THE ASSOCIATION BETWEEN STOCK PRICES AND MACROECONOMIC VARIABLES. IS THERE A LINK BETWEEN THE JCI, INTEREST RATES, INFLATION AND THE EXCHANGE RATE IN INDONESIA?

Dyah Dwi Zubaidah, David Kaluge, Marlina Ekawaty
Brawijaya University
Jl. Veteran No.169, Malang City, East Java, 65145, Indonesia
dyahdwizubaidah@gmail.com

ABSTRACT

The long-term relationship between JCI (Jakarta Composite Index), exchange rates, interest rates, and inflation in Indonesia is crucial for economic stability, policymaking, market performance, and investment decisions. The data from Januari 208-December 2022 show some findings. The analysis by VECM indicates a positive feedback loop between the stock market index and bank reserves, with inflation positively impacting the stock market index. The exchange rate is influenced by all three variables. Over time, the influence of the BI rate on the stock market increases, inflation fluctuates, and the exchange rate's influence decreases. The ability of JCI and inflation to affect the exchange rate grows, while the exchange rate stabilizes but gradually declines after an initial rise. Policymakers can use the insights from the positive feedback loop between the stock market index and bank reserves to design policies that promote a stable and mutually reinforcing relationship between these variables. It is due to any fluctuations in the stock market index, bank reserves, or inflation could potentially impact the exchange rate, affecting the competitiveness of Indonesian goods and services in the global market. For the market participants, adequate risk management strategies can be adopted to mitigate potential risks arising from these variables.

Keywords: JCI, Exchange Rate, Inflation, Interest Rate, Vecm

INTRODUCTION

JCI (Indeks Harga Saham Gabungan - IHSG), interest rates, exchange rates, and inflation are closely related to a country's macroeconomic conditions. Indonesia is a country with a large and important economy in Southeast Asia. The study of how these variables interact will help in understanding their impact on economic stability and long-term growth. The stability of the Indonesian economy is essential for sustainable growth and development. The long-term association between the IHSG, exchange rates, interest rates, and inflation can offer insights into the overall economic stability of the country. Understanding these relationships can assist policymakers in formulating appropriate monetary and fiscal policies to maintain economic stability.

According to Leeni and Oki (2017) the capital market influences economic growth positively. Pradhan, et al (2015) explained that there is a long-term balance relationship between economic growth, inflation and capital market development. Meanwhile, in the short term, there is a unidirectional causality relationship. Inflation is also known to have a relationship with the stock market in Jordan.

Apart from the macroeconomics, there is also an impact on dynamic financial markets. The Indonesian financial market has dynamic characteristics and continues to grow. Changes in the JCI and exchange rates can affect the performance of the business and trade sectors, while inflation rates can impact purchasing power and price stability. Therefore, a deeper understanding of the long-term relationship between these variables can assist market participants in making investment decisions and risk management.

The stability and resilience of financial markets are crucial for attracting investments and supporting economic growth. Research on the long-term relationship between these variables can help identify potential vulnerabilities and risks in the financial system and inform policymakers about necessary measures to maintain market stability.

The government and central bank of Indonesia use data on the IHSG, exchange rates, interest rates, and inflation to formulate policies that can mitigate economic challenges and support growth. Knowledge of the long-term relationship between these variables can help policymakers make informed decisions that impact various aspects of the economy, including trade, investment, and inflation control.

The IHSG reflects the performance of the Indonesian stock market, making it an essential indicator of overall market sentiment and economic health. Exchange rates play an important role in determining the competitiveness of Indonesian goods and services in the global market. On the other hand, interest rates and inflation are vital monetary policy tools that influence borrowing costs, consumer spending, and investment decisions. Understanding the long-term relationship between these variables can provide valuable insights into the dynamics of the Indonesian economy.

Investors, both domestic and foreign, consider the IHSG, exchange rates, interest rates, and inflation when making investment decisions. A comprehensive study of the long-term relationship between these variables can help investors assess risk and potential returns more accurately, leading to more informed investment choices. Therefore it is important to maintain the stability of these variables to intensify the economics.

LITERATURE REVIEW

The financial markets weave a complicated web of relationships that connect stock prices, inflation, interest rates, and currency rates, impacting global economic dynamics. Stock prices are influenced by a variety of factors, including business performance and market sentiment, as well as macroeconomic pressures. The rise in general price levels, affects stock prices through its impact on consumer purchasing power and corporate profitability. When inflation rises, customers may reduce their spending, hurting companies' revenues and earnings and, as a result, stock prices. Interest rates are important because they influence borrowing costs for both businesses and consumers.

Higher interest rates can lower consumer spending and corporate borrowing, so affecting company profitability and, as a result, stock values. Currency fluctuations have an impact on earnings when converting foreign revenues back to the local currency for internationally active enterprises. Furthermore, exchange rates affect the competitiveness of exports and imports, which in turn affects company financial performance and stock prices. These links are closely monitored by investors, making financial markets extremely sensitive to changes in inflation, interest rates, and also exchange rates.

The Association Between JCI, Exchange Rate, Inflation, and Interest Rate

Several studies have examined the relationship between JCI and macroeconomic factors. They are interest rates, exchange rates, and inflation. JCI is the main stock market index in Indonesia and reflects the performance of the Indonesian stock market. JCI or Composite Stock Price Index is the main indicator that reflects the condition of the stock market in Indonesia. JCI is influenced by various factors, including macroeconomic conditions. When Indonesia's macroeconomic conditions are good, such as stable and high economic growth, the JCI tends to rise. Conversely, if macroeconomic conditions are bad, such as low economic growth or a recession, the JCI tends to fall.

In simple terms, interest rates affect the capital market through various channels. If interest rates rise, investors will logically choose to invest in banks, and if interest rates fall, investors will be more interested in the capital market. For China, what plays a major role in the transformation of oil prices is the interest rate market which ultimately also has an impact on the Chinese stock market (Wei et all, 2019).The study conducted by Egilsson (2020) investigates the relationship between interest rates, inflation, and exchange rates.

It highlights the transmission channels of monetary policy, where changes in interest rates affect the exchange rate and subsequently impact inflation. The study discusses the demand-pull effects and cost-push effects associated with changes in interest rates. The findings suggest that interest rate changes can cause inflation and currency depreciation. Another finding from Eldomiaty et al (2020) also explain that there is cointegration between stock prices, changes in stock prices brought on by inflation rates, and changes in stock prices brought on by real interest rates. Inflation has negative association with stock price while interest rates has positive relation.

Exchange rate represents a country's currency against another country's currency. Exchange rates also have a significant influence on macroeconomic conditions. If the rupiah exchange rate against foreign currencies weakens, for example against the US dollar, then this can have a negative impact on Indonesia's macroeconomic conditions. The weakening of the rupiah exchange rate will make import prices more expensive, which in turn can cause inflation to increase. Apart from that, the weakening of the exchange rate can also affect the JCI, because it can reduce the interest of foreign investors to invest in the Indonesian stock market.

The exchange rate is also related to inflation. If the rupiah exchange rate weakens, then the price of imported goods will rise, which can cause inflation. Inflation is a general and continuous rise in the prices of goods and services in an economy. High inflation can disrupt economic stability and reduce people's purchasing power. Therefore, the government needs to control inflation so that it does not get too high and has a negative impact on macroeconomic conditions

The presence of two-way causality over a long time scale and strong coherence between stock prices and exchange rates (Afshan et al, 2018) also picture the relationship. The evidence from Pakistan highlight the long term relationship between stock price and exchange rate (Bayer and Hanck, 2013). Boonyanam (2014) establishes a long-run relationship between monetary variables and stock prices in the context of Thailand's emerging economy. While there is no short-run adjustment towards the long-run equilibrium, narrow money and interest rates exhibit significant short-term effects on stock prices, and the bidirectional and unidirectional causality between various factors provides valuable insights for investors and policymakers in making effective investment decisions and policy designations.

The relationship between stock prices and inflation can be complex and is influenced by several factors. Inflation can impact the purchasing power of consumers and the profitability of businesses. Moderate inflation may lead to an increase in stock prices because it can boost corporate revenues and earnings, leading to higher stock valuations. This is known as the "wealth effect," where investors see their stocks appreciate in value relative to the declining purchasing power of money. Investor perception of inflation and its potential impact on the economy can influence stock market behavior. Expectations of higher inflation in the future may lead investors to adjust their portfolios, which can affect stock prices.

The chanel between inflation and stock price can be through intermediary interest rates. If inflation rises, central banks may respond by raising interest rates to keep it in check. Higher interest rates can make borrowing more expensive, resulting in lower consumer spending and company investment. This may have an adverse effect on business earnings and stock values.

Interest rate changes can have a considerable impact on stock values, and the relationship between the two is intricate and multidimensional. Interest rates have an impact on the cost of borrowing money for businesses. Borrowing costs fall when interest rates are low, making it less expensive for firms to finance their operations and invest in growth possibilities. Companies may benefit from increased profitability and higher stock prices as a result of this. Several research support the idea that the inflation rate has a detrimental impact on emerging capital markets. Thisi finding comes from several countries such as Ghana (Adusei, 2014), Nigeria (Uwubanmwen and Eghosa, 2015), and Kenya (Jepkemei, 2017).

Bhuiyan and Chowdhury (2012) also explain that there is a long-term relationship between industrial production, money supply and long-term interest rates with the sectors in the stock market. There is also research which reveals that exchange rates and interest rates affect the stock market in the agricultural sector and inflation has no effect (Akbar, Yuliana and Marwa, 2016)

Market sentiment and investor perceptions of interest rate movements can also be influential. Short-term swings in stock prices might occur as investors modify their positions in response to interest rate shift. It also has an impact on the opportunity cost for investors. When interest rates are low, the rewards on safer investments such as bonds may be less appealing when contrasted to the possible gains on equities. As a result, investors may be more likely to invest in stocks, potentially leading to increased demand and higher stock prices.

Interest rates often reflect broader economic conditions. When interest rates are low, it may signal an accommodative monetary policy and a favorable economic environment, which can boost investor confidence and drive stock prices higher. Conversely, rising interest rates may be seen as a response to an overheating economy, potentially leading to concerns about future economic growth and impacting stock prices negatively.

All those variables somehow connected. As mentioned by Khataybeh & Ghassan (2021), The impact of real GDP on the ASE market index and its market capitalization is negative and significant. Furthermore, while the influence of the consumer price index on the market index is insignificant, the effect on market capitalization is negative and significant. In Indonesia, changes in the currency rate have a substantial impact on the financial sector stock price index.. Inflation and the BI rate have no significant effect on the financial sector stock price index (Yunita, Robiyanto, 2018). A negative relationship between interest rate, inflation and trade and market capitalization, and a positive relationship between GDP growth rate and the Nigerian stock exchange's market capitalization was found by Olokoyo et al. (2020) With so many various research findings, this study will show whether there is a long-term relationship between the JCI, interest rates, inflation, and currency rates.

METHODS

This paper examine the impact of interest rate, exchange rate, and inflation on JCE (IHSG) in Indonesia during the monthly period Januari 2018- December 2022. To carry out this, the specify model is:

$$JCE_t = \lambda + \beta_1 BR_t + \beta_2 RP_t + \beta_3 INF_t + \varepsilon_t \quad (1)$$

Where JCE is Jakarta Composite Index, BR is interest rate in Indonesia (BI Rate), INF is inflation, The parameters' expected indications are $\lambda>0$, $\beta_1>0$, $\beta_2>0$, $\beta_3>0$. The error term (ε) is assumed to be is independent and identically in its distribution. Finally, the subscript (t) stands for the period used in the analysis (Januari 2018- December 2022). Tthis research has 60 observations (time series), thus we follow 5 steps to do the examination.

The first step is to use the Augmented Dickey-Fuller (ADF) test to determine the data's stationarity. Second, using an unrestricted vector autoregressive model (VAR), we use the Schwarz information criteria (SC) to identify the appropriate lag number. Third, we utilize the Johansen co-integration test to assess the variables' long-term association.. This co-integration is tested using the maximum eigenvalue (λmax) and the trace test (λtrace).

$$\lambda \max = - T \log(1 - \lambda r + 1) \quad (2)$$

where, the null is r = g co-integrating vectors with (g = 0, 1, 2, 3,…) against the alternative (r ≤ g + 1).

$$\lambda \, \text{trace} = -\ T\, \Sigma \text{logki} = \text{r} + 1(1 - \lambda\text{i}) \quad (3)$$

where, the null is r = g against the general specification r ≤ 1.

Fourth, the restricted vector auto-regression (VECM) model is calculated to investigate the short term effect of the macroeconomic variables (interest rate, exchange rate, and inflation) on JCE. Then, to investigate the long-run connection between the variables, we estimate a vector error-correction (VEC) model.

$$\Delta \text{JCE}_t = \alpha + \lambda e_{t-1} + \sum_{i=1}^{n} \Delta b \text{iBR}_{t-1} + \sum_{i=1}^{m} \Delta c \text{iRP}_{t-1} = \sum_{i=1}^{o} \Delta d \text{iINF}_{t-1} + \varepsilon_t \quad (4)$$

And for the last step, we estimate the Breusch-Godfrey Serial Correlation LM test and the CUSUM test for residual stability.

RESULTS

Data analysis using vecm produces the following results

Table 1. Unit Root Test - Augmented Dickey-Fuller Test

	Level	First Difference
JCE	0.0000	0.0000
BI Rate	0.5826	0.0141
Exchange Rate	0.0000	0.0000
Inflation	0.9732	0.0000

Source: Processed Data, 2023

In Table 1, we report of the ADF test results. All four variables are clearly stationary at first difference. Based on these findings, we may proceed with the research and utilize the Johansen co-integration test to determine the long-term co-integrating connection between our variables. However, before we can proceed, we must first determine the lag structure for model estimate.

Table 2. Endogenous Variables - JCE, BI Rate, Exchange Rate, Inflation

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-317.3140	NA	1.731567	11.90052	12.04785	11.95734
1	-272.8607	80.67450	0.604902	10.84669	11.58335*	11.13079*
2	-252.4566	34.00676	0.519248	10.68358	12.00957	11.19496
3	-237.7604	22.31645	0.559292	10.73187	12.64719	11.47053
4	-220.2004	24.06371	0.554944	10.67409	13.17874	11.64003
5	-194.6970	31.17084*	0.424609*	10.32211*	13.41609	11.51534

Source: Processed Data, 2023

Table 2 show the result of lag structure determination from January 2018 to December 2022. According to the reported data, the optimum lag for the estimation is 5. This optimum lag is used to calculate the Johansen cointegration test.

Table 3. Johansen Multivariate Co-Integration Test

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.647996	104.6374	40.17493	0.0000
At most 1 *	0.438832	48.25536	24.27596	0.0000
At most 2 *	0.242956	17.05766	12.32090	0.0075
At most 3	0.036853	2.027656	4.129906	0.1820

Source: Processed Data, 2023

Table 4. Johansen Multivariate Co-Integration Test

Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.647996	56.38206	24.15921	0.0000
At most 1 *	0.438832	31.19770	17.79730	0.0003
At most 2 *	0.242956	15.03000	11.22480	0.0103
At most 3	0.036853	2.027656	4.129906	0.1820

Source:Processed Data, 2023

In Table 3 and 4, it show the Johansen co-integration test result. The supplied trace and maximum eigenvalue statistics show that a co-integrating relationship exists at the 5% significance level in all estimations. The results indicate that there is a long run relationship between the stock market index, interest rate, exchange rate and inflation. This conclusions indicate that the next step of estimation is Vector Error Correction Model (VECM).

Table 5. Co-Integration Test Regression

Cointegrating Eq:	CointEq1	CointEq2	CointEq3
D(IHSG(-1))	1.000000	0.000000	0.000000
D(BR(-1))	0.000000	1.000000	0.000000
D(RP(-1))	0.000000	0.000000	1.000000
D(INF(-1))	-2.054305	-1.376485	0.920989
	(1.46752)	(0.39811)	(0.54093)
	[-1.39985]	[-3.45754]	[1.70260]

Source: Processed Data, 2023

In table 5, it show a t-table value for a 90% confidence level with 4 degrees of freedom (as we have here is approximately 1.68288. There are different interpretations for each variable. First is IHSG. The absolute value of the t-statistic 1.39985) is less than 1.68288. Thus, the coefficient of D(IHSG(-1)) is not statistically significant at a 90% confidence level. Then interest rate (BR). Theabsolute value of the t-statistic (3.45754) is greater than

1.68288. Thus, the coefficient of D(BR(-1)) is statistically significant at a 90% confidence level. Third is exchange rate, where the absolute value of the t-statistic (1.70260) is greater than 1.68288. Thus, the coefficient of D(RP(-1)) is statistically significant at a 90% confidence level. And last is Inflation. The absolute value of the t-statistic (2.054305) is greater than 1.68288. Thus, the coefficient of D(INF(-1)) is statistically significant at a 90% confidence level.

We use the LM test as a residual diagnostic test to assess the residuals in terms of their serial correlation behavior. Tables 6 and 7 show the outcomes. The results reveal that serial correlation does not exist in the error terms.

Table 6. VEC Residual Serial Correlation LM Tests

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	21.84798	16	0.1482	1.423260	(16, 86.2)	0.1501
2	11.98169	16	0.7452	0.739100	(16, 86.2)	0.7469
3	11.57822	16	0.7725	0.712634	(16, 86.2)	0.7740
4	16.17785	16	0.4406	1.021247	(16, 86.2)	0.4432
5	18.75520	16	0.2816	1.200952	(16, 86.2)	0.2840
6	10.25182	16	0.8532	0.626433	(16, 86.2)	0.8542
7	15.49409	16	0.4888	0.974401	(16, 86.2)	0.4913
8	21.81364	16	0.1493	1.420751	(16, 86.2)	0.1513
9	9.894402	16	0.8721	0.603414	(16, 86.2)	0.8730
10	21.77036	16	0.1508	1.417590	(16, 86.2)	0.1527

Source: Processed Data, 2023

Table 7. Granger Causality

Null Hypothesis:	Obs	F-Statistic	Prob.
BR does not Granger Cause IHSG	55	0.55511	0.7336
IHSG does not Granger Cause BR		0.44491	0.8146
RP does not Granger Cause IHSG	55	11.9492	2.E-07
IHSG does not Granger Cause RP		0.68356	0.6383
INF does not Granger Cause IHSG	55	1.41408	0.2380
IHSG does not Granger Cause INF		1.02215	0.4163
RP does not Granger Cause BR	55	1.17584	0.3363

BR does not Granger Cause RP		0.70650	0.6217
INF does not Granger Cause BR	55	2.21391	0.0698
BR does not Granger Cause INF		0.18226	0.9678
INF does not Granger Cause RP	55	0.74705	0.5926
RP does not Granger Cause INF		0.52634	0.7550

Source: Processed Data, 2023

Based on the results of the Granger causality tests, it appears that RP Granger causes IHSG, but there is no significant Granger causality between the other variables (BR, INF, and RP). This means that past values of "RP" can predict future values of "IHSG."

Table 8. Impluse Response to Cholesky One S.D. (d.f. adjusted) Innovations

Response of D(IHSG):

Period	D(IHSG)	D(BR)	D(INF)	D(RP)
1	3.125615	0.000000	0.000000	0.000000
2	-2.144412	-0.114729	-1.868793	-2.843400
3	0.332225	0.402189	1.012237	2.012227
4	-1.474179	0.111200	0.115689	0.404347
5	1.381547	-0.555063	0.300860	-0.095283
6	-0.944233	0.189429	-0.817923	0.346175
7	1.213205	0.617314	0.734013	0.053437
8	0.137795	0.114582	-0.401451	-1.401740
9	0.056048	-0.251486	0.244469	0.679103
10	-1.311665	0.243086	0.308138	0.303041
11	0.821647	-0.418856	-0.084459	0.079180
12	-0.110751	-0.240543	-0.226674	-0.296279
13	0.332384	0.574573	0.609112	0.212226
14	0.113897	0.041857	-0.288314	-0.398284
15	0.010429	-0.070439	0.579861	0.149555
16	-0.519165	0.093949	-0.118870	0.074898
17	0.502858	-0.191065	-0.217908	0.133641
18	-0.201943	-0.004000	0.293969	-0.262072
19	0.329220	0.124681	-0.054050	0.070217
20	-0.060217	0.094451	0.085350	-0.095112
21	-0.047748	0.061957	0.499099	0.056499
22	-0.019030	-0.088002	-0.348838	0.057283
23	0.090355	0.032077	0.261154	0.046493
24	0.005555	0.024252	0.017914	-0.177079

Response of D(BR):

Period	D(IHSG)	D(BR)	D(INF)	D(RP)
1	0.058893	0.108072	0.000000	0.000000
2	0.041525	0.053411	0.042853	0.010594
3	0.001035	0.011551	0.041850	0.010436
4	0.004175	0.042788	0.022321	0.002185
5	0.051289	-0.002225	0.019843	-0.032331
6	0.024425	0.009713	0.067135	-0.007390
7	0.007399	0.026696	0.068416	0.003017

8	0.026809	0.008791	0.064380	-0.004545
9	0.014476	0.013036	0.078553	-0.003349
10	0.032262	0.017791	0.043986	-0.004055
11	0.032597	0.013431	0.050094	-0.014002
12	0.019839	0.014983	0.062258	-0.014592
13	0.024950	0.015208	0.041623	-0.006559
14	0.017892	0.016115	0.064854	-0.004842
15	0.018944	0.013395	0.057657	-0.003267
16	0.028064	0.014027	0.046077	-0.002213
17	0.023121	0.020183	0.063292	-0.011034
18	0.029908	0.015516	0.047696	-0.010231
19	0.022525	0.016368	0.054262	-0.006273
20	0.017117	0.017581	0.062006	-0.006949
21	0.026326	0.010673	0.045078	-0.004822
22	0.021250	0.016225	0.060288	-0.005872
23	0.024801	0.017507	0.054946	-0.008645
24	0.028474	0.014218	0.049449	-0.006924

Response of D(INF):

Period	D(IHSG)	D(BR)	D(INF)	D(RP)
1	0.007908	-0.050372	0.338839	0.000000
2	0.033774	-0.010320	0.094774	0.008955
3	0.041451	-0.006927	0.074341	-0.035460
4	-0.013842	0.008202	0.154196	-0.008490
5	0.062896	-0.029631	-0.049887	-0.015812
6	0.011095	0.012134	0.057989	-0.040750
7	-0.009507	0.009374	0.048637	-0.003690
8	0.036903	-0.001783	-0.011189	0.020678
9	-0.015304	0.038333	0.111186	-0.009787
10	0.038363	0.001604	-0.008911	0.002128
11	0.025957	0.016307	0.029206	0.006489
12	0.000395	0.033452	0.080409	-0.027407
13	0.049884	-0.011942	-0.031653	-0.005622
14	-0.013401	0.021507	0.085564	0.003102
15	0.009779	0.015804	0.044062	-0.008665
16	0.043836	-0.011053	-0.003439	0.004029
17	-0.013122	0.031605	0.102637	-0.007146
18	0.040766	0.008214	-0.000766	-0.008846
19	0.023487	0.003958	0.038720	-0.003783
20	-0.010720	0.027159	0.081133	-0.010149
21	0.043511	-0.004655	-0.017752	0.000660
22	0.001161	0.014463	0.076659	-0.005075
23	0.012861	0.017545	0.041535	-0.008852
24	0.040304	-0.000419	0.002289	0.000742

Response of D(RP):

Period	D(IHSG)	D(BR)	D(INF)	D(RP)
1	-0.729555	0.143335	1.065850	2.727083
2	0.443740	-0.512883	-0.701079	-2.743404
3	1.481078	0.706952	-0.274210	0.129491
4	-1.134441	-0.345479	0.015741	-0.005037
5	-0.037216	0.290141	0.877853	0.489631
6	-0.673519	-0.748453	-0.952763	-0.197544
7	0.559404	-0.060022	0.335627	0.454923
8	-0.178334	0.537627	-0.022403	-0.405022

9	0.913187	-0.287739	-0.313297	-0.054398
10	-0.981067	0.284904	0.482876	-0.048389
11	0.214860	0.008825	-0.176122	0.240455
12	-0.041959	-0.388132	-0.537533	-0.122831
13	-0.123689	0.113231	0.588270	0.159444
14	0.142116	-0.009902	-0.721613	-0.137711
15	0.207889	0.027411	0.378945	0.001459
16	-0.428065	0.133553	0.202594	-0.096889
17	0.308605	-0.146856	-0.499036	0.263207
18	-0.374226	0.014544	0.354958	-0.101760
19	0.214558	-0.065318	-0.245876	0.004909
20	0.073824	-0.053418	-0.325853	-0.034275
21	-0.163464	0.167498	0.548931	-0.036129
22	0.060334	-0.121928	-0.482427	0.020893
23	-0.059547	-0.010353	0.177110	0.126903
24	-0.181575	0.058916	0.092911	-0.083421

Cholesky Ordering: D(IHSG) D(BR) D(INF) D(RP)

Source: Processed Data, 2023

The data presented in Tabel 7 and Figure 1 is organized into four sections, each corresponding to theresponse of one variable to the four shocks: D(IHSG), D(BR), D(INF), and D(RP). In each section, we have the response of the variable for 24 different periods. Each period's response is represented by a numerical value, indicating the percentage change or impact of the respective shock on the variable. The data represents the changes in these variables in response to some unknown stimuli or shocks. The Cholesky ordering is provided as D(IHSG) D(BR) D(INF) D(RP), indicating the order in which the variables are affected by the shocks.

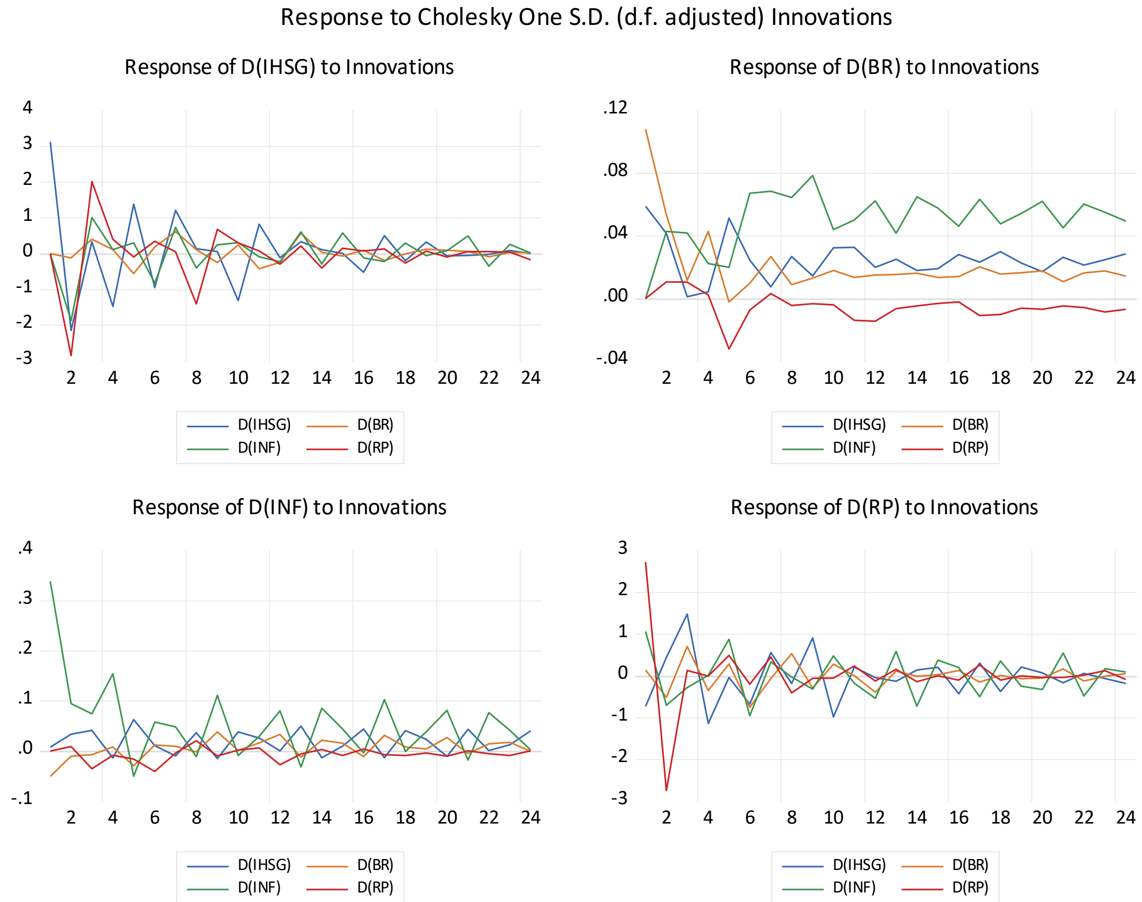

Figure 1. Impulse Response to Cholesky One S.D. (d.f. adjusted) Innovations
Source: Processed Data, 2023

According to the **Figure 1**, JCE (IHSG) for estimation in 2 years (24 months), the first year is very fluctuative

Table 9. Variance Decomposition

Variance Decomposition of D(IHSG):

Period	S.E.	D(IHSG)	D(BR)	D(INF)	D(RP)
1	3.125615	100.0000	0.000000	0.000000	0.000000
2	5.094944	55.34989	0.050707	13.45377	31.14563
3	5.595021	46.25041	0.558770	14.42938	38.76143
4	5.802302	49.46000	0.556290	13.45660	36.52711
5	5.998589	51.58044	1.376702	12.84191	34.20096
6	6.139981	51.59716	1.409208	14.03183	32.96181
7	6.331977	52.18661	2.275503	14.53757	31.00032
8	6.500161	49.56596	2.190348	14.17645	34.06724
9	6.545183	48.89374	2.307951	14.12160	34.67671
10	6.693711	50.58782	2.338546	13.71378	33.35985

11	6.757937	51.10907	2.678457	13.46997	32.74250
12	6.773404	50.90266	2.792354	13.52051	32.78447
13	6.836349	50.20600	3.447556	14.06655	32.27990
14	6.855082	49.95958	3.432468	14.16666	32.44129
15	6.881557	49.57614	3.416585	14.76789	32.23938
16	6.903182	49.83162	3.413735	14.70516	32.04948
17	6.928827	49.99015	3.464552	14.69542	31.84988
18	6.942949	49.87159	3.450506	14.81497	31.86293
19	6.952433	49.95986	3.473259	14.78063	31.78626
20	6.954509	49.93752	3.489630	14.78686	31.78598
21	6.973063	49.67682	3.478979	15.22058	31.62362
22	6.982598	49.54198	3.485367	15.42862	31.54404
23	6.988293	49.47799	3.481797	15.54314	31.49708
24	6.990603	49.44535	3.480699	15.53352	31.54043

Variance Decomposition of D(BR)

Period	S.E.	D(IHSG)	D(BR)	D(INF)	D(RP)
1	0.123077	22.89695	77.10305	0.000000	0.000000
2	0.147220	23.95872	67.05048	8.472946	0.517858
3	0.153845	21.94394	61.96305	15.15869	0.934319
4	0.161306	20.02802	63.40008	15.70367	0.868235
5	0.173477	26.05739	54.83262	14.88583	4.224153
6	0.188007	23.87294	46.95125	25.42489	3.750921
7	0.202000	20.81426	42.41843	33.49575	3.271563
8	0.213929	20.12824	37.98866	38.92108	2.962020
9	0.228751	18.00480	33.55002	45.83314	2.612049
10	0.235872	18.80484	32.12374	46.58514	2.486268
11	0.244098	19.34203	30.29777	47.70962	2.650574
12	0.253556	18.53810	28.42871	50.24550	2.787692
13	0.258689	18.73993	27.65736	50.86027	2.742450
14	0.267823	17.92976	26.16507	53.31392	2.591260
15	0.274959	17.48589	25.06192	54.97957	2.472620
16	0.280562	17.79505	24.32093	55.50295	2.381074
17	0.289456	17.35638	23.33555	56.92574	2.382318
18	0.295465	17.68224	22.67179	57.23967	2.406297
19	0.301759	17.50947	22.03010	58.11026	2.350172
20	0.309117	16.99242	21.31723	59.40021	2.290144

21	0.313713	17.20245	20.81300	59.73739	2.247165
22	0.320624	16.90813	20.18149	60.72551	2.184870
23	0.326825	16.84836	19.70978	61.26915	2.172710
24	0.332146	17.04785	19.26663	61.53840	2.147123

Variance Decomposition of D(INF)

Period	S.E.	D(IHSG)	D(BR)	D(INF)	D(RP)
1	0.342654	0.053265	2.161094	97.78564	0.000000
2	0.357381	0.942062	2.070046	96.92510	0.062792
3	0.369149	2.143787	1.975378	94.89923	0.981602
4	0.400473	1.941013	1.720399	95.45959	0.878993
5	0.409818	4.208875	2.165599	92.63730	0.988227
6	0.416227	4.151329	2.184418	91.74770	1.916548
7	0.419288	4.142350	2.202619	91.75862	1.896415
8	0.421568	4.863947	2.180639	90.83888	2.116531
9	0.438043	4.627032	2.785506	90.57722	2.010237
10	0.439818	5.350573	2.764397	89.88864	1.996386
11	0.441899	5.645341	2.874593	89.48087	1.999192
12	0.451232	5.414294	3.306512	88.99292	2.286269
13	0.455275	6.519101	3.316858	87.90294	2.261099
14	0.463948	6.361065	3.408884	88.04824	2.181815
15	0.466487	6.335966	3.486668	87.98473	2.192640
16	0.468702	7.150920	3.509398	87.16033	2.179351
17	0.481080	6.862066	3.762730	87.28449	2.090712
18	0.482956	7.521348	3.762486	86.60811	2.108056
19	0.485105	7.689246	3.735875	86.47938	2.095497
20	0.492814	7.497900	3.923624	86.50561	2.072869
21	0.495071	8.202086	3.896761	85.84697	2.054183
22	0.501207	8.003036	3.885203	86.09731	2.014449
23	0.503473	7.996404	3.971745	86.00458	2.027269
24	0.505090	8.582028	3.946431	85.45701	2.014529

Variance Decomposition of D(RP)

Period	S.E.	D(IHSG)	D(BR)	D(INF)	D(RP)
1	3.020896	5.832357	0.225129	12.44860	81.49392
2	4.195658	4.142094	1.611005	9.245565	85.00134
3	4.515405	14.33501	3.842170	8.351309	73.47151

4	4.668561	19.31459	4.141831	7.813489	68.73009
5	4.784495	18.39595	4.311283	10.80586	66.48691
6	4.985177	18.76999	6.225236	13.60604	61.39873
7	5.048576	19.52929	6.084000	13.70841	60.67830
8	5.096422	19.28677	7.083140	13.45416	60.17593
9	5.195318	21.64904	7.122783	13.31047	57.91771
10	5.317002	24.07405	7.087614	13.53298	55.30535
11	5.329689	24.12209	7.054184	13.57783	55.24590
12	5.372339	23.74671	7.464580	14.36422	54.42449
13	5.409402	23.47471	7.406457	15.35070	53.76814
14	5.460917	23.10163	7.267709	16.80858	52.82208
15	5.478064	23.10125	7.224787	17.18204	52.49193
16	5.500972	23.51478	7.223681	17.17487	52.08667
17	5.540380	23.49172	7.191544	17.74272	51.57402
18	5.565287	23.73408	7.128001	17.99106	51.14686
19	5.575230	23.79759	7.116322	18.12143	50.96465
20	5.585593	23.72684	7.099087	18.39459	50.77949
21	5.617496	23.54279	7.107589	19.14113	50.20849
22	5.639853	23.36795	7.098089	19.72137	49.81259
23	5.644383	23.34158	7.087035	19.78818	49.78321
24	5.648991	23.40684	7.086357	19.78296	49.72384

Cholesky Ordering: D(IHSG) D(BR) D(INF) D(RP)

Source: Processed Data, 2023

The variance decomposition analysis provides valuable insights into the relative contributions of different shocks to the fluctuations in each variable over time. The Cholesky Ordering for the VAR model is "D(IHSG) D(BR) D(INF) D(RP)."

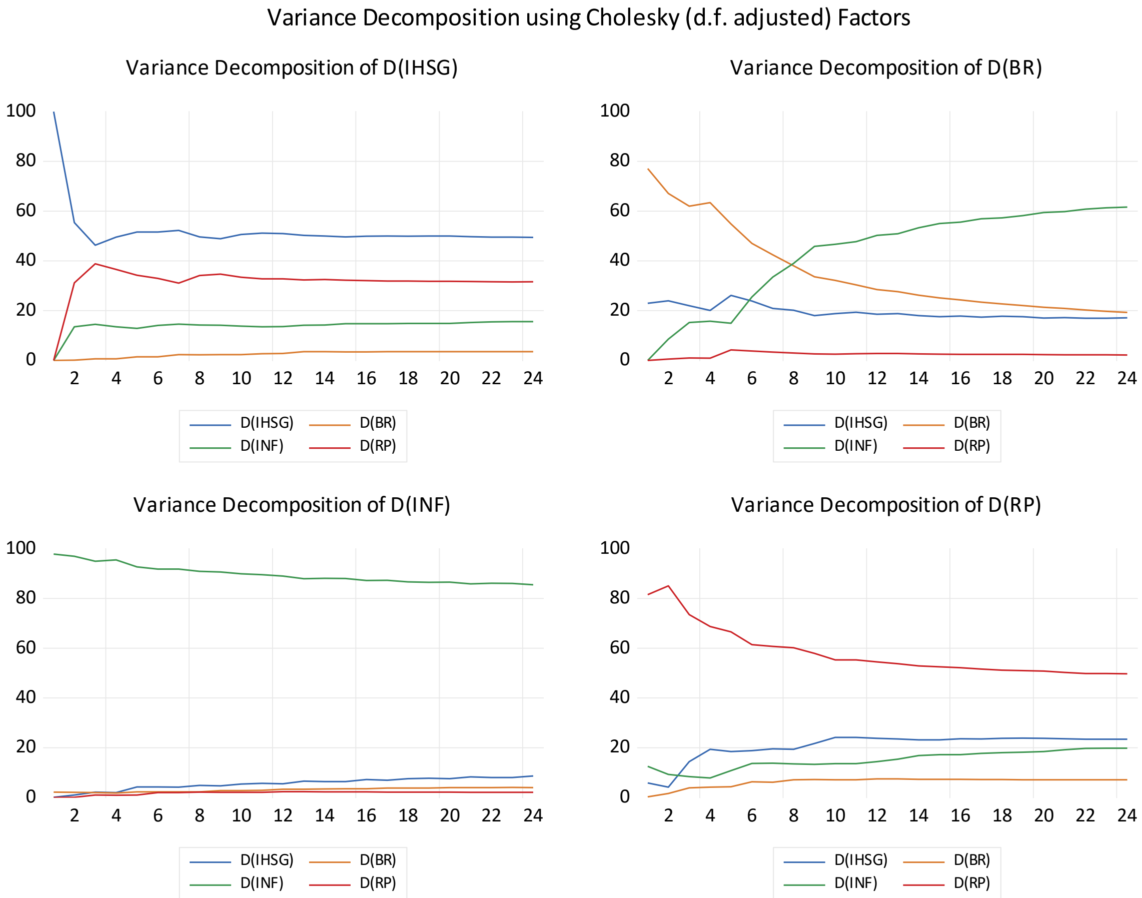

Figure 2. Variance Decomposition
Source: Processed Data, 2023

DISCUSSION

According to IRF in Tabel 7 and Figure 1, stock market index and bank reserves are positively impacted by the shocks in D(IHSG) and D(BR) themselves. This suggests a positive feedback loop where positive changes in these variables reinforce each other. This might indicate a potential positive relationship between the stock market and bank reserves in the given economic setting.

The inflation rate, D(INF), appears to have a significant positive impact on the stock market index (D(IHSG)). This result suggests that in this economic context, an increase in inflation might lead to a rise in the stock market index. This relationship could be attributed to factors such as increased company profits due to higher prices during inflationary periods.

The exchange rate (D(RP)) seems to be highly influenced by all three variables - D(IHSG), D(BR), and D(INF). It is positively impacted by shocks in the stock market index and inflation rate but negatively influenced by changes in bank reserves. This suggests that fluctuations in the stock market and inflation could lead to changes in the exchange rate, while changes in bank reserves might have a stabilizing effect on the exchange rate. Overall, the Cholesky ordering helps to understand the causal relationships between the variables. It suggests that shocks in D(IHSG) will have the most immediate and direct impact on the other variables, followed by D(BR), D(INF), and finally D(RP)

The variance decomposition (Tabel 8 and Figure 2) shows that during period 1, 100% of the variation in the IHSG stock market index is attributed to its own shock, indicating that it is the dominant driver of its own fluctuations. However, in subsequent periods, the self-response decreases, indicating that other variables start to play a more significant role in explaining the variations in the IHSG index. The response of "D(RP)" becomes increasingly important, reaching around 33.36% in period 10, suggesting that shocks to "D(RP)" have a substantial impact on the fluctuations in the stock market index.

The variance decomposition for "D(BR)" indicates that during period 1, almost 77% of the variation in BR can be attributed to its own shock, making it the primary driver of its fluctuations. However, as time progresses, its self-response decreases, and the responses of "D(INF)" and "D(RP)" become more significant, indicating that shocks in inflation and RP start to influence the variation in "D(BR)" more prominently.

Regarding "D(INF)," the variance decomposition reveals that in period 1, around 97.79% of the variation in inflation is explained by its own shock, making inflation the dominant factor influencing its fluctuations. As time goes on, the self-response decreases, and the responses of "D(IHSG)" and "D(BR)" start to become more substantial, indicating that shocks in the stock market index and BR increasingly affect the variations in inflation.

Finally, for "D(RP)," the variance decomposition shows that during period 1, around 81.49% of the variation in RP can be attributed to its own shock, making it the primary driver of its fluctuations. However, in subsequent periods, the self-response decreases, and the responses of "D(IHSG)" and "D(INF)" gain importance, indicating that shocks in the stock market index and inflation have a more significant impact on the variations in RP.

To be more clear, the longer the period, the greater the ability of the BI rate to influence the JCI. Meanwhile, inflation has a very fluctuating effect on the JCI. And the ability of the exchange rate tends to decrease in influencing the JCI. For the bi rate, the longer the period, the smaller the influence of the IHSG and the exchange rate. Meanwhile, the influence of inflation is getting bigger. For inflation, the longer the influence of the JCI and the BI rate, the greater, while the exchange rate, although stable, tends to fall
Meanwhile, the ability of the IHSG and inflation has increasingly affected the exchange rate, while in the first 8 months it tends to rise, then stabilizes but gradually declines.

CONCLUSION

The long-term relationship between the Jakarta Composite Index (JCI), exchange rates, interest rates, and inflation in Indonesia is essential for economic stability, policymaking, market performance, and investment decisions. In conclusion, the analysis of the Jakarta Composite Index (JCI), exchange rates, interest rates, and inflation in Indonesia reveals several important findings. There exists a positive feedback loop between the stock market index and bank reserves, indicating a potential positive relationship between the two variables. Additionally, inflation has a significant positive impact on the stock market index, likely due to increased company profits during inflationary periods.

The exchange rate is highly influenced by all three variables, with the stock market and inflation positively impacting it, while changes in bank reserves have a stabilizing effect. The Cholesky ordering indicates that shocks in the stock market index have the most immediate and direct impact on other variables, followed by bank reserves, inflation, and then the exchange rate. Over time, the ability of the BI rate to influence the JCI increases, while the exchange rate's influence on the JCI decreases. Inflation's influence on the JCI and the BI rate grows. The ability of the JCI and inflation to affect the exchange rate strengthens, with an initial rise in the exchange rate followed by gradual stabilization and decline.

LIMITATION

The research on the long-term relationship between JCI, exchange rates, interest rates, and inflation in Indonesia provides valuable insights. However, limitations include data constraints, model assumptions, external factors, causality issues, evolving economic conditions, neglect of market participant behavior, and sample size adequacy.

REFERENCES

Adusei, M. (2014). Does stock market development promote economic growth in Ghana. *International journal of economics and finance*, 6(6), 119-126.

Afshan, S., Sharif, A., Loganathan, N., & Jammazi, R. (2018). Time–frequency causality between stock prices and exchange rates: Further evidences from cointegration and wavelet analysis. *Physica A: Statistical Mechanics and its Applications*, 495, 225-244.

Akbar, A. J., Yuliana, S., & Marwa, T. (2016). Pengaruh nilai tukar rupiah, suku bunga SBI, dan inflasi terhadap indeks harga saham gabungan (IHSG) sektor pertanian di Bursa Efek Indonesia. *Jurnal Ekonomi Pembangunan*, 14(2), 47-53.

Bayer, C., & Hanck, C. (2013). Combining non-cointegration tests. *Journal of Time series analysis*, 34(1), 83-95.

Bhuiyan, Erfan, M. Chowdhury, Murshed. (2012). Macroeconomic Variables and Stock Market Indices: Asymmetric Dynamics in The US and Canada. *The Quarterly Review of Economics and Finance*.

Boonyanam, N. (2014). Relationship of stock price and monetary variables of Asian small open emerging economy: Evidence from Thailand. *International Journal of financial research*, 5(1), 52.

Eilsson, J. H. (2020). How raising interest rates can cause inflation and currency depreciation. *Journal of Applied Economics*, *23*(1), 450-468.

Jepkemei, B. (2012). *The impact of inflation on stock market liquidity: the case of Nairobi securities exchange* (Doctoral dissertation, University of Nairobi).

Khataybeh, M., & Ghassan, O. M. E. T. (2021) Economic Growth, Inflation, And Capital Market Performance: Is There A Link In Jordan?. J*ournal of Economics Finance and Accounting*, 8(1), 1-7

Lenee, T. L., & Oki, J. (2017). Capital market development and economic growth: Evidence from the MINT countries. *Journal of Economics and Sustainable Development*, *8*(2), 68-107.

Olokoyo, F. O., Ibhagui, O. W., & Babajide, A. (2020). Macroeconomic indicators and capital market performance: Are the links sustainable?. *Cogent Business & Management*, *7*(1), 1792258.

Pradhan, R. P., Arvin, M. B., & Bahmani, S. (2015). Causal nexus between economic growth, inflation, and stock market development: The case of OECD countries. *Global Finance Journal*, *27*, 98-111.

Uwubanmwen, A., & Eghosa, I. L. (2015). Inflation rate and stock returns: Evidence from the Nigerian stock market. *International Journal of Business and Social Science*, *6*(11), 155-167.

Wei, Y., Qin, S., Li, X., Zhu, S., & Wei, G. (2019). Oil price fluctuation, stock market and macroeconomic fundamentals: Evidence from China before and after the financial crisis. *Finance Research Letters*, *30*, 23-29.

Yunita, Y., & Robiyanto, R. (2018). The Influence of Inflation Rate, Bi Rate, and Exchange Rate Changes To the Financial Sector Stock Price Index Return in the Indonesian Stock Market. *Jurnal Manajemen Dan Kewirausahaan*, *20*(2), 80-86.

Finance