations following the removal of 40 outlier data points from the initial 160. With all classical assumptions satisfied, the multiple linear regression model is suitable for hypothesis testing, as presented in Table 3.

Table 3. Hypothesis Test Results (t-Test)

Coefficients ^a					
Model	Unstandardized Coefficients			t	Sig.
	B	Std. Error	Beta		
1 (Constant)	.001	.001		1.036	.303
Exchange Rate Volatility	-.161	.167	-.046	-.967	.336
Foreign Currency Debt	.025	.001	.863	18.361	.000
Operating Cash Flow	-.002	.001	-.148	-3.166	.002

a. Dependent Variable: *FX Hedging Intensity*

Source: IBM SPSS Statistics 25 output, processed data (2026).

The resulting regression equation is: $FX \text{ Hedging Intensity} = 0.001 - 0.161 \text{ Exchange Rate Volatility} + 0.025 \text{ Foreign Currency Debt} - 0.002 \text{ Operating Cash Flow} + e$. The constant of 0.001 indicates the estimated FX Hedging Intensity when all independent variables equal zero. The negative coefficient of Exchange Rate Volatility (-0.161) is not statistically significant, whereas

Foreign Currency Debt has the largest standardized coefficient (Beta = 0.863), confirming it as the most dominant predictor of FX Hedging Intensity in the model.

Table 4. F-Test (ANOVA) Results

		ANOVA ^a				
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.000	3	.000	114.643	.000 ^b
	Residual	.000	116	.000		
	Total	.000	119			

a. Dependent Variable: *FX Hedging Intensity*

b. Predictors: (Constant), Operating Cash Flow, Foreign Currency Debt, Exchange Rate Volatility

Source: IBM SPSS Statistics 25 output, processed data (2026).

The F-test results show a calculated F-value of 114.643 with a significance of 0.000 (< 0.05). Because the calculated F-value (114.643) exceeds the F-table value (2.68) and the significance value is below α (0.05), H0 is rejected. This indicates that Exchange Rate Volatility, Foreign Currency Debt, and Operating Cash Flow simultaneously have a significant effect on FX Hedging Intensity, so H4 is accepted.

Table 5. Coefficient of Determination (R²) Results

Model Summary ^b				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.865 ^a	.748	.741	.0007777364

a. Predictors: (Constant), Operating Cash Flow, Foreign Currency Debt, Exchange Rate Volatility

b. Dependent Variable: *FX Hedging Intensity*

Source: IBM SPSS Statistics 25 output, processed data (2026).

Table 5 shows an R value of 0.865, an R Square of 0.748, and an Adjusted R Square of 0.741. The Adjusted R Square value indicates that 74.1% of the variation in FX Hedging Intensity can be explained jointly by Exchange Rate Volatility, Foreign Currency Debt, and Operating Cash Flow, while the remaining 25.9% is explained by other factors outside the model. This explanatory power is relatively high compared with prior hedging studies, which generally range between

18.5%–58.7% (Normalisa et al., 2021; Meridelima & Isbanah, 2021), a condition driven largely by the dominant contribution of Foreign Currency Debt.

1. Effect of Exchange Rate Volatility on FX Hedging Intensity

The t-test results show a t-value of -0.967 ($< t\text{-table } 1.981$) with a significance of 0.336 (> 0.05), so H1 is rejected: Exchange Rate Volatility has no significant effect on FX Hedging Intensity. This finding does not align with the predictions of Hedging Theory (Smith & Stulz, 1985) or Foreign Exchange Exposure Theory (Adler & Dumas, 1984). This lack of significance can be explained by the fact that Exchange Rate Volatility is measured as a macro-level variable that is identical for all companies in a given year, and is therefore less able to capture differences in FX Hedging Intensity across companies within a pooled cross-sectional model (Madura & Zipfel, 2021). Hedging decisions are also more strongly determined by firm-specific real exposure than by aggregate market volatility (Smith & Stulz, 1985), and some hedging activity is compliance-driven, following Bank Indonesia Regulation No. 16/21/PBI/2014 in conjunction with No. 18/4/PBI/2016 on minimum hedging ratios, which applies regardless of prevailing exchange rate volatility conditions. This result is consistent with Yudha et al. (2023), Pratama and Imronudin (2024), and Salsabila et al. (2023), who likewise found that the exchange rate has no significant effect on hedging decisions.

2. Effect of Foreign Currency Debt on FX Hedging Intensity

The t-test results show a t-value of 18.361 ($> t\text{-table } 1.981$) with a significance of 0.000 (< 0.05) and a positive coefficient ($\beta = 0.863$), so H2 is accepted: Foreign Currency Debt has a positive and significant effect on FX Hedging Intensity, and is the most dominant predictor in the model. This finding is consistent with Hedging Theory (Smith & Stulz, 1985) and Foreign Exchange Exposure Theory (Adler & Dumas, 1984): the greater the proportion of foreign-denominated liabilities, the greater the balance sheet exposure a company faces when the Rupiah depreciates, thereby driving more intensive use of FX derivative instruments to lock in the exchange rate for settling obligations. This result is consistent with Yudha et al. (2023), Fajri et al.

(2023), Chila and Desmiza (2024), Pratama and Imronudin (2024), and Salsabila et al. (2023), all of whom confirm a significant positive effect of foreign debt on hedging decisions and intensity across various sectors.

3. Effect of Operating Cash Flow on FX Hedging Intensity

The t-test results show a t-value of -3.166 (exceeding t-table 1.981 in absolute terms) with a significance of 0.002 (< 0.05), so H3 is accepted in terms of significance, but with a negative direction that differs from the hypothesized positive direction. This direction does not align with the conventional prediction of Cash Flow Theory (Almeida et al., 2003). Several arguments explain this pattern: first, companies with strong operating cash flow tend to rely on self-insurance through internal cash reserves as a substitute for formal hedging (Yulianingsih & Lastanti, 2024); second, pressure from the cost of imported raw materials due to Rupiah depreciation squeezes operating cash flow precisely when hedging needs increase (Pratama & Imronudin, 2024); and third, the minimum hedging ratio obligation under Bank Indonesia regulations remains binding regardless of a company's internal cash flow condition. This result is consistent with Fajri et al. (2023) and Hosama and Setyawan (2022), who likewise found a negative relationship between cash capacity/liquidity and hedging intensity.

4. Simultaneous Effect of Exchange Rate Volatility, Foreign Currency Debt, and Operating Cash Flow on FX Hedging Intensity

The F-test results show an F-value of 114.643 ($> F$ -table 2.68) with a significance of 0.000 (< 0.05), so H4 is accepted: the three independent variables simultaneously have a significant effect on FX Hedging Intensity, with an Adjusted R Square of 0.741. Theoretically, Hedging Theory (Smith & Stulz, 1985) asserts that hedging intensity is determined by a combination of external environmental exposure (exchange rate), the structure of financial obligations (foreign debt), and internal funding capacity (operating cash flow). Although Exchange Rate Volatility is not significant partially, the combination of the three variables still has strong explanatory power, driven by the dominance of Foreign Currency Debt. This result is consistent with Pratama and

Imronudin (2024), Larasati and Wijaya (2022), and Meridelima and Isbanah (2021), who likewise found a significant simultaneous effect of financial variables on corporate hedging decisions.

D. CONCLUSIONS

Based on the test results and discussion, it can be concluded that Exchange Rate Volatility has no significant effect on FX Hedging Intensity in industrial sector companies listed on the IDX during 2021–2025, because exchange rate uncertainty measured in aggregate at the market level has not been sufficient to drive companies to increase their use of derivative instruments, given that hedging decisions are more strongly determined by each company's real exposure. Foreign Currency Debt has a positive and significant effect on FX Hedging Intensity and is the most dominant contributing variable, indicating that the greater the proportion of foreign-denominated liabilities, the greater the intensity of FX derivative instrument use as a balance sheet exposure protection mechanism. Operating Cash Flow has a significant negative effect on FX Hedging Intensity, indicating that strong operating cash flow in this study's sample functions more as an internal self-insurance mechanism that substitutes for formal hedging, rather than as a prerequisite for financing derivative instrument premiums. Simultaneously, the three variables have a significant effect on FX Hedging Intensity, with the model explaining most of its variation explanatory power substantially driven by the dominant influence of Foreign Currency Debt so that the three risk dimensions (external exposure, liability structure, and internal capacity) remain jointly relevant in explaining corporate hedging decisions, even though their contributions are not proportional to one another.

E. SUGGESTIONS

Future researchers are encouraged to add other variables with the potential to influence FX Hedging Intensity, such as firm size, liquidity, profitability, institutional ownership, growth opportunity, and financial distress, and to consider panel data regression approaches with fixed or random effects to more precisely capture time-based variation in Exchange Rate Volatility, as well

as a Tobit regression approach given the large proportion of observations with an FX Hedging Intensity value of zero. Expanding the scope of the research object to other IDX sectors and extending the observation period are also recommended to produce more comprehensive findings with better generalizability. For industrial sector companies, it is recommended that the foreign currency debt ratio be used as a primary indicator in determining hedging needs and intensity, rather than relying solely on the strength of operating cash flow as a substitute for a formal hedging strategy. For investors and financial analysts, it is recommended to pay attention to the foreign currency debt ratio and the consistency of FX derivative instrument use as indicators of risk management quality that are more relevant than general market exchange rate volatility.

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