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Does inflation or interest rate matter to Indonesian stock prices? An asymmetric approach

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Abstract

Purpose – This paper examines the asymmetric effects of inflation and interest rate on stock prices in Indonesia.
Design/methodology/approach – Variables such as interest rate, inflation rate, gross domestic product (GDP) and exchange rate were tested using the time-series data fitted to the Nonlinear Autoregressive Distributed Lag (NARDL) model. The asymmetric effects of interest rate and inflation rate were estimated in two separate models, with data covering the period from 1997:Q1 to 2023:Q3.
Findings – The results indicated that interest rates exhibit asymmetric effects on stock prices in both the short and long run. Conversely, no asymmetric effect was identified for the inflation rate model. The NARDL result of the asymmetry interest rate model revealed that both positive and negative changes in the interest rate have a negative impact on stock prices in Indonesia. Notably, stock prices were positively and significantly influenced by both economic growth and exchange rate. The results suggested that policymakers should respond more proactively by adjusting the interest rate in line with stock price movements.
Originality/value – This study diverges from previous studies by employing a general equilibrium theoretic model to link output with stock returns and extending it to include macroeconomic variables relevant to stock price determination. This study uniquely examined the asymmetric effects of monetary policy variables in Indonesia, particularly by comparing the asymmetric effects of inflation and interest rate.

Keywords Stock prices, Macroeconomic variables, NARDL, Indonesia, Asymmetric
Paper type Research paper

1. Introduction

Indonesia depicts high economic potential as the largest economy and emerging market in Southeast Asia. The Indonesian Stock Exchange is established for citizens to invest in securities and assists organizations in obtaining funds from investors. The Jakarta Composite Index (JCI) has served as a primary indicator of national financial market performance since 1999, with shifts in stock prices reflecting changes in investor sentiment and expectations about future economic conditions. Notably, macroeconomic variable shifts can influence the stock market both positively and negatively (Bahmani-Oskooee and Saha, 2016). Projected profits could serve as a proxy for the level of aggregate economic activity, while stock prices

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represent investors' expectations of future earnings. The global financial crisis has introduced nonlinearity and asymmetry into financial and economic time series (Cheah *et al.*, 2017; Dhaoui *et al.*, 2018).

Since the 1990s, Indonesia has experienced a relatively high average inflation rate compared with its peer countries (Palomba, 2012). High inflation negatively affects the economy by reducing purchasing power (Tan and Uprasen, 2023), promoting currency substitution (Özbilgin, 2012) and increasing the risk of real income losses (Cochrane, 2022). These conditions foster cautious investor behavior to avoid inflation-associated risks. Interest rate, which central banks use to manage inflation, significantly affect the capital market and generally track inflation with some delay. Additionally, interest rate reflects the opportunity cost of holding money in financial assets, while inflation represents the opportunity cost of holding money in real assets (Bahmani-Oskooee *et al.*, 2021).

The Central Bank of Indonesia (BI) adopted an inflation targeting framework (ITF) in July 2005 to stabilize the economy. BI faces two significant challenges: managing inflation expectations and implementing monetary policy amid global financial instability. Its mandate centers on stabilizing the Rupiah, with inflation as the main objective. The ITF framework, which employs the policy rate as a monetary policy signal, allows BI to continuously adapt its policy approach in response to dynamic economics complexities. Since the 2008–2009 global financial crisis, BI has employed a "flexible ITF" framework, using the interest rate to manage inflation expectations and maintain policy autonomy to meet future targets.

Based on Fisherian theory, the nominal expected returns on assets encompass estimated inflation and real interest rate (Li *et al.*, 2010). Although empirical studies on the Fisher hypothesis are mixed, inflation and deflation impact stock prices differently. Higher interest rates generally depress earnings and stock prices, while lower rates encourage capital flows into the stock market, increasing demand and prices. On the other hand, a high interest rate diminishes stock liquidity (Eaton *et al.*, 2022). Inflation also affects stock prices through its effect on production decisions. Antonakakis *et al.* (2017) highlighted a positive relationship between expected inflation and stock returns. A decline in inflation, often driven by portfolio changes and stock sales, can result in negative stock market index returns (Constantinos *et al.*, 2012). Meanwhile, inflation-driven increases in input costs and production expenses can suppress profit margins and stock prices (Bahmani-Oskooee and Saha, 2016). Boyd *et al.* (1996) provided the theoretical support for a nonlinear relationship between inflation and stock returns.

Within the ITF, achieving sustainable economic growth centers on price stability, maintained through inflation control. Interest rate adjustments, a primary tool for managing inflation, directly impact discount rates and both present and future cash flows of organizations. Consequently, rising interest rates tend to depress stock prices, potentially prompting investors to liquidate stock positions and pursue alternative investments. Interest rate and credit availability are key instruments of monetary policy, typically regulated through short-term interest rate and bank reserves. In Indonesia, credit ceilings and interest rate controls are the most extensively employed monetary policies to moderate market liquidity expansion. Studies indicate that ITF improves macroeconomic performance in emerging economies across Europe and Central Asia (Arsić *et al.*, 2022).

The flexible ITF offers an explanation for stock market volatility, as it establishes a risk premium to compensate for inflation uncertainty, thus reducing stock market fluctuations (Dridi and Boughrara, 2023). In response to rising inflation, central banks often raise interest rate, suggesting a relevant area for investigating the differential reactions of stock prices to interest and inflation rate due to their crucial roles in monetary policy. Both the expected inflation and real interest rate determine the nominal expected return on assets. Recent research has highlighted a nonlinear relationship between monetary policy and stock prices, indicating that stringent and flexible policies exert distinct influences on stock prices (Lee and Ryu, 2018). Therefore, this study aims to examine the asymmetric effects of changes in inflation and interest rate on Indonesian stock prices, given the importance of these factors in

monetary policy. Unlike previous research, this study compares the asymmetric effects of inflation rate and interest rate on stock prices in Indonesia. It addresses the literature gap from theoretical and empirical perspectives. Theoretically, this study utilizes a general equilibrium model that relates output to stock returns, as opposed to the arbitrage pricing theory (APT) and capital asset pricing model (CAPM) used in earlier studies. The study also incorporates inflation, interest rate, and exchange rate into the estimation models. Empirically, there is a lack of study comparing the asymmetric effects of inflation and interest rate on stock prices in Indonesia. Different from Chang and Rajput (2018) and Syed (2021), this study focuses on examining these asymmetric effects from the perspective of monetary policy variables, specifically inflation targeting in Indonesia, by comparing the asymmetric effects of inflation and interest rate.

The results reveal a parsimonious model that integrates the asymmetric effects of interest rate on stock prices in Indonesia. Key determinants of Indonesian stock prices include interest rate, inflation, income, and exchange rate, with asymmetric interest rate effects observed in both the short and long run. These results suggest that monetary policy transmits interest rate changes to inflation asymmetrically, subsequently affecting stock prices. As a result, investment decisions are influenced by changes in policy rates due to their effects on the stock prices, therefore requiring interest rate adjustments to manage inflation effectively. Given the influence of broader macroeconomic variables on stock prices, investors also consider the economic performance, inflation, and exchange rate when making investment decisions. Furthermore, the policymakers should incorporate these insights into policy design to enhance market stability.

The sections in this paper are sequenced as follows: Section 2 outlines the development of the asymmetric effects of macroeconomic fundamentals in the stock market specification; Section 3 presents the methodology; Section 4 elaborates on empirical outcomes and discussions and Section 5 concludes the research.

2. Literature review

Extensive research has explored the impact of inflation and interest rate on stock prices across distinctive economies. Erdoğan and Tiryaki (2018) investigated the nonlinear dynamic relationships among several macroeconomic variables, including the world oil price index (OILP), consumer price index (CPI), real effective exchange rate (RER), country interest rate (INT), industrial production index (IPI), and the stock returns in G-7 countries. In Malaysia, Cheah *et al.* (2017) examined the asymmetric effects of exchange rate fluctuations on stock returns alongside other macroeconomic variables such as money supply, IPI and CPI. Lee and Ryu (2018) analyzed the behavior of primary and secondary stock market returns in Korea to the changes in CPI, INT, and RER using the nonlinear ARDL co-integration (NARDL) approach. The findings showed the significant long-run adverse effects of macroeconomic shocks on stock returns.

While CAPM was widely used to determine stock prices, Dickinson (2000) recommended employing a general equilibrium model with macroeconomic variables for predicting stock prices, given the complexities in testing CAPM. This model elucidated the correlation between output and stock returns, relying on historical capital rates of return for investment decisions under the assumption of a constant income-saving ratio among consumers (Devarajan and Go, 1998). Devarajan and Go (1998) further refined the general equilibrium model to include dynamic optimization based on future prices in realizing savings and investment. Subsequently, researchers like Dickinson (2000), Chang and Rajput (2018) and Syed (2021) have incorporated macroeconomic variables to explain stock prices.

In this study, macroeconomic variables such as inflation, interest rate and exchange rate were integrated within the general equilibrium model alongside income. A comprehensive literature review by Ho and Iyke (2017) revealed that real income, banking sector, interest rate, private capital flows, inflation, and exchange rate are key macroeconomic determinants of stock market development, underpinning the macroeconomic variable selection in this study. In the context of Indonesia, the selection of macroeconomic variables was informed by

Setiawan (2020), who emphasized economic indicators (gross domestic product [GDP], inflation, interest rate, and exchange rate) as external factors shaping stock performance. Since the influence of world oil price index was indirectly reflected in inflation (Renou-Maissant, 2019), this study incorporates inflation rather than world oil price index, aligning with Indonesia's ITF. Different from previous studies using CAPM and APT, this study employed the general equilibrium model, extending the range of predictors to better explain stock returns.

2.1 Inflation rate (CPI)

In line with past literature, inflation had an adverse effect on stock prices (Maysami and Koh, 2000; Wahyudi *et al.*, 2017; Delgado *et al.*, 2018). Generally, inflation increased input and manufacturing expenditures and subsequently decreased profit margins and stock prices. Higher inflation also diminished the real rate of return on monetary and other assets. Fisher (1930) posited that an increase in both current and anticipated inflation should result in higher anticipated nominal dividend payments. According to Aziz and Masih (2018), the inflation-stock price relationship could differ depending on the types of inflation, such as demand-pull or cost-push inflation. Demand-pull inflation arises from excessive demand relative to supply, while cost-push inflation is driven by increased manufacturing expenses. Constantinos *et al.* (2012) were among the first to investigate the asymmetric effect of inflation on stock market prices using the NARDL method and to identify an asymmetric effect of inflation on Greek stock market returns. More recently, Sia *et al.* (2023) confirmed the asymmetric effect of inflation rate on stock prices.

2.2 Interest rate (INT)

The relationship between interest rate and stock prices has been widely studied, yielding mixed results. Ho and Iyke (2017) asserted the substantial role of interest rate in ascertaining financial and stock market pricing. Meanwhile, other empirical studies (Humpe and Macmillan, 2009; Setiawan, 2020) have reported a negative relationship between interest rate and stock prices. Prior research employing APT and CAPM approaches has been used in a previous study that has related interest rate with stock price movements (Dutta and Sinha, 2022). High interest rate tend to suppress economic activities and reduce stock returns. An elevated interest rate can discourage borrowing and investment in the stock market. In contrast, Eldomiaty *et al.* (2018) found a positive relationship between interest rate and stock prices, suggesting that investors adjust stock prices in response to trends in real interest rate. Similarly, Moussa and Delhoumi (2022) showed that interest rate fluctuations significantly explained stock market index returns in the MENA region.

2.3 Gross domestic product (GDP)

National GDP denoted the sum of the total economic revenue and expenditure on products and services. Mankiw and Reis (2018) highlighted GDP as a key indicator of economic performance. Previous studies (Humpe and Macmillan, 2009; Ho and Iyke, 2017; Setiawan, 2020) have confirmed a positive relationship between GDP and stock prices, with composite indices serving as benchmarks for investors and authorities to assess global stock market performance. The positive relationship between output and stock prices arouses because increased output enhances firms' profitability, subsequently boosting stock prices (Hashmi and Chang, 2023). Overall, stock markets tend to stimulate economic growth, and vice versa. However, a recent study by Hashmi and Chang (2023) found that industrial production does not exhibit asymmetric effects on stock prices in either the short or long run.

2.4 Exchange rate (EXC)

The exchange rate denoted the value of a domestic currency relative to a foreign currency. Research has shown that the IDR/USD exchange rate positively and significantly affected

stock prices (Upadhyaya *et al.*, 2018; Demir, 2019; Luwihono *et al.*, 2021). Bahmani-Oskooee and Saha (2016) found that exchange rate fluctuations can have positive and negative effects on stock prices, with changes exhibiting an asymmetric effect. Using the NARDL approach, Wong (2022) investigated the asymmetric effect of real exchange rate movements on stock prices in Malaysia, revealing that depreciation may have impacted stock prices differently than appreciation. Depreciation in the exchange rate benefited export-dependent firms by making domestic goods cheaper for foreign buyers, thereby potentially increasing profitability. Conversely, for import-dependent firms, a weaker currency raised the cost of imported goods, escalating production costs and potentially reducing stock prices.

2.5 Asymmetric approach

The heightened uncertainties and fluctuations in the financial market following the 2008 global financial crisis have spurred scholarly interest in nonlinear time series models examining the stock price-currency rate relationship. Yacouba and Altintas (2019) explored the asymmetric effects of exchange rate, money supply, and interest rate on stock returns with a similar methodology, identifying significant asymmetric effects of real effective exchange and interest rate on stock returns. In Indonesia, interest rate is a key monetary policy instrument used to meet inflation targets. Hence, this study aims to address gaps in the literature on asymmetric dynamics by comparing the asymmetric effects of interest rate (an ITF instrument) and inflation rate (an ITF goal) on Indonesian stock prices.

Building on prior research, this study establishes a model specification to capture the asymmetric effects of both inflation and interest rate on stock prices. Given the possibility that stock prices respond asymmetrically to changes in macroeconomic fundamentals, this study incorporates the variables representing both an inflation targeting instrument (interest rate) and an inflation targeting goal (inflation rate) to verify their asymmetric effects on Indonesian stock prices across two different models. The decision to compare the asymmetric effects of inflation and interest rate is further supported by Eldomiaty *et al.* (2020), who found persistent relationships between stock prices, inflation rate, and interest rate. Understanding these asymmetric effects is essential for effective monetary policy formulation in Indonesia, where inflation targeting is actively implemented. Unlike the previous studies that have addressed the total asymmetric effects of all macroeconomic variables on stock prices.

Drawing from the influence of macroeconomic variables on stock prices discussed above, this study addresses key research gaps through the development of the following hypotheses:

H1. Inflation rate asymmetrically affects stock prices.

H2. Interest rate affects stock prices asymmetrically.

H3. Gross domestic product affects stock prices symmetrically.

H4. Exchange rate affects stock prices symmetrically.

H5. Interest rate affects stock prices symmetrically.

H6. Inflation rate affects stock prices symmetrically.

3. Methodology

This study examines the asymmetric effects of interest rate and inflation on Indonesian stock prices. The JCI was used as a proxy for stock prices, as it was suitable upon application for natural log transformation. The CPI served as a proxy for inflation (INF), while the Central BI interest rate represented the interest rate (INT). The GDP was used proxy economic development, and the exchange rate (EXC) was denoted by the Indonesian Rupiah per USD.

Quarterly data from 1997 to 2023 were derived from the Indonesia Stock Exchange, CEIC Data, and the International Monetary Fund. This period included key events, such as the 1997 Asian financial crisis, the subprime mortgage crisis, and the COVID-19 pandemic. This study primarily aimed to investigate the asymmetric effects of inflation and interest rate on stock prices. To achieve this, the NARDL method developed by Shin *et al.* (2014) was employed as an asymmetric extension of the well-established ARDL model by Pesaran and Shin (1999). The NARDL approach allowed for the identification of both long- and short-run asymmetries while retaining the standard benefits of ARDL.

The asymmetric co-integrating equations are specified in vector autoregressive (VAR) models (Shin *et al.*, 2014) as follows:

Model I

$$LnSP_t = \alpha_0 + \alpha_1 INF_t^+ + \alpha_2 INF_t^- + \alpha_3 INT_t + \alpha_4 LnGDP_t + \alpha_5 LnEXC_t + e_t \quad (1)$$

Model II

$$LnSP_t = \alpha_0 + \alpha_1 INT_t^+ + \alpha_2 INT_t^- + \alpha_3 INF_t + \alpha_4 LnGDP_t + \alpha_5 LnEXC_t + e_t \quad (2)$$

where Ln, INF_t, INT_t, GDP_t and EXC_t denote the natural logarithm for inflation, interest rate, GDP and exchange rate, respectively. Model 1 demonstrates the asymmetry relationship between stock prices and INF changes, whereas Model 2 exhibits the asymmetry parameters between stock prices and INT shifts. The co-integrating vector entails the long-run parameters to be forecasted and is indicated by $\alpha = (\alpha_0, \alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5)$. The decomposition of the independent variables (INF and INT) is denoted as follows (Shin *et al.*, 2014):

$$\begin{aligned} INF_t^+ &= \sum_{i=1}^{t} \Delta INF_i^+ = \sum_{i=1}^{t} max(\Delta INF_i, 0) \\ INF_t^- &= \sum_{i=1}^{t} \Delta INF_i^- = \sum_{i=1}^{t} min(\Delta INF_i, 0) \end{aligned} \quad (3)$$

and

$$\begin{aligned} INT_t^+ &= \sum_{i=1}^{t} \Delta INT_i^+ = \sum_{i=1}^{t} max(\Delta INT_i, 0) \\ INT_t^- &= \sum_{i=1}^{t} \Delta INT_i^- = \sum_{i=1}^{t} min(\Delta INT_i, 0) \end{aligned} \quad (4)$$

Equations (1) and (2) are subsequently specified in Pesaran and Shin's (1999) and Pesaran *et al.*'s (2001) ARDL framework as follows:

Model 1

$$\begin{aligned} \Delta LnSP_t = \alpha &+ \sum_{i=1}^{p} \gamma_{1i} \Delta LnSP_{t-i} + \sum_{i=0}^{q_1} \left(\gamma_{2i}^+ \Delta INF_{t-i}^+ + \gamma_{2i}^- \Delta INF_{t-i}^- \right) + \sum_{i=0}^{q_2} \gamma_{3i} \Delta INT_{t-i} \\ &+ \sum_{i=0}^{q_3} \gamma_{4i} \Delta LnGDP_{t-i} + \sum_{i=0}^{q_4} \gamma_{5i} \Delta LnEXC_{t-i} + \theta_0 LnSP_{t-1} + \theta_1 INF_{t-1}^+ + \theta_2 INF_{t-1}^- \\ &+ \theta_3 INT_{t-1} + \theta_4 LnGDP_{t-1} + \theta_5 LnEXC_{t-1} + \mu_t \end{aligned} \quad (5)$$

Model 2

$$\Delta LnSP_t = \alpha + \sum_{i=1}^{p} \gamma_{1i} \Delta LnSP_{t-i} + \sum_{i=0}^{q_1} \left(\gamma_{2i}^{+} \Delta INT_{t-i}^{+} + \gamma_{2i}^{-} \Delta INT_{t-i}^{-} \right) + \sum_{i=0}^{q_2} \gamma_{3i} \Delta INF_{t-i} + \sum_{i=0}^{q_3} \gamma_{4i} \Delta LnGDP_{t-i} + \sum_{i=0}^{q_4} \gamma_{5i} \Delta LnEXC_{t-i} + \theta_0 LnSP_{t-1} + \theta_1 INT_{t-1}^{+} + \theta_2 INT_{t-1}^{-} + \theta_3 INF_{t-1} + \theta_4 LnGDP_{t-1} + \theta_5 LnEXC_{t-1} + \mu_t \quad (6)$$

where Δ, γ_0 and μ_t characterize the operator of the first difference, drift component and white noise residual, respectively. The long-run effect of INF and INT shifts on stock prices is reflected by $\alpha_1 = -\theta_1/\theta_0$ and $\alpha_2 = -\theta_2/\theta_0$, respectively. Contrarily, the short-run impacts of a rise in INF_POS (or INT_POS) on stock prices are measured by $\sum_{i=0}^{q_1} \gamma_{2i}^{+}$, whereas the short-run effects of a decline in INF_NEG (or INT_NEG) on stock prices are measured by $\sum_{i=0}^{q_1} \gamma_{2i}^{-}$. In the event of $\alpha_1 = \alpha_2$, the absence of an asymmetry correlation between inflation (or interest) rate and stock prices could be summarized. Nevertheless, a nonlinear correlation could be deduced in the event of $\alpha_1 \neq \alpha_2$.

First, the augmented Dickey-Fuller (ADF) and Phillips-Peron (PP) unit root tests were applied to validate the integration orders of the variables. Unit root tests were necessary as $I(2)$ variables would invalidate the estimated F-statistics for verifying co-integration. Nonetheless, NARDL could be conducted regardless of whether the variables were $I(0)$ or $I(1)$. Equations (5) and (6) were estimated using standard ordinary least squares (OLS) in the second stage. Following the approach of Katrakilidis and Trachanas (2012) and Ibrahim (2015), the general-to-specific method was employed to eliminate insignificant lags from the final NARDL model specification. Third, the presence of co-integration among the estimated variables was determined using the bound-testing methods proposed by Pesaran *et al.* (2001) and Shin *et al.* (2014). The Wald F-statistic in the bounds test was used to assess the null hypothesis: $\theta_0 = \theta_1 = \theta_2 = \theta_3 = \theta_4 = \theta_5 = 0$. Lastly, long- and short-run asymmetries deduced from the inflation and interest rate on stock prices in the presence of co-integration were analyzed. Several diagnostic tests constituting normality, serial correlation, multicollinearity, functional form and heteroscedasticity were performed to ensure the robustness of the model. The optimal lag length of both Model 1 and Model 2 was determined to be four, as selected by the Hannan-Quinn information criterion. This criterion is known for its strong consistency in estimating the order of an autoregressive model (Hannan and Quinn, 1979). Therefore, fixing the lag length at four for both models helped reduce the results sensitivity due to different lags.

4. Findings and discussion

An overview of the descriptive statistics of all variables is presented (see Supplementary Table I; Ozcelebi and Izgi, 2023). The null hypothesis of normality (Jarque and Bera, 1980) was rejected for all-time series at the 1% significance level, suggesting potential nonlinearity in the variables. This non-normality implied that nonlinear models, which allow for regime changes, could account for skewness in inference. The unit root properties of the estimated variables were also checked using ADF and PP unit root tests. Both the ADF and PP test results indicated that all variables were stationary at the 1% significance level.

Prior to the testing of NARDL, the Brock, Dechert and Scheinkman (BDS) test (Brock *et al.*, 1996) was conducted to determine nonlinearity in the stochastic process. The null hypotheses for Models 1 and Model 2 were rejected, confirming that nonlinear relationships existed in the time series (see Supplementary Table II). Additionally, all variables were integrated at order 1, fulfilling the requirement of no $I(2)$ variables (see Supplementary Table I). The analysis proceeded with bounds testing in the absence of the $I(2)$ variable.

The bounds of the *F*-statistics results demonstrated co-integration among the variables (see Supplementary Table III). The computed *F*-statistic values for Model 1 and Model 2 were 5.47 and 16.40, respectively, both exceeding the 95% upper critical value at the 1% significance level (Narayan, 2005). Thus, the variables in both empirical models exhibit long-run co-integration.

To validate Model 1 and Model 2 under dynamic specifications, multiple diagnostic tests were conducted (see Table 1). The results indicated that Model 1 violated the normality assumption. Contrarily, Model 2 that incorporated the asymmetric interest rate effect was found to have no issue in the diagnostic tests. The CUSUM and CUSUMSQ tests showed that their lines fall between the upper-bound and lower-critical bounds, validating the stability of the NARDL model.

Table 1. Estimation results of nonlinear ARDL models

	Model 1 Dependent variable: SP		Model 2	
Independent variable	Coefficient	*p*-value	Coefficient	*p*-value
Short-run dynamics				
Constant	−18.1889	0.0000***	−13.5633	0.0000***
LSP(−1)	−0.2803	0.0000***	−0.2591	0.0000***
INF(−1)	–	–	−0.0108	0.0000***
INF_POS(−1)	−0.0130	0.0001***	–	–
INF_NEG(−1)	−0.0718	0.5163	–	–
INT(−1)	0.1576	0.0097***	–	–
INT_POS(−1)	–	–	−0.0306	0.0000***
INT_NEG(−1)	–	–	−0.0191	0.0000***
LGDP(−1)	0.9355	0.0000***	0.7072	0.0000***
LEXC(−1)	0.1576	0.2898	0.2704	0.0452**
Long-run dynamics				
Constant	−64.8804	0.0001***	−52.3578	0.0000***
INF	–	–	−0.0418	0.0007***
INF_POS	−0.0465	0.0011***	–	–
INF_NEG	−0.2562	0.5318	–	–
INT	0.0404	0.0180**	–	–
INT_POS	–	–	−0.1180	0.0000***
INT_NEG	–	–	−0.0738	0.0002***
LGDP	3.3368	0.0000***	2.7301	0.0000***
LEXC	0.5620	0.3359	1.0437	0.0870*
Diagnostic tests				
R-squared	0.5655		0.7484	
Normality	76.1934	0.0000***	2.2767	0.3204
Serial correlation	2.1647	0.1212	1.3282	0.2705
Heteroskedasticity	0.3591	0.9880	0.9459	0.5217
Functional form	1.5735	0.1194	1.5565	0.1233
CUSUM	Stable		Stable	
CUSUMSQ	Stable		Stable	

Note(s): Jarque Bera normality test is based on skewness and kurtosis of residual tests. Lagrange Multiplier (LM) test of residual serial correlation was used to diagnose serial correlation while regression of squared residuals on squared fitted values was used to diagnose heteroskedasticity. Square of fitted values was used in Ramsey's RESET test to verify functional form of the model. CUSUM designates the cumulative sum of recursive residuals test and CUSUMQ refers to the cumulative sum of squares of recursive residuals test, which were used to verify the stability of the model. The dummy variable of 2001Q3 and 2008Q3 are included. Lastly, *, ** and *** indicate the significance at 10%, 5% and 1% level, respectively

Source(s): Authors' own creation

Table 1 presents the co-integrating results for long- and short-run equations for both models. The asymmetric effects of inflation and interest rate shifts on Indonesian stock prices were represented by the positive and negative changes. For Model 1, the NARDL results revealed that increases in inflation significantly impact stock prices at the 1% significance level, while decreases in inflation indicated no significant effect on stock prices in both the long and short run. These results aligned with Chang and Rajput (2018) for short-run effects, supporting H1.

In Model 2, stock prices exhibited a nonlinear response to interest rate shifts in both the long and short runs. The positive shock (INT_POS) and negative shock (INT_NEG) to interest rates were negative and statistically significant in both the long and short run. Based on the estimates, a high-interest rate significantly and negatively influenced the stock price, while a low counterpart had a significant and negative impact. A 1% increase in interest rate would reduce stock prices by 0.03 and 0.12% in the short and long run, respectively. Meanwhile, a 1% decrease in interest rate would increase stock prices by 0.02 and 0.07% in the short and long run, respectively. These results aligned with Setiawan (2020), confirming that a high interest rate negatively impacted Indonesian stock prices, thus supporting H2. High BI rates adversely influenced stock prices, as increased interest costs reduced corporate profits, promoting investors to shift funds to the bond market. On the other hand, a lower interest rate supported economic growth by facilitating borrowing, which benefits the economy and corporate profitability. Consequently, investors could minimize risk by adjusting their portfolio to enhance diversification, such as reallocating funds to bonds. As the financial regulator, BI was responsible for adjusting the BI rate to manage inflation, with rate changes significantly impacting Indonesian stock prices. INT_POS demonstrated a stronger effect on stock prices compared to INT_NEG, with interest rate showing a significant negative effect at the 1% significance level in this model. It was crucial for BI to carefully evaluate the implications of interest rate increases, as a rate hike tends to reduce stock prices to a greater extent than the increase in stock prices resulting from a rate cut.

For GDP, the short-run estimates demonstrated a significant positive effect on stock prices in both Model 1 and Model 2. A 1% increase in GDP raised stock prices by 0.94% in Model 1 and 0.71% in Model 2, supporting H3. The long-run estimates showed a stronger effect, with a 1% increase in GDP elevating stock prices by 3.34% in Model 1 and 2.73% in Model 2. This result corroborated with Setiawan (2020) and supported the underpinning theory that economic activity and stock prices are positively correlated, as higher national income boosted share purchases and capital investments.

The results indicated that stock prices responded positively to exchange rate. In Model 1, the effect was not statistically significant in either the short or long run, while the coefficient was significant at the 10% significance level in Model 2. Thus, H4 is not supported in Model 1, whereas it is supported in Model 2. In Model 2, a 1% depreciation of the IDR increased stock prices by 0.27% in the short run and 1.04% in the long run. Similarly, Suriani *et al.* (2015) proposed a positive relationship between stock price and exchange rate, suggesting that when the local currency depreciates, local businesses become more competitive, leading to increased exports. Currency depreciation enhanced competitiveness among exporters, positively affecting stock prices (Yacouba and Altintas, 2019) and potentially generating higher stock returns (Puah and Jayaraman, 2007). Movements in the Rupiah influenced Indonesia's international competitiveness and trade balance, subsequently affecting both current and future cash flows of companies, which in turn impacts stock prices. Given the positive effect of Rupiah depreciation on stock prices, policymakers should consider the influence of currency depreciation when formulating exchange rate management policies.

In Model 1, interest rate was found to be positively related to stock prices at the 1% significance level, though the effect is minimal. A 1% increase in interest rate raised stock prices by 0.008% in the short run and 0.018% in the long run. Thus, H5 is supported, aligning with the findings of Eldomiaty *et al.* (2020). In Model 2, interest rate was also significant in explaining stock prices at the 1% significance level. On the other hand, a 1% increase in the

inflation rate would reduce the stock prices by 0.01% in the short run and 0.04% in the long run. The result was consistent with Eldomiaty *et al.* (2020), supporting H6. A higher inflation rate reduced the real return rate on assets, thereby discouraging lending. The reduction in loans resulted in less efficient resource allocation and a decline in financial intermediation, adversely impacting capital formation and stock market performance over the long term. Information on inflation could guide investors in evaluating equity performance by identifying the industries that struggled under high inflation. Consequently, policymakers must consistently update their insights into the inflation and stock prices relationship when formulating appropriate policies. Interest rate adjustments could serve as a potential inflation targeting tool in monetary policy to influence stock prices via inflation dynamics. Overall, exchange rate is not significant in explaining stock prices, and the normality problem prevails in Model 1. Conversely, all the sign of coefficients for macroeconomic variables in Model 2 are consistent with *a priori* theory, with all coefficients significant, making Model 2 the parsimonious model.

Last but not least, quantile regression was performed to check the robustness of Model 2. Table 2 indicates the asymmetric effects of positive and negative interest rate on stock prices for the nine quantile levels. The median quantiles (τ = 0.4–0.6) reflected a normal market condition, while lower quantiles (τ = 0.1–0.3) reflected bearish regime, and higher quantiles (τ = 0.7–0.9) reflected a bullish market condition. The results showed that positive interest rate movements have an inverse relationship with stock prices, with the effect most significant in the medium quantiles. Negative interest rate movements exerted a positive effect across all quantiles, but this effect is not significant. These findings indicated that stock prices reacted differently to interest rate changes across diverse market conditions. Furthermore, the Wald test for symmetry showed that the null hypothesis of symmetry is rejected in the medium quantiles, indicating asymmetry in the normal market regime. These results confirmed the findings in Table 1, where positive interest rate movements are more impactful than negative movements, particularly in the period of normal market conditions.

5. Conclusion

Using nonlinear estimation approaches, the study estimates and compares models incorporating changes in inflation and interest rate to explain Indonesian stock prices from 1997:Q1 to 2023:Q3. A parsimonious model has been derived by including changes in interest rate, inflation rate, GDP, exchange rate, capturing stock price dynamics in both the short and long run. The findings are summarized as follows. First, an increase in interest rate possesses a greater impact on stock prices. Second, a higher inflation rate weakens stock market performance. Third, rising GDP strengthens stock prices, while currency depreciation also improves stock market performance. The findings provide valuable practical and theoretical implications for the Indonesian stock market.

Practically, understanding the factors affecting the stock market performance is crucial for effective policymaking and implementation. The policy implications are as follows. First, implementing inflation targeting as part of monetary policy can help achieve policy objectives by accounting for the impact of interest rate fluctuations on stock prices. In Indonesia, monetary policy affects the economy through its effect on stock assessments, with the BI 7-Day (Reverse) Repo Rate (BI7DRR) established as the policy rate to optimize the monetary policy transmission efficiency. This highlights the significance of asymmetric interest effects on Indonesian stock prices. Second, monitoring inflation through monetary policy is crucial, as rising inflation can negatively impact stock market performance. The authorities could monitor the inflation rate via monetary policy as an increase in inflation could weaken the stock market performance. Third, economic growth should also be emphasized by policymakers as higher national income boosts stock market performance. The general public would possess more spending power with a broadened monetary policy, leading to greater demand for shares and higher stock prices. Lastly, exchange rate stability is vital in

Table 2. Estimation results of Quantile Regression model

Variable	Quantile 0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
C	−28.612**	−27.938	−32.422***	−30.660***	−30.397***	−27.233***	−24.772***	−21.753	−18.714***
	(0.0452)	(0.1345)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.2449)	(0.0000)
INT_POS	−0.0054	−0.0151	−0.0197***	−0.0194***	−0.0193***	−0.0111	−0.0138**	−0.0053	0.0022
	(0.6714)	(0.4776)	(0.0000)	(0.0000)	(0.0000)	(0.1473)	(0.0498)	(0.8935)	(0.8474)
INT_NEG	0.0091**	0.0028	0.0014	0.0004	−0.0004	0.0044	−0.0007	0.0057	0.0072
	(0.0253)	(0.3499)	(0.5111)	(0.8575)	(0.8771)	(0.5978)	(0.9307)	(0.7747)	(0.3906)
INF	−0.0152	−0.0147	−0.0190***	−0.0179***	−0.0178***	−0.0151***	−0.0136***	−0.0109	−0.0094**
	(0.2165)	(0.3439)	(0.0000)	(0.0000)	(0.0000)	(0.0010)	(0.0033)	(0.5328)	(0.0364)
LGDP	2.2453***	2.0668***	2.2342***	2.1679***	2.1532***	2.0244***	1.8629***	1.6778***	1.5952***
	(0.0000)	(0.0024)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0085)	(0.0000)
LEXC	−0.9411	−0.5776	−0.4000***	−0.4577***	−0.4559***	−0.5546***	−0.4812***	−0.4244	−0.6168**
	(0.1698)	(0.4814)	(0.0012)	(0.0007)	(0.0012)	(0.0009)	(0.0025)	(0.6571)	(0.0338)
H_0:	−1.4002	−0.9312	−7.2525***	−6.3980***	−5.8300***	−4.6634***	−3.8713***	−0.5500	−1.4244
$\alpha_1 = \alpha_2$	(0.1646)	(0.3540)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0002)	(0.5836)	(0.1575)
Adjusted R^2	0.816890	0.844510	0.859033	0.860711	0.852453	0.836198	0.817861	0.790903	0.764876

Note(s): *p*-value is shown in the parenthesis. H_0: $\alpha_1 = \alpha_2$ is the Wald test for asymmetrical checking. Lastly, *, ** and *** indicate the significance at 10%, 5% and 1% level, respectively

Source(s): Authors' own creation

Indonesia to mitigate currency fluctuation risks on stock prices. The primary monetary objective of Indonesia is to achieve a stable currency through low and stable inflation.

Theoretically, this study contributes to advancing the knowledge of stock market performance by employing the general equilibrium model. Unlike other theoretical models, the general equilibrium model integrates macroeconomic variables to explain stock prices. This integration provides a comprehensive view of stock market dynamics, with inflation serving as an indicator of macroeconomic instability, particularly important in emerging economies where inflation negatively affects stock market performance. Additionally, macroeconomic variables such as exchange rate provide insights into developments in international markets that influence domestic stock market performance.

This study focuses on the asymmetric effects of macroeconomic variables from a monetary policy perspective, specifically inflation targeting, in the context of Indonesia. Future studies could extend this exploration by examining the asymmetric effects of macroeconomic variables based on key policy instruments of monetary policy in other Association of Southeast Asian Nations (ASEAN) countries, such as Malaysia, the Philippines, Singapore and Thailand. Moreover, future studies could consider incorporating United States economic policy uncertainty to enhance the prediction of stock prices, as the international transmission mechanism of monetary policy could be influenced by economic policy uncertainty in developed countries (Ozcelebi and Izgi, 2023). Furthermore, this study employs NARDL to estimate the models. Future studies could investigate other methodologies to identify the asymmetric effects of these predictors, such as generalized autoregressive conditional heteroskedasticity (GARCH).

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Supplementary material

Supplementary material for this article can be found online.

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