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How Long Can Macroeconomic Variables Affect the Islamic Index in Indonesia?

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Abstract

This study aimed to examine the effect of macroeconomic variables' lags on Indonesia's Islamic index. The influence of lag can determine how long macroeconomic variables affect the Islamic index. The macroeconomic variables observed for their impact on the Islamic index are inflation, industrial production index, interest rates, exchange rates, gold prices, money supply, and world oil prices from May 2011 to December 2021. The approach used is the Autoregressive Distributed Lag (ARDL) model. The results show that the lags of macroeconomic variables influence the sharia index. The time it takes to affect the stock varies. Inflation, gold prices, and the money supply need a minimum of 1 month to affect stock prices. Industrial production indices and exchange rates have a high-speed ability to influence stock price movements at that time. Interest rates and world oil prices take at least three months to affect stock prices.

Keywords : *ARDL; Islamic Index; Macroeconomics*

INTRODUCTION

The Islamic capital market is one of the Islamic finance sectors with yearly stable development. This development can be seen in the development of its products. In June 2022, the Indonesian Sharia Stock Index increased by 6.02%, the collection of Sukuk through the Securities Crowdfunding (SCF) mechanism

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increased by 859%, and the outstanding state Sukuk increased by 6.12%. However, sharia mutual fund products decreased by 7.15% (OJK, 2022). Although the increase in the value of sharia shares was not as significant as Sukuk, the largest capitalization was given by sharia shares, which amounted to Rp. 4.259.24 Trillion. It shows the public interest in sharia stock products compared to other products. Khoiruddin (2016) found that Islamic stocks can provide higher returns than Sukuk in the short term, and no significant difference was found between stock returns and Sukuk during the research period.

Maximum return can be obtained if investors consider several risks in each investment activity, both before and after holding investment products. One of these risks is systematic risk, which is the primary source of risk in portfolio returns that both cause and explain large movements in market returns (Aithal*et al.*,2019). Moreover, all companies in a region can feel the impact of changes in systematic risk (Sudarmanto *et al.,* 2021). According to Chen *et al.* (1986), these systematic factors are changes in macroeconomic variables. Therefore, changes in macroeconomic variables need to be considered in every investment decision in stock products, such as buying, selling, or maintaining the portfolio they hold.

Several studies have been conducted to determine the stocks' response to changes in macroeconomic variables. Syed (2021) and Chang & Rajput (2018) found that inflation, interest rates, exchange rates, and industrial production indices have long-term effects on stock price movements in India. Study Hashmi *et al.* (2021) found that oil prices have both short-term and long-term impacts on stock prices in oil-exporting and importing countries. Beh & Yew (2020) also tested that the export value, money supply, exchange rate, and gold price had short-term and long-term effects on stock prices in the United States. Panta (2020) concluded that stock price fluctuations in Nepal are closely related to changes in the money supply, interest rates, inflation, and exchange rates. Samour *et al.* (2020) also found that stock prices in Turkey are affected by changes in inflation, money supply, exchange rates, and interest rates in the long and short term. Sheikh *et al.* (2020) also prove that the money supply, interest rates, and inflation have long-term effects on the KSE-100 index.

The studies above use the Autoregressive Distributed Lag model only to examine macroeconomic variables' long-term and short-term effects on stock

indices. However, an essential aspect of the model that is often overlooked by previous research is the impact of lag, which can determine how long a variable takes to affect other variables. So the purpose of this study is to assess the effect of the macroeconomic variable lags on the stock index to find how long macroeconomic variables can affect stock prices. Investors can use the results of this study in making investment decisions. By observing changes in macroeconomic variables and knowing how long it takes to affect the stock index, investors can use this information to maximize expected returns and minimize investment risk.

LITERATUR REVIEW

Arbitrage Pricing Theory

Arbitrage Pricing Theory (APT) was developed by Ross (1976). This theory explains the relationship between risk and returns in an asset portfolio. In addition, APT can also calculate the fair price of an asset (Darmawan, 2022). Aithal *et al.* (2019) explain that an asset's risk can be in the form of systematic and unsystematic risks. Systematic risk is the primary risk source of an investment whose impact can be experienced by all companies and can cause significant changes in returns.

Meanwhile, unsystematic risk is a partial risk only experienced by specific companies or industries. The existence of an extensive and comprehensive impact of systematic risk always raises interest to be discussed in more depth. Systematic risk is a macroeconomic variable (Chen *et al.*, 1986). The stock price index is a statistical measure that reflects the overall price movement of a group of stocks selected based on certain criteria and methodologies and evaluated periodically (IDX, 2022). Stock prices can be used to estimate the expected return based on the Capital Asset Pricing Model (CAPM), which is the origin of the Arbitrage Pricing Theory (APT) (Darmawan, 2022).

Inflation and stock prices

According to Modigliani & Cohn (1979), high inflation rates can lead to low stock prices and vice versa. The rationale behind this statement is that

high inflation indicates low expected dividend growth or a high subjective risk premium. High inflation indicates an increased risk in investment. It causes a decrease in investor interest in the capital market. So the demand for shares will decrease. In the end, this will lower the stock price. Meanwhile, according to Martin (1983), inflation can increase the tax rate on the profits received by the company. Therefore, it can indirectly reduce the actual net return of each unit of capital (shares) received by investors. Both theories conclude that investors' profits are low if inflation is high. Campbell & Vuolteenaho (2004) states that inflation is highly correlated with mispricing (incorrect prices). Hence, investors form subjective growth estimates by extending data (information) from past nominal growth rates without adjusting for changes in inflation.

The relationship between inflation and stock prices has been tested in several studies. Shih & Hoang (2021) found that higher inflation can increase production costs and product selling prices. The increase in selling prices will impact decreasing market demand so that the company will respond by reducing output which ultimately results in a decrease in efficiency and profitability. Fuad & Yuliadi (2021) and Luwihono *et al.* (2021) found that an increase in inflation will reduce the real income of people with a fixed income. It will reduce purchasing power. Thus, the people's low purchasing power will reduce the demand for the company's products, resulting in consolidated net income. The study results of Eldomiaty *et al.* (2020) show that inflation negatively impacts stock prices. Based on the description above, the hypotheses offered are as follows:

H1: the lag of the inflation variable can affect stock prices

Industrial production index and stock price

Tse (2015) explains that industrial production is a fundamental market aspect. The value of the industrial production index is close to the value of real GDP (Umam *et al.*, 2019). Therefore, this value can be used as a measure of the productivity of a country. Finding Humpe & McMillan (2020) explains that higher economic output or industrial production leads to higher stock prices. Higher industrial production signals higher future cash flows and lower risk. Finding Ahmed & Sarkodie (2021) also explained that increased industrial production

led to solid growth and performance of an economy. More robust economic performance results in higher corporate earnings and dividend payments to shareholders, resulting in higher share prices. Based on the description above, the hypotheses offered are as follows:

H2: the lag of the industrial production index variable can affect stock prices

Interest rates and stock prices

According to the hypothesis of Cornell (1983), stock prices will fall due to the actual component of the nominal interest rate, which is expected to increase. The increase can affect the share price directly and indirectly. This increase instantly shows that the real discount rate or interest on loans and bonds increases so that the rate of return on the money market is more profitable than the return on the capital market (investment). Finally, the demand for stocks decreases and stock prices also fall. Indirectly, an increase in the actual discount rate will cause a reduction in the firm's output. It is due to the addition of loan interest expense that must be paid by the company so that it must reduce production costs, which will reduce the amount of production. The number of decreased production indicates the level of profit and the company's performance is declining. Thus, the demand for shares will decrease, and the stock price will eventually fall (Hardouvelis, 1987).

Conrad (2021) found that the decline influences stock prices in interest rates. Low-interest rates lead to an increase in the value of dividends. It is an implication of the lower loan interest expense that must be paid by the company so that the company's profits are higher and the dividends distributed will be higher. According to Fuad & Yuliadi (2021), lower interest rates can be used by companies to expand a business. On the other hand, according to Ghazo *et al.* (2021), an increase in actual interest rates will harm investment decisions. Two conditions can explain this. The first condition is when interest rates are high, and investors are willing to borrow to speculate on the stock market, the increase in costs (borrowing interest) experienced by investors is more heightened. Therefore, it limits his investment decisions in the stock market. The second case is when actual interest rates are high and investors are willing to invest their

funds in the stock market, investors will prefer to deposit their funds in banks rather than take risks in the stock market. As a result, there is less investment or demand for shares. Even though companies that are members of ISSI are free from bank interest transactions, interest movements can directly affect investor behaviour (including Muslim investors) which impacts stock demand. Based on the description above, the hypotheses offered are as follows:

H3: The lag of the interest rate variable can affect stock prices

Exchange rates and stock prices

According to Kurniati & Hardiyanto (2003), excessive exchange rates can lead to economic instability. According to Crowley & Lee (2003), foreign exchange rate volatility can hinder capital flows by increasing the risk and uncertainty in foreign direct investment. Therefore, the exchange rate must form a balance. Study Qing & Kusairi (2019) found that the capital market performs better when the exchange rate is low (domestic currency strengthens). Study Ding (2021) also proves that when the dollar strengthens, stock prices in the United States rise. A stronger local currency will make investors more daring to invest. The local currency's strength positively impacts the company so that it can maintain and even increase company profits. The company's profit increases, as well as the distribution of dividends, which also increases, so the demand for shares will also increase, and the share price will increase (Ranto, 2019). Some of the statements above explain the negative relationship between exchange rates and stock prices.

However, according to Ghazo *et al.* (2021), The strengthening of the local currency has made foreign investors reluctant to invest in the domestic capital market. It is due to the higher share price for foreign investors, so the money that must be spent to buy shares is more extensive or expensive. Thus, foreign investors' demand for shares will decrease, and share prices will fall. Based on the description above, the hypotheses offered are as follows:

H4: the lag of the exchange rate variable can affect the stock price

Gold price and stock price

Gold is one of the most sought-after commodities by the public. Apart from jewellery, gold can also be used as an alternative investment. Gold price changes can cause changes in other investment alternatives, one of which is stocks. It is due to gold's low risk (Syahri & Robiyanto, 2020). Thus, investing in gold tends to be more attractive to investors, especially in uncertain economic conditions (Hidayat & Sudjono, 2022). Chkili (2022), Tuna (2022), Baur & Lucey (2010), and Barunik *et al.* (2016) agreed that gold could be used as an alternative to hedging compared to the capital market during uncertain economic and political conditions. Arisandhi & Robiyanto (2022) found that gold prices positively correlate with ASEAN-5 stock prices. Garnia *et al.* (2022) prove that the price of gold positively affects returns in the property sector. Finding Prasad *et al.* (2022) emphasized that the price of gold is one of the strong predictors of the volatility of the CBOE VIX index in the United States. Based on the description above, the hypotheses offered are as follows:

H5: the lag of the gold price variable can affect the stock price

Money supply and stock price

Conrad (2021) explains the positive relationship between the money supply and stock prices in three ways. First, higher economic productivity causes the demand for stock prices to rise and stock prices to rise. Therefore, the central bank must provide money or increase the money supply to prevent deflation. Second, the amount of money in circulation causes an increase in purchasing power or demand for assets so that the stock price will rise with a constant number of shares. Third, an increase in the money supply leads to a lower interest rate and, thus, a lower discount rate for future cash flows from the firm's expected profits.

Study Qing & Kusairi (2019) support the second reason of Conrad (2021). The findings prove that expansionary monetary policy has boosted the economy and increased cash flows in society. It causes the demand for stocks and other assets also to increase. After translating this need into actual purchases, the stock price may rise. Study Conrad (2021) found that the money supply directly impacted stock prices. Central banks have a strong responsibility for the stock market if

they increase the money supply disproportionately to actual production. If an increase has followed an expansionary monetary policy in stock prices, this policy must be issued slowly. Otherwise, there will be a crash. Based on the description above, the hypotheses offered are as follows:

H6: the lag of the money supply variable can affect stock prices

World oil prices and stock prices

Prasad *et al.* (2022) explained that oil price strongly predicts stock price volatility. Brown & Yücel (2002), Doğrul & Soytas (2010), and Lardic & Mignon (2008) explained that higher oil prices lead to an increase in the marginal cost of production, so with this additional cost, the company will cut production costs, such as raw materials and labour. As a result, it causes the quantity of production to decrease and unemployment to increase. Both of these phenomena indicate a declining economic performance, so investors will be reluctant to invest because the expected profit prediction is small. Thus, the stock price will fall.

Berument & Taşçı (2002) and Cologni & Manera (2008) also explained that the export-import activity of oil causes a transfer of wealth from the importing country to the exporting country. As a result, it causes the demand or purchasing power of products in the importing country to decline, which makes the economy sluggish and ultimately lowers stock prices. Furthermore, considering the effects of inflation, Berument & Taşçı (2002) and Lardic & Mignon (2008) explained that high oil prices will increase production costs so that to cover these costs, the company will increase the selling price of goods. As a result, it causes demand or purchasing power will decrease so that the stock price will fall.

According to Kilian (2010) and Sadorsky (1999), higher oil prices cause a decrease in disposable income so that consumption or purchasing power of investment products decreases, investment or productivity decreases because company costs increase, and stock prices decrease because decreased productivity causes decreased profits or even losses. Therefore, based on the description above, the hypotheses offered are as follows:

H7: the lag of the world oil price variable can affect stock prices

RESEARCH METHOD

This research is quantitative with a causal study type to find the relationship between one variable and another (Sekaran & Bougie, 2019). The variables to be tested as systematic risks are macroeconomic variables consisting of inflation (CPI), industrial production index (IPI), interest rates (IR), exchange rates (EXC), gold prices (GOLD), money supply (M2) and world oil prices (OIL). Indonesia has several sharia indices listed on the Indonesia Stock Exchange. Therefore, we choose the Indonesian Sharia Stock Index (ISSI), which is a stock index containing 469 shares issued by Islamic issuers in Indonesia. Thus, the dependent variable in this study is ISSI. The observed data started from May 2011 to December 2021, totalling 128 observations.

Finding out how long it takes for macroeconomic variables to affect the Indonesian Sharia Stock Index, we use the Autoregressive Distributed Lag (ARDL) method. This time series data testing method includes the lag (past variable) of the independent variable as the independent variable. The maximum lag we use in this study is 12 because the data used is monthly. The equations formed by the ARDL model are as follows:

$$\Delta ISSI_t = \beta_0 + \beta_1 ISSI_{t-1} + \beta_2 CPI_{t-1} + \beta_3 IPI_{t-1} + \beta_4 IR_{t-1} + \beta_5 EXC_{t-1} + \beta_6 GOLD_{t-1} + \beta_7 M2_{t-1} + \beta_8 OIL_{t-1} + \sum_{i=1}^{n} a_{1i}\, \Delta ISSI_{t-1} + \sum_{i=1}^{n} a_{2i}\, \Delta CPI_{t-1} + \sum_{i=1}^{n} a_{3i}\, \Delta IPI_{t-1} + \sum_{i=1}^{n} a_{4i}\, \Delta IR_{t-1} + \sum_{i=1}^{n} a_{5i}\, \Delta EXC_{t-1} + \sum_{i=1}^{n} a_{6i}\, \Delta GOLD_{t-1} + \sum_{i=1}^{n} a_{7i}\, \Delta M2_{t-1} + \sum_{i=1}^{n} a_{8i}\, \Delta OIL_{t-1} + e_t \quad (1)$$

Testing of the above equation is carried out in several stages. First, test the stationarity of the data with two methods, namely the unit root test with Augmented Dickey-Fuller (ADF) and Phillips Perron (PP). (Widarjono, 2018). Second, perform a cointegration test by testing the stationarity of the residuals or errors. If the residual is stationary, then there is cointegration. The ARDL method requires three things, namely the data has a different level of stationarity, all data are stationary at the first difference, and there is cointegration. Third, estimate

the ARDL model above using the OLS method with a general to a specific method to get the best model, eliminating insignificant lags. The ARDL model is often used to examine the long-term effect. However, we focus on the discussion of the impact of the lag variable and ignore the long-term effect of macroeconomic variables to achieve this study's objectives. Fourth, estimate the ARDL model with the Error Correction Model (ARDL-ECM model) to determine the impact of the lag variable. The following equation shows the ARDL-ECM model:

$$\Delta ISSI_t = \alpha_0 + \sum_{i=1}^{n} a_{1i}\,\Delta ISSI_{t-1} + \sum_{i=1}^{n} a_{2i}\,\Delta CPI_{t-1} + \sum_{i=1}^{n} a_{3i}\,\Delta IPI_{t-1} + \sum_{i=1}^{n} a_{4i}\,\Delta IR_{t-1} + \sum_{i=1}^{n} a_{5i}\,\Delta EXC_{t-1} + \sum_{i=1}^{n} a_{6i}\,\Delta GOLD_{t-1} + \sum_{i=1}^{n} a_{7i}\,\Delta M2_{t-1} + \sum_{i=1}^{n} a_{8i}\,\Delta OIL_{t-1} + \emptyset ECT_{t-1} + e_t \quad (2)$$

RESULTS AND DISCUSSION

We conducted several preliminary tests, namely descriptive statistical analysis, data stationarity test, and cointegration test before conducting a more in-depth analysis of the effect of macroeconomic variable lags on stock prices. Table 2 depicts descriptive statistics of the variables observed from May 2011 to December 2021. Those variables are the Indonesian Sharia Stock Index (ISSI), inflation (CPI), industrial production index (IPI), interest rates (IR), exchange rates (EXC), gold prices (GOLD), money supply (M2) and world oil prices (OIL). The average value of the ISSI variable is Rp. 163.2157 with a maximum and minimum value of Rp. 197.46 and Rp. 115.42 and the standard deviation of 20.1488. The maximum and minimum values of inflation, respectively, are 0.0879% and 0.0132%, with an average of 0.041593% and a standard deviation of 0.019277. The interest rate variable has a maximum and minimum value of 7.75% and 3.5%, respectively, with an average value of 5.693359% and a standard deviation of 1.331853.

Descriptive Statistics

Table 2
Descriptive Statistics

Variable	mean	Maximum	Minimum	Std. Dev.
ISSI	163.2157	197.46	115.42	20.1488
CPI	0.041593	0.0879	0.0132	0.019277
IR	5.693359	7.75	3.5	1.331853
EXC	12680.85	16367.01	8508	1964,637
GOLD	1474,898	2027	1121	223.2959
M2	4826183	7867090	2475286	1370913
WTI	67.48500	107.6500	18.84000	22.59841

Source: Data processed 2022

The exchange rate variable has a maximum and minimum value of Rp.16367.01 and Rp.8508, with an average of Rp.12680.85 and a standard deviation of 1964,637. The gold price variable has a maximum and minimum value of US$ 2027 and US$ 1121, with an average value of US$ 1474,898 and a standard deviation of 223,2959. The money supply variable has a maximum and minimum value of Rp. 7867090 billion and Rp. 2475286 billion with an average of Rp. 4826183 billion and standard deviation 1370913. The world oil price variable has a maximum and minimum value of US$ 107.65 and US$ 18.84, with an average of US$ 67,485 and a standard deviation of 22,59841

Next, we conducted a stationarity test to determine whether the ARDL model could be applied to the research data. Table 3 presents the results of the data stationarity test of the variables in this study.

Stationarity Test

Table 3
Stationarity Test

Variable	ADF		PP	
	Level	1st Diff.	Level	1st Diff.
LISSI	-2.116834	-9.849424***	-2.275795	-9.844874***
CPI	-1.387725	-8.715734***	-1.661764	-8.403819***
IR	-0.779608	-7.411812***	-0.901903	-7.561675***
LEXC	-1.852101	-12.34435***	-1.699852	-12.72877***
LGOLD	-1.761807	-12.11416***	-1.532868	-12.65028***
LM2	-3.364904*	-15.49775***	-3.422581**	-15,78169***
LWTI	-2.231081	-8.876146***	-2.285609	-9.983713***

Note: Signs ***, **, * indicate that the data is stationary at =1%, =5%, and =10%

Source: Data processed 2022

The data stationarity test using ADF and PP showed that the ISSI, CPI, IR, LEXC, LGOLD, and LWTI variables were stationary at the first difference level. In contrast, LM2 has been stationary at level. Thus, based on the results of the data stationarity test, the ARDL model can be used. Furthermore, a cointegration test is carried out, the second requirement of the ARDL model. Table 4 shows the results of the cointegration test of the model.

Cointegration Test

Table 4
Cointegration Test

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistics		-5.311130	0.0000
Test critical values:	1% level	-3.482453	
	5% level	-2.884291	
	10% level	-2.578981	

Source: Data processed 2022

Based on the results of the cointegration test, it was found that the t-statistic was greater than the t-table (-5.311130>-3.482453) at a significance level of 1%, and the probability value was less than 0.01. It means that the residual model is stationary at level, and cointegration occurs so that all the conditions for using the ARDL model are met. Table 5 presents the estimation results of the ARDL-ECM model (equation 2) to determine the effect of lag (Δ) macroeconomic variables.

ARDL-ECM Model Estimation

Table 5
ARDL-ECM model estimation results

Variable	Coefficient	Std. Error	Variable	Coefficient	Std. Error
ΔCPI_{t}	-0.123862	0.495903	$\Delta LEXC_{t-2}$	-0.228154*	0.131865
ΔCPI_{t-1}	1.093140*	0.552396	$\Delta LEXC_{t-3}$	-0.156369	0.127321
ΔCPI_{t-2}	1.053192*	0.554102	$\Delta LGOLD_{t}$	-0.093621	0.066519
ΔCPI_{t-3}	1.997571***	0.558775	$\Delta LGOLD_{t-1}$	0.449235***	0.095139
ΔIPI_{t}	-0.001437***	0.000536	$\Delta LGOLD_{t-2}$	0.485369***	0.095613
ΔIPI_{t-1}	0.001805**	0.000694	$\Delta LGOLD_{t-3}$	0.297947***	0.092512
ΔIPI_{t-2}	0.001443**	0.000647	$\Delta LGOLD_{t-4}$	0.373207***	0.090693
ΔIPI_{t-3}	0.002753***	0.000573	$\Delta LGOLD_{t-5}$	0.439223***	0.081798
ΔIPI_{t-4}	0.002549***	0.000582	$\Delta LGOLD_{t-6}$	0.237656***	0.077512
ΔIPI_{t-5}	0.002839***	0.000590	$\Delta LGOLD_{t-7}$	0.013089	0.074968
ΔIPI_{t-6}	0.001318**	0.000594	$\Delta LGOLD_{t-8}$	0.198093***	0.065109
ΔIPI_{t-7}	0.001430*	0.000583	$\Delta LGOLD_{t-9}$	0.226394***	0.066616
ΔIPI_{t-8}	0.001609***	0.000541	$\Delta LGOLD_{t-10}$	0.179672***	0.064064
ΔIPI_{t-9}	0.001340***	0.000450	$\Delta LGOLD_{t-11}$	0.143910**	0.060893
ΔIR_{t}	-0.022198	0.016456	$\Delta LM2_{t}$	0.015648	0.237024
ΔIR_{t-1}	0.002727	0.017373	$\Delta LM2_{t-1}$	-0.453316	0.245055
ΔIR_{t-2}	0.018571	0.017666	$\Delta LM2_{t-2}$	0.241520	0.253058
ΔIR_{t-3}	0.065365***	0.017878	$\Delta LM2_{t-3}$	0.668457**	0.257754
ΔIR_{t-4}	0.034748*	0.017841	$\Delta LM2_{t-4}$	1.132945***	0.240962
ΔIR_{t-5}	-0.018773	0.017504	$\Delta LM2_{t-5}$	0.612882***	0.222225
ΔIR_{t-6}	0.043766***	0.016292	$\Delta LWTI_{t}$	0.012083	0.022180
ΔIR_{t-7}	0.030995*	0.016081	$\Delta LWTI_{t-1}$	-0.001994	0.023606

$\Delta LEXC_{t}$	-0.963260***	0.129155	$\Delta LWTI_{t-2}$	0.014247	0.025075
$\Delta LEXC_{t-1}$	0.079021	0.130385	$\Delta LWTI_{t-3}$	0.074625***	0.027346
ECT_{t-1}*	-0.314094***	0.043096			
R^2		0.810678			
White Test		48.17931			
LM Test		1.917403			
CUSUM Test		StablE			

Note: Signs ***, **, * indicate that the data is significant at =1%, =5%, and =10%

Source: Data processed 2022

Based on the estimation results in table 5, the ARDL-ECM model (3, 9, 7, 3, 11, 5, 3) is obtained, which explains the effect of macroeconomic variables in the short term. These figures clarify that the optimum lags of the CPI, IPI, IR, LEXC, LGOLD, LM2 and LWTI are 3, 9, 7, 3, 11, 5, and 3. used as a measure of how long a macroeconomic variable can affect stock price movements. Based on table 5, it is known that inflation takes a maximum of 3 periods or three months to affect stock prices. The fastest is one period or one month after changes in the inflation variable occur. The industrial production index variable takes a maximum of 9 periods or nine months and the fastest period at that time to influence stock price movements. The interest rate variable takes a maximum of 7 periods or seven months and a maximum of 3 periods or three months to affect stock prices. The exchange rate variable takes a maximum of 2 periods or two months and is the fastest at that time to affect stock prices. The gold price variable takes a maximum of 11 periods or 11 months and a maximum of 1 period or one month to affect stock prices. The money supply variable takes a maximum of 5 periods or five months and a maximum of 1 period or one month to influence stock prices. Meanwhile, world oil prices need a maximum of 3 periods or three months to affect stock prices. In conclusion, the macroeconomic variables used in this study have a short-term effect on stock prices accompanied by differences in the effects of lag.

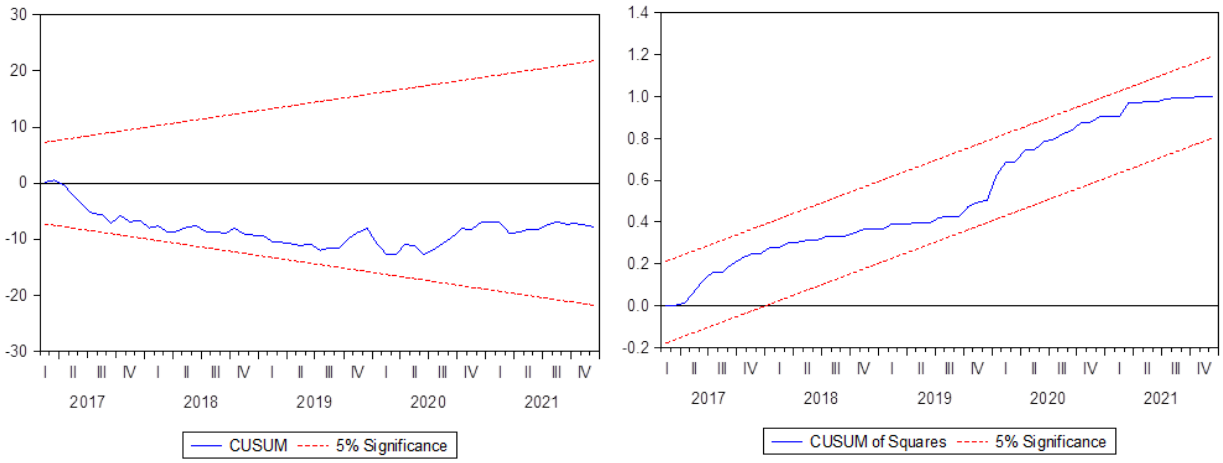
We performed several tests at the bottom of table 5 to ensure whether the model formed was free from problems. The tests are the validity test (Error Correction Term), the goodness of the model (R^2 test), the heteroscedasticity test (white test), the autocorrelation test (LM test) and the stability test (CUSUM test).

The negative and significant ECT coefficient value indicates that the ARDL-ECM model formed is valid. The R^2 value of 0.810678 indicates that macroeconomic variables in this study can explain 81% of the movement that occurs in stock prices. Based on the white test and LM test, the model does not have heteroscedasticity and autocorrelation problems, and the results from the CUSUM test show that the model formed is stable.

The results of the CUSUM test are shown in the following figure:

Figure 1

Stability Test



Source: Data processed 2022

Discussion

Based on the estimation results, it can be concluded that macroeconomic variables are proven to be a systematic risk to stock prices. These results are in line with the arbitrage pricing theory developed by Ross (1976). Movements in macroeconomic variables affect stock prices which are the return projections for investors. The response of stock prices to the inflation variable is positive. This finding is in line with the findings of Junaidi *et al.* (2021), Humpe & McMillan (2020), and Norehan & Ridzuan (2020). Good capital market conditions cause a positive effect on inflation. According to Kumar & Sahu (2018), investment in the capital market can protect the value of money from the impact of inflation. Thus, higher inflation causes an increase in the number of investments and

demand for shares which causes stock prices also to increase. Inflation can affect stock prices fairly quickly, within a month, so investors must be careful of changes in inflation. Especially in uncertain economic conditions such as during the current pandemic.

The industrial production index also has a positive impact on stock prices. This finding is in line with MY Ahmed & Sarkodie (2021) and Humpe & McMillan (2020). A high production index indicates high economic productivity. It signals high cash flow, good company performance and positive dividend expectations. Thus, investment activity will be more excellent, and the demand for shares will be higher and cause stock prices to also be higher. The very rapid response of stock prices to changes in the value of the industrial production index indicates the response of investors who are also quick in making investment decisions when economic conditions are good.

Stock prices also responded positively to changes in interest rates. This finding is in line with Alqaralleh *et al.* (2021) and Gu *et al.* (2021). Two things can cause this positive effect. First, there is an engineering demand from investors when interest rates rise. Rising interest rates can harm investors because the demand for shares will decrease because many investors prefer to deposit their money rather than invest in the capital market. Therefore, investors with significant capital will manipulate the demand for shares so that stock prices rise or remain stable despite high-interest rates. Second, the central bank's contractionary monetary policy through interest instruments was ineffective, so even though interest rates rose, stock prices remained buoyant due to good capital market conditions.

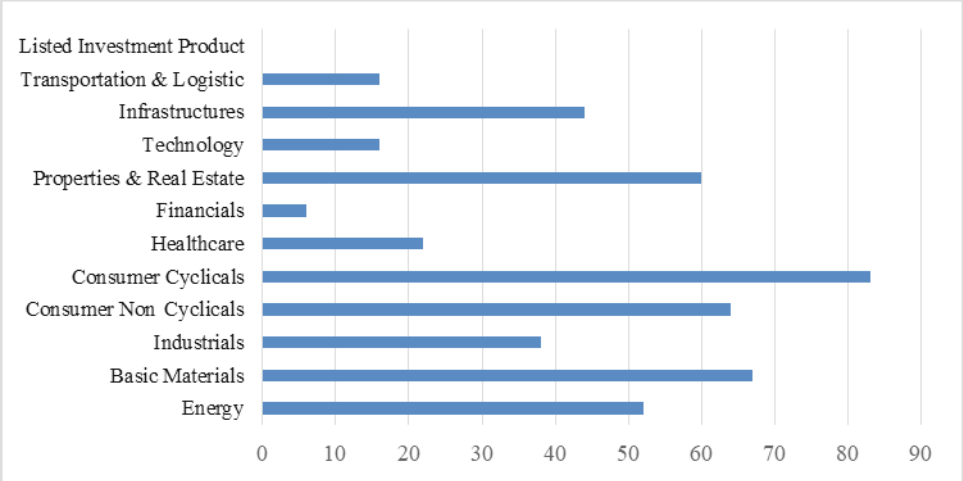
Exchange rates have a high-speed ability to affect stock prices negatively. This finding is in line with the results of Jufri & Haryono (2022) and Ding (2021). The finding concludes that a high exchange rate indicates economic instability so that the projected return expected by investors will fall and cause stock demand to decline. Therefore, investors' interest in investing will decrease when the exchange rate is high (Luwihono *et al.*, 2021). Stock prices also respond reasonably quickly to changes in gold prices, one period or month. The positive effect given by the price of gold on stock prices is in line with the findings of Arisandhi & Robiyanto (2022), Garnia *et al.* (2022), and Prasad *et al.* (2022). The result indicate

that the low risk of investing in gold amid economic uncertainty makes gold more desirable as an alternative to hedging than investing in the capital market.

The money supply takes a minimum of 3 months to affect stock prices positively. This positive effect is in line with the findings of A. Conrad (2021), Godfrey (2021), and Junaidi *et al.* (2021) that the more money people hold, the economy will be stimulated both in terms of production and consumption. On the other hand, oil prices also take three months to affect stock prices. However, oil prices have a positive influence on stock prices. Therefore, it is not following the hypothesis that was built and the findings of Ghazo *et al.* (2021), Bagautdinova *et al.* (2021), and Olanrewaju & Oladipo (2021). The most likely rationalization of this result is that not all companies listed on the Indonesian stock exchange use oil as a production staple. This opinion is in line with data from the Indonesia Stock Exchange (figure 2). The data shows the classification of companies in ISSI by sector. Based on Figure 2, it is known that companies in the consumer cyclicals, basic materials, consumer non-cyclicals and properties and real estate sectors dominate the companies included in ISSI. Meanwhile, companies that use oil as their main production material are companies in the energy sector which are fewer than the four sectors. This shows the limitations of oil prices to affect stock prices negatively.

Figure 2

Companies' Classification based on sector



Source: Data processed 2022

CONCLUSION

Based on the test results, it can be concluded that the lag of macroeconomic variables influences stock prices. The time it takes to affect the stock varies. Inflation, gold prices, and the money supply need a minimum of 1 month to affect stock prices. Industrial production indices and exchange rates can easily influence stock price movements at that time. Interest rates and world oil prices take at least three months to affect stock prices. Investors can use the results of this study in making investment decisions. By observing changes in macroeconomic variables and knowing how long it takes to affect the stock index, investors can use this information to maximize expected returns and minimize investment risk. The limitations of this research are that it does not provide information about stock price forecasting that can be done by the ARDL method, the observed macroeconomic variables are still small, and the research period is short. Future research is expected to improve this study by completing these limitations.

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