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Preface

We are pleased to present the proceedings of the 5th International Conference on Financial Technology (ICFT 2024), successfully held in Singapore on September 23–25, 2024. The conference served as a platform to foster research, innovation, and collaboration in the fields of Financial Technology (FinTech), Artificial Intelligence, and Machine Learning.

The conference featured insightful presentations by experts and industry leaders from around the world. We are deeply grateful to our distinguished Keynote Speakers, Siau Keng Leng (City University of Hong Kong, China) and Erik Cambria (Nanyang Technological University, Singapore), and distinguished invited speakers, Ke-Wei Huang (National University of Singapore, Singapore), Chi Seng Pun (Nanyang Technological University, Singapore), Steven Li (RMIT University, Australia), Thierry H. Brutman (EDDA Stock Finance, France), and Jaber Jemai (Higher Colleges of Technology, UAE). In addition, we extend our sincere thanks to the more than 20 presenters whose contributions enriched the discussions and knowledge shared throughout the event.

ICFT 2024 received a total of 35 papers via the Openconf system, of which 17 papers were selected for inclusion in these proceedings. The authors represent institutions and organizations from various countries, including China, Singapore, the USA, the UK, South Africa, Indonesia, Italy, the UAE, etc. Each submitted paper underwent a rigorous peer-review process, utilizing a single-blind review. Every paper received 3 reviews, ensuring the highest academic and professional standards. We are immensely grateful to the scientific committee members for their dedicated efforts in making this possible.

Our heartfelt thanks also go to all participants, presenters, and organizers whose hard work and enthusiasm contributed to the success of ICFT 2024. Their commitment ensured that the conference was an enriching and impactful experience for all involved.

We hope that the proceedings of ICFT 2024 will serve as a valuable resource, capturing the latest advancements and ideas in the FinTech field. We believe these contributions will inspire continued progress and innovation in financial technology and related disciplines.

We eagerly anticipate future opportunities for collaboration and knowledge exchange within the global FinTech and AI communities.

Ke-Wei Huang
Qi Cao
Ruidan Su

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Contents

Does E-Money Mediate the Effect of Fundamental Factors on the Stock Price Index?

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Abstract. This study aims to examine the role of e-money in mediating the effect of fundamental factors, which are also independent variables on different stock price indexes, i.e., the Composite Index (IHSG), LQ 45, Kompas 100, Jakarta Islamic Index (JII), and Srikehati. The independent variables are money supply (X_1), gross domestic product (X_2), and interest rate (X_3). The research data is secondary data using monthly data from July 2009 to March 2023. The money supply measured from the amount of money circulation, GDP using the amount of gross domestic product, interest rate from BI rate, e-money (Y_1) from the volume of e-money transactions, and stock price index (Y_2) from the closing data of each type of index. Data analysis used a path analysis. The results show that money supply and GDP have a positive effect, while the interest rate has a negative effect on e-money and stock price index for Composite Index, LQ 45, Kompas 100, and Srikehati. While for JII, money supply and interest rates do not effect the stock price index. As a result, e-money also do not mediate the effect of money supply and interest rates on stock price indexes. It is possible that these different result caused by differences in investor characteristics. This research is important to be continued since understanding of investor characteristics will be very useful for investment analysts and policymakers, especially the Financial Services Authority.

Keywords: Money Supply · GDP · Interest Rate · E-Wallet · Stock Price Index

1 Introduction

The development of electronic payment systems in Indonesia has been widely used. Central Bank of Indonesia (BI) reports electronic money transactions in August 2022 grew 43.24% annually (yoy) (indonesia.go.id October 14, 2022). Meanwhile, for 2023, BI projects that the value of e-money transactions will continue to grow 30.84% compared to 2021 (indonesia.go.id April 3, 2023). The practicality of using e-money has a significant positive effect on consumer lifestyles (Foster, Sukono, and Johansyah 2022), (Khatimah, Susanto, and Abdullah 2019). Currently, prospective investors can make transactions on the stock exchange online using the payment platform provided by the Indonesia Stock Exchange (IDX) (Kompas.com, 2021). Based on Financial Services

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Authority (OJK) regulations, currently, transaction settlements on the stock exchange can be done by book transfer or cash (OJK 2019). Hollis Chenery's theory in his book Pattern of Development, the economic development of a country is accelerated through 4 factors, namely increasing domestic demand, expanding exports, import substitution and technological change (Behrman 1981). Through the development of electronic money, it is expected to encourage economic growth, especially in the development of the capital market. The capital market is one of the entities that is expected to be part of the digitalization breakthrough that is currently developing. According to OJK 2020 data, there are 89 companies, the majority of which are 40% market platforms, in addition, 80% of retail investors are under 40 years old. So it is very possible that this type of investor has an interest that tends to utilize digital technology in transacting in the capital market (cnbcindonesia.com January 31, 2022). According to a study, in Thailand, stock performance in the capital market will affect economic growth, which can have an impact on the use of e-money (Aimon, Sentosa, and Mahatir 2021). Therefore, digital development and capital markets should have a very close relationship to support each other in creating a better national economy.

Apart from the development of digital technology, other factors that can affect the capital market are fundamental macroeconomic factors. Fundamental macroeconomic factors such as inflation, interest rates, money supply, Gross Domestic Product, and currency exchange rates affect the stock market and stock price index (Hosseini, Ahmad, and Lai 2011), (Naik and Padhi 2012), (Yahya and Hussin 2012), (Baskara and Sulasmiyati 2017), (Camilleri, Scicluna, and Bai 2019), (Assagaf et al. 2019), (Vatansever 2020). Fundamental macroeconomic variables determine the growth prospects of companies on the stock exchange. The long-term relationship of fundamental variables that have a greater influence on the stock price index is the interest rate and inflation (1971 Tap), (Al-Majali and Al-Assaf 2014), (Aimon, Sentosa, and Mahatir 2021), (A. Conrad 2021). Based on the theory and results of previous research, the background for the author to test the influence of fundamental macroeconomic variables on the stock price index through e-money. The variables money supply, Gross Domestic Product, and interest rates are used in measuring fundamental macroeconomic variables, because these three variables have an effect on e-money (Arifin and Oktavilia 2020).

2 Literature Review

2.1 Stock Price Index and Fundamental Factors that Influence It

Fundamental macroeconomic factors are factors that influence changes in the economic conditions of a region, for example interest rates, inflation rates, GDP figures, and the amount of money in circulation (Al-Tamimi, Alwan, and Rahman 2011). Macroeconomic fundamentals can influence how stock prices perform in the capital market (WORLU and OMODERO 2017). Money supply is the amount of money circulating in society, which will affect the level of consumption.

According to Keynes' theory(Harcourt 1994) that the quantity of money demand is determined by the need for money for 3 purposes, namely demand for transactions, demand for precautionary money, demand for money for speculation. Most investment analysts predict the movement and performance of the capital market using money

supply forecasts (Shiblee 2011).Gross Domestic Product is an indicator that measures the level of economic growth of a region, and is measured on the basis of constant price GDP (Setiawan 2020). Any growth in GDP will have an impact on increasing domestic demand, both household consumption and investment consumption (Reddy 2012), (Financial Services Authority 2022). *Interest rate*is the percentage of interest rates set by the government, as a form of monetary policy in regulating the stability of the financial system. Based on empirical tests, it states that interest rates are a factor in influencing stock index returns assessed through stock portfolio proxies (Zhou, 1996), (Setiawan 2020).

2.2 E-Money

*Electronic Money*or E-money is a prepaid electronic payment tool, where a certain amount of money is attached to it, which can be refilled and can be used to finance various transactions at merchants. According to Nizar and Hanifah (2021), E-money has several criteria: a). Issued on the basis of the value of the money deposited in advance, b). Stored electronically in a medium such as a server or chip, c) used as a means of payment, and d). The value of electronic money deposited by the holder is managed by the issuer.

E-money appears as a form of transaction instrument that falls into the claim form classification (through a technological infrastructure that is centered on blockchain), (Adrian and Mancini-Griffoli 2021). E-money is growing faster in various countries in the world because it has advantages including user comfort, complementarity, available ubiquity, low cost transactions, trust, and network effect (Van Hove 1999), (Moharana, Sai, and Ramesh 2013), (Aithal 2016), (Adrian and Mancini-Griffoli 2021). The development of technology through the issuance of electronic money as a means of payment encourages increased transactions and public consumption. The capital market began to develop following the development of technology has implemented online transaction automation for stock exchange players, through regulations on non-cash securities settlement.

2.3 Stock Price Index

The stock price index is an indicator that measures the performance of stock prices on the capital market (Hartono 2016). The number of stock indexes on the Indonesian Capital Market (IDX) in 2021 are 37 indexes, consist of 4 sector classifications, namely headline, sector, thematic, factor (Indonesia Stock Exchange 2021). The stock price index used in this study are:

a. Composite Stock Price Index (IHSG)
   It is an index that measures the performance of all stock prices listed on the Indonesia Stock Exchange, both on the Main Board and the Development Board.
b. LQ45
   It is a stock index that measures the performance of 45 stocks that have a high level of liquidity and market capitalization with good company fundamental conditions.

c. Jakarta Islamic Index (JII)
   It is a stock index that measures the performance of 30 shares of sharia companies with good financial performance and a good level of company liquidity.
d. KOMPAS100
   KOMPAS100 Index is a stock price index that measures 100 stocks of companies with good financial performance and liquidity levels.
e. SRI-KEHATI
   It is a stock price index that measures the performance of 25 listed stocks that have good financial performance in encouraging sustainable business, as well as awareness of the environment, social, and good corporate governance (Sustainability and Responsible Investment).

2.4 Relationship Between Variables and Hypothesis Formulation

The Influence of Money Supply on E-Money
The amount of money circulating in society influences consumer interest in carrying out consumption activities (Khatimah, Susanto, and Abdullah 2019). This behavior will affect consumer motivation to transact with e-money with various promotional facilities and ease of use (Lukmanulhakim, Djambak, and Yusuf 2016), (Qin 2017), (Putri and Prasetyo 2020), (Foster, Sukono, and Johansyah, 2022).

H1: Money Supply has an effect on E-money.

The Impact of GDP on E-Money
Long-term changes in national income levels have an impact on fluctuations in transactions using e-money (Arifin and Oktavilia 2020). Good economic conditions will influence the way people use the value of money (Suseco 2016), (Putri and Prasetyo 2020).

H2: Gross Domestic Product has an effect on E-money.

The Influence of Interest Rates on E-Money
The interest rate policy will affect the money flow cycle in society, so it will have an impact on encouraging the use of e-money as a transaction tool (Allen, Mcandrews, and Strahan 2002), (Ichwani and Nisa 2021), (Ramadhani, Yuwono, and Nugroho, 2021).

H3: Interest Rate has an effect on E-money.

The Influence of E-money on Stock Index.
The impact of issuing e-money provides convenience in transactions (Alghifari Mahdi Igamo1 2018). E-money will have an impact on the company's financial performance and influence stock prices in the capital market (Thomas 2005), (Aimon, Sentosa, and Mahatir 2021), (Brimantyo et al. 2021). Several countries that have implemented digital capital market transactions, have revealed that electronic money plays a role in the development and improvement of capital market performance (Neama and Saleh 2020), (Igoni, Ogiri, and Boloupremo, 2021).

H4: E-money has an effect on the Stock Index.

The Influence of Money Supply on Stock Indexes.

Money circulation affects investor stock transactions on the stock exchange. So changes in money supply will have an impact on the stock price index on the capital market (Rogalski and Vinso 1977), (Blanchard 2002), (Baskara and Sulasmiyati, 2017).

H5: Money Supply has an effect on the Stock Index.

The Impact of GDP on Stock Price Index.

When a country's economic condition improves in the long term, it will encourage stock performance in the capital market to also increase. Because the community as potential investors have the financial ability to make investments, so it will also have an impact on stock prices (Shiblee 2011), (Naik and Padhi 2012), (Baskara and Sulasmiyati, 2017).

H6: Gross Domestic Product has an effect on the Stock Index.

The Influence of Interest Rates on Stock Indexes.

The interest rate level will determine the sustainability of the company in its business process. In the long term or short term, the interest rate level can affect stock prices in the capital market (Zhou, 1996), (Camilleri, Scicluna, and Bai 2019), (A. Conrad 2021), (Extract 2023).

H7: Interest Rate has an effect on the Stock Index.

The Influence of Fundamental Factors on Stock Indexes via E-money.

Fundamental macroeconomic factors can influence the volume of e-money transactions (Putri and Prasetyo 2020). In addition, fundamental macroeconomic factors such as the amount of money in circulation, GDP value, and interest rates can affect the stock price index (Rogalski and Vinso 1977), (Triani 2013), (Muid and Raharjo 2013), (Baskara and Sulasmiyati 2017). Through electronic money instruments and easy transaction facilities, these factors influence stock prices (Neama and Saleh 2020) (Igoni, Ogiri, and Boloupremo 2021).

H8-a. Money Supply affects the Stock Price Index through E-money.

H8-b Gross Domestic Product has an effect on the Stock Price Index through E-money.

H8-c Interest rate affects the Stock Price Index through E-money.

3 Research Methods

3.1 Research Variables and Measurement

The variables in this study consist of independent variables, namely money supply (X1), gross domestic product (X2), interest rate (X3), intervening variables, namely (Y1), and dependent variables, namely the Stock Price Index (Y2). The data used in the study are

secondary data collected using the documentation method and obtained through the Bank Indonesia website, namely www.bi.go.id, Indonesia Stock Exchange, namely www.idx.co.id. And BPS namely bps.go.id. Meanwhile, the type of data used in this research is quantitative data in the form of:

a. Stock Price Index IHSG, LQ 45, Jakarta Islamic Index (JII), KOMPAS100, SRI-KEHATI closing per month from July 2009 – March 2023
b. Transaction volume using e-money per month from July 2009 – March 2023
c. Money Supply using amount of money in circulation per month from July 2009 – March 2023
d. Gross Domestic Product (GDP) using data per month from May 2009- March 2023
e. Percentage of BI Rate using interest rate per month from July 2009- March 2023

Data analysis using path analysis. Before the hypothesis test, descriptive statistical tests were carried out, classical assumption tests consisting of normality tests, multicollinearity tests, heteroscedasticity tests, and autocorrelation tests (Chandrarin 2017). The following Fig. 1 is a path analysis model formulated in the path analysis statistical model.

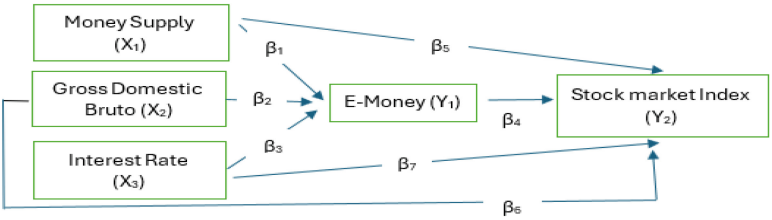

Fig. 1. Path Analysis Statistical Model

4 Research Result

4.1 Descriptive Statistical Test

Statistical tests on 165 data, found 6 outlier data, leaving 159 data consisting of money supply data, GDP, interest rate, IHSG stock price index, LQ45, JII, KOMPAS 100, and SRI-KEHATI from July 2009-March 2023. Table 1 presents the results of descriptive statistics.

Based on the results of descriptive statistical tests, it shows that the minimum value of the five stock indices above occurred in early February 2010. This condition coincided with a decrease in the amount of money supply and was followed by a decrease in GDP in the first quarter of 2010, and was the lowest GDP value throughout the research period. The decrease in the level of per capita income of the community had an impact on the decrease in consumption and utilization of e-money transactions, indirectly impacting the financial condition of the company, and the decrease in stock prices in the capital market. The stock price index with the highest liquidity according to the LQ45, JII,

Table 1. Descriptive Statistical Test Results

	N	Minimum	Maximum	Mean
Money Supply	159	490084.00	2539067.00	1268763.5031
GDP	159	547452.00	996212.00	785031.1321
Interest Rate	159	3.50	7.75	5.65
E-money	159	1914662.00	985462663.00	179337395.9371
IHSG	159	2549.00	7229.00	5177.6226
LQ45	159	496.00	1106.00	842.1509
JII	159	414.00	787.00	616.9119
KOMPAS100	159	611.00	1397.00	1069.5283
SRIKEHATI	159	145.00	440.00	301.4465
Valid N listwise)	159			

Source: Data Processed by Researchers 2023.

and KOMPAS100 stock indices was in January 2018 when GDP, money supply and interest rates were stable before the pandemic hit Indonesia. Meanwhile, for the IHSG and SRI-KEHATI indices, the highest occurred in 2022, after the pandemic recovery and economic conditions began to experience good growth, which had an impact on changes in the stock price index.

To meet the regression requirements, normality test conducted using Normal P-Plot shows that data is normally distributed. Autocorrelation test with Durbin Watson concludes that there is no autocorrelation. Multicollinearity test using tolerance value $>$ 10, VIF $<$ 10 shows that the test results do not have multicollinearity in the regression model. Heteroscedasticity test using Spearman rank shows that the sig. (2 tailed) value $>$ 0.05 means that there are no symptoms of heteroscedasticity, and the classical assumption test on this research variable has been met.

4.2 Hypothesis Testing

Model Accuracy Test (F Test) and R2 Determination Coefficient Test

The following Table 2 presents the results of the model accuracy test and determination test;

Based on the results of the F test, sig $<$ 0,05, it shows that all models formulated in the study are appropriate (fit). Meanwhile, the results of the R^2 test show that the independent variables in this study influence the dependent variables, namely 5 stock price indixes with different values. Among these results, the independent variables have a greater influence on the SRI-KEHATI stock index, namely the stock index that measures Sustainable and Responsible Investment, by 88%.

4.3 T-Test Results

Regression results with 5 dependent variables, namely the stock price index IHSG, LQ45, JII, KOMPAS100, and SRI-KEHATI are presented in the following figure:

Table 2. F and R^2 Test Results

Stock Price Index	F Test		R^2 Test	
	F	Sig	R Square	Adjusted R Square
IHSG	229,599	0.000	0.856	0.853
LQ45	111,969	0.000	0.744	0.737
JII	56,008	0.000	0.593	0.582
KOMPAS100	105,903	0.000	0.733	0.726
SRIKEHATI	306,628	0.000	0.888	0.886

Source: Data Processed by Researchers 2023

The Influence of Money Supply, GDP, and Interest Rate on E-Money
The results of the regression as presented in Fig. 2 shows that the money supply and GDP have a significant positive effect on e-money, while the interest rate variable has a significant negative effect. This means that the higher the money supply and GDP, the higher the use of e-money. Meanwhile, the higher the interest rate, the lower the use of e-money.

The Influence of Money Supply (X1), GDP (X2), and Interest Rate (X3) and E-money (Y1) on the Stock Price Index (Y2)
As explained in the previous section, there are 5 stock price indixes tested in this study including: IHSG, LQ45, JII, KOMPAS100, and SRIKEHATI. The results show that all hypotheses are accepted for the IHSG, LQ45, Kompas 100 and Srikehati. This means that on the four stock indices, money supply, GDP and E-money have a positive effect while the interest rate has a negative effect. Meanwhile, for the JII stock index, only GDP has a positive effect while other variables have no effect.

The Influence of Money Supply (X1), GDP (X2), and Interest Rate (X3) on the Stock Price Index (Y2) via E-money (Y1)
After conducting the analysis of the direct influence between variables, it is necessary to look at the indirect influence. For this purpose, the analysis is carried out by testing the influence of the three independent variables (X1, X2, and X3) on the stock index through the use of E-money. The results of the t-test are presented in the following Table 3:

This result shows that for JII index, e-money does not mediate the influence of money supply, GDP and interest rates on the stock price index. This is because in the JII index, the influence of Y1 on Y2 is not significant ($0.849 > 0.05$). Unlike the other four indexes, namely IHSG, LQ45, Kompas 100 and Srikehati, the use of e-money is proven to mediate the influence of independent variables on the stock price index.

5 Discussion

This study obtained important findings related to the role of e-money in mediating the influence of fundamental factors on stock prices. Related to the fact that for the JII stock price index with different results from other stock indices, this finding is quite interesting.

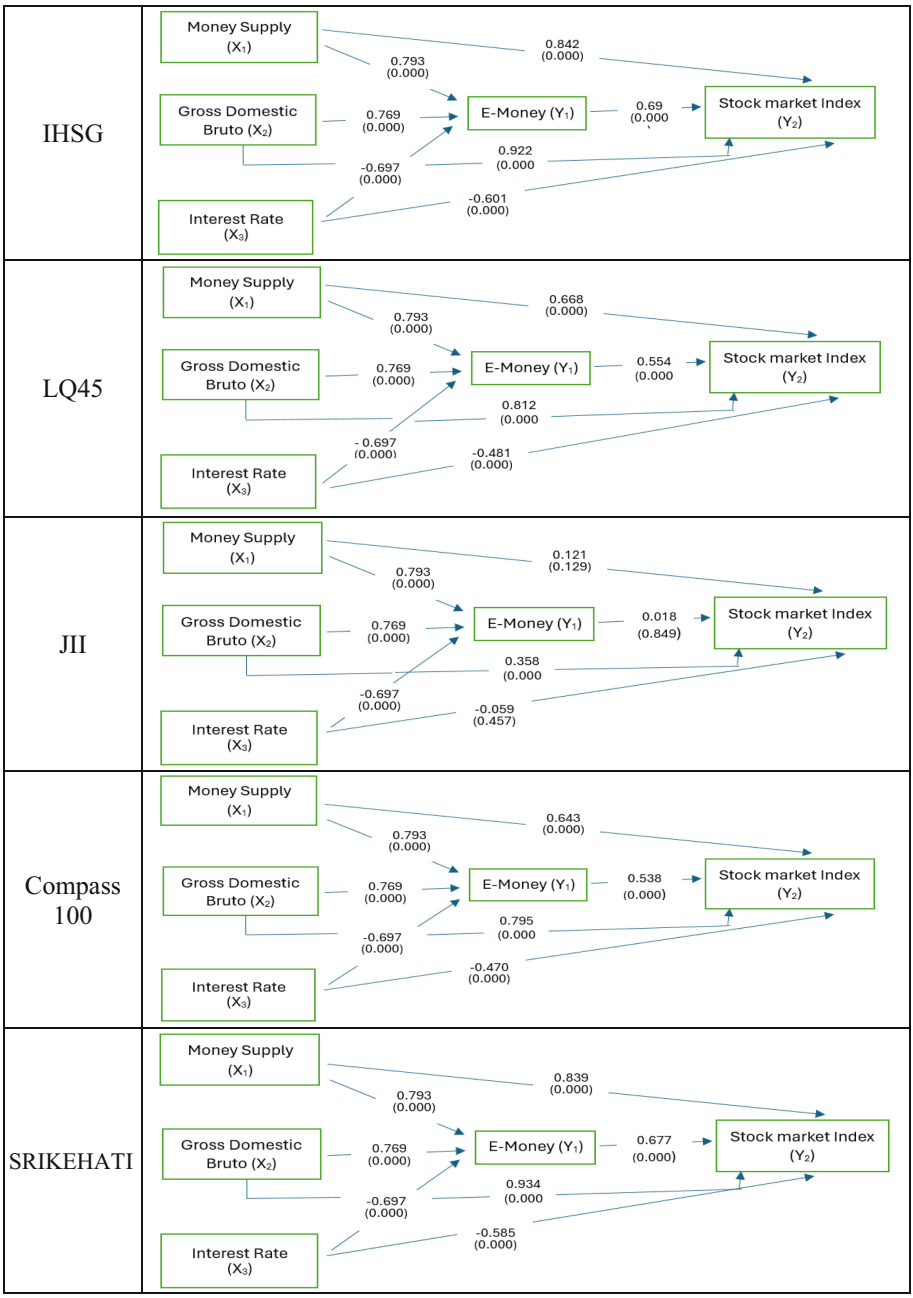

Fig. 2. Regression Coefficient and Significance of 5 Dependent Variables.

Table 3. Test Results Indirect Effects of variables X1, X2, X3 on Y2 through Y1

Index	Relationship Between Var	Indirect Effects	Direct Effects	Total Influence	Hypothesis Rejected/ Accepted
IHSG	X1 → Y1 → Y2	0.547	0.842	1,389	H8-a. Accepted
	X2 → Y1 → Y2	0.531	0.922	1,453	H8-b Accepted
	X3 → Y1 → Y2	-0.481	-0.601	-1,120	H8-c Accepted
LQ-45	X1 → Y1 → Y2	0.440	0.668	1,108	H8-a. Accepted
	X2 → Y1 → Y2	0.426	0.812	1,238	H8-b Accepted
	X3 → Y1 → Y2	-0.386	-0.481	-0.867	H8-c Accepted
JII	X1 → Y1 → Y2	0.014	0.121	0.135 *	H8-a. Rejected
	X2 → Y1 → Y2	0.013	0.358	0.371*	H8-b Rejected
	X3 → Y1 → Y2	-0.012	-0.059	-0.071*	H8-c Rejected
Compass 100	X1 → Y1 → Y2	0.427	0.643	1,070	H8-a. Accepted
	X2 → Y1 → Y2	0.414	0.795	1,209	H8-b Accepted
	X3 → Y1 → Y2	-0.375	-0.470	-0.845	H8-c Accepted
Be careful	X1 → Y1 → Y2	0.537	0.839	1,376	H8-a. Accepted
	X2 → Y1 → Y2	0.520	0.934	1,454	H8-b Accepted
	X3 → Y1 → Y2	-0.472	-0.585	-1,057	H8-c Accepted

* In the JII Stock Price Index, the influence of variable Y1 on Y2 is not significant at the 0.05 level.

Basically, JII is one of three sharia stock indexes in Indonesia. Sharia stocks are stocks where the companies issuing them are companies that have sharia principles and whose operational activities do not violate sharia principles. Therefore, the JII constituents are very limited, consisting of only 30 stocks. Further research is needed, especially regarding the characteristics of investors who invest in these sharia stocks.

The results of this research support the research of Naik and Padhi (2012), Baskara and Sulasmiyati (2017), Vatansever (2020), Setiawan (2020) and Shiblee (2011), that the stock price index is directly and indirectly influenced by fundamental macroeconomic factors. The higher the amount of money supply, the consumer's purchasing power will also increase, then, the use of e-money in society will also increase.

Support previous research (Reddy 2012) show that GDP has a positive effect on the stock price index, both directly and through the e-money variable, because GDP is an indicator of the economic conditions of a country. When the economic conditions indicated by the GDP value incerase, it indicates that the welfare of the community and the economic sector increased, and then affects stock prices. While the interest rate level shows a negative relationship with stock prices which is in line with the research Setiawan2020), because the higher the interest rate, the more a person will tend to use money for operational activities.

Based on the coefficient value, among the 3 fundamental macroeconomic factors, the most dominant factor and the largest direct influence on the stock price index is the GDP. The second factor is money supply, and then interest rate. Meanwhile, e-money has the greatest influence as mediating the interest rate on the stock index.

6 Conclusion

The test results show that the variables of money supply and GDP have a significant positive effect while the interest rate has a significant negative effect on e-money and the stock price index on the IHSG, LQ 45, Kompas 100 and Srikehati. While on the JII index the results obtained are different, where money supply, interest rates, and e-money do not affect the stock price index. The analysis that can be done on the results is that there is a possibility that the difference is caused by differences in investor characteristics. This research is important to continue because understanding investor characteristics will be very useful for investment analysts and policy makers, for example the Financial Services Authority as and the Stock Exchange authority (OJK).

References

Conrad, C.A.: The Effects of Money Supply and Interest Rates on Stock Prices, Evidence from Two Behavioral Experiments. Applied Economics and Finance **8**(2), 33 (2021). https://doi.org/10.11114/aef.v8i2.5173

Adrian, T., Tommaso, M.-G.: The Rise of Digital Money. (2021). https://doi.org/10.1146/annurev-financial-101620

Aimon, H., et al.: E-money and Stock: Empirical Evidence from Indonesia and Thailand. Signifikan: Jurnal Ilmu Ekonomi **10**(1), 139–148 (2021). https://doi.org/10.15408/sjie.v10i1.15380

Aithal, P S.: Realization Ideal Banking Concept Using Ubiquitous Banking. (2016). https://ssrn.com/abstract=2864295

Igamo, A.M., Falianty, T.A.: The Impact of Electronic Money on The Efficiency of The Payment System And The Substitution of Cash In Indonesia. Sriwijaya International Journal Of Dynamic Economics And Business **2**(3), 237–54 (2018)

Allen, F., Mcandrews, J., Strahan, P.: E-Finance: An Introduction. Journal of Financial Services Research. **22**(1), 5–27 (2002)

Al-Majali, A.A., Al-Assaf, G.I.: Long-Run and Short-Run Relationship Between Stock Market Index and Main Macroeconomic Variables Performance in Jordan. Eur. Sci. J. **1010**(1010), 1857–7881 (2014)

Al-Tamimi, H.A., et al.: Factors Affecting Stock Prices in the UAE Financial Markets. Journal of Transnational Management **16**(1), 3–19 (2011). https://doi.org/10.1080/15475778.2011.549441

Arifin, M., Nisa, Q., Oktavilia, S.: Analysis The Use of Electronic Money in Indonesia. Economics Development Analysis Journal **9**(4), 361–373 (2020). https://doi.org/10.15294/edaj.v9i4.39934

Assagaf, A., Murwaningsari, E., Gunawan, J., Mayangsari, S.: The Effect of Macro Economic Variables on Stock Return of Companies That Listed in Stock Exchange: Empirical Evidence from Indonesia. International Journal of Business and Management **14**(8), 108 (2019). https://doi.org/10.5539/ijbm.v14n8p108

BankIndonesia. 2009. *Peraturan Bank Indonesia Nomor :11/12/PBI/2009*

Baskara, Y., Sulasmiyati, S.: Pengaruh Faktor Fundamental Makroekonomi Terhadap Keputusan Investasi Saham Oleh Investor Asing Di Indonesia (Studi Pada Bursa Efek Indonesia (BEI) Periode 2007 â 2014). Jurnal Administrasi Bisnis S1 Universitas Brawijaya **47**(1), 130–139 (2017)

Behrman, J.R.: Review Article On Hollis B. Chenery, Structural Change And Development Policy. (1981)

Blanchard, O.: Output, The Stock Market, and Interest Rates. (2002). https://www.researchgate.net/publication/4723102

Brimantyo, H., et al.: The Role of E-Money on Business Growth in Indonesia. Jurnal Bisnis Dan Manajemen **8**(2), 405–411 (2021). https://doi.org/10.26905/jbm.v8i2.7091

Camilleri, S.J., et al.: Do Stock Markets Lead or Lag Macroeconomic Variables? Evidence from Select European Countries. North American Journal of Economics and Finance **48**, 170–186 (2019). https://doi.org/10.1016/j.najef.2019.01.019

Chandrarin, G.: Metode Riset Akuntansi Pendekatan Kuantitatif. In: Metode Riset Akuntansi Pendekatan Kuantitatif, Puji , P. (eds.) Lestari, pp. 102–106. Malang, Salemba Empat (2017)

Diana, Fatatik Noer, and Widita Kurniasari. 2021. "Buletin Ekonomika Pembangunan Buletin Ekonomika Pembangunan" 2 (2): 116–33

Foster, B., et al.: Analysis of the Effect of Financial Literacy, Practicality and Consumer Lifestyle on the Use of Chip-based Electronic Money Using Sem. Sustainability (Switzerland) **14**(1). (2022). https://doi.org/10.3390/su14010032

Harcourt, G.C.: Kahn and Keynes and the Making of The General Theory.Cambridge Journal of Economics. **18** (1994). https://doi.org/10.1093/oxfordjournals.cje.a035256

Hartono, J.: Teori Portofolio Dan Analisis Investasi, 11th edn. BPFE-Yogyakarta, Yogyakarta (2016)

Hosseini, S.M., Ahmad, Z., Lai, Y.W.: The Role of Macroeconomic Variables on Stock Market Index in China and India. International Journal of Economics and Finance **3**(6) (2011). https://doi.org/10.5539/ijef.v3n6p233

Hove, L.V.: Electronic Money and the Network Externalities Theory: Lessons for Real Life . Netnomics. Vol. 1 (1999)

Ichwani, T., Nisa, C.: Determinants of BI 7 – Days Reverse Repo Rate, GDP, and Exchange Rate Against the Money Supply. Journal of Business, Management, and Accounting **3**(2), 92–99 (2021)

Igoni, S., et al.: The Link between Electronic Transactions and Stock Market Performance in the Nigerian Financial Ecosystem. International Journal of Advanced Engineering Research and Science (IJAERS) **8**(1), 2456–1908 (2021). https://doi.org/10.22161/ijaers

Indonesia Stock Exchange: IDX Stock Index Handbook v1.2. (2021)

Keran, M.W.: Expectations , Money , and the Stock Market. Federal Reserve Bank of St.Louis, pp. 16–31 (1971)

Khatimah, H., Susanto, P., Abdullah, N.L.: Hedonic Motivation and Social Influence on Behavioral Intention of E-Money: The Role of Payment Habit as a Mediator. International Journal of Entrepreneurship **23**(1), 1–9 (2019)

Lukmanulhakim, M., Djambak, S., Yusuf, K.: Pengaruh Transaksi Non Tunai Terhadap Velositas Uang Di Indonesia. Jurnal Ekonomi Pembangunan **14**(1), 41–46 (2016)

Moharana, S.S., et al.: Ubiquitous Virtual Currency. (2013). www.iosrjournals.org

Muid, D., Raharjo, D.: Analisis Pengaruh Faktor-Faktor Fundamental Rasio Keuangan Terhadap Perubahan Harga Saham Yang Terdaftar Di Indeks LQ45 Selama Periode 2007–2011. Diponegoro Journal of Accounting **2**(2), 444–454 (2013)

Naik, P.K., Padhi, P.: Interaction of Macroeconomic Factors and Stock Market Index: Empirical Evidence from Indian Data. SSRN Electron. J. (2012). https://doi.org/10.2139/ssrn.2150208

Neama, N.H., Mahdi Saleh, H.: Evaluation of Electronic Trading and Central Depositery. Iraq Stock Exchange for the Perios (2008–2018) **12**(2), 22–33 (2020). https://doi.org/10.28936/jmracpc12.2.2020

Nizar, M.A., Hanifah, A.: Program Penjaminan Uang Elektronik (E-Money). Fiskal.Kemenkeu.Go.Id, (2021)

OJK: Peraturan Otoritas Jasa Keuangan Republik Indonesia Nomor 22/PJOK.04/2019 Tentang Transaksi Efek. PJOK Tentang Transaksi Efek, pp. 1–29 (2019)

Keuangan, O.J.: CAPITAL MARKET FACT BOOK. Indonesia (2022)

Putri, C.A., Eko Prasetyo, P.: Money Supply, Counterfeit Money, and Economic Growth Effect to E-Money Transaction. Efficient Indonesian Journal of Development Economics **3**(1), 634–649 (2020). https://doi.org/10.15294/efficient.v3i1.35951

Qin, R.: The Impact of Money Supply and Electronic Money: Empirical Evidence from Central Bank in China. BMC Public Health **5**(1), 1–8 (2017)

Ramadhani, W., et al.: Pengaruh Pembayaran Non Tunai Dan Tingkat Suku Bunga Kebijakan Terhadap Sistem Pembayaran Di Indonesia. (2021). https://doi.org/10.14414/jbb.v11i1.2591

Reddy, D V Lokeswar. 2012. "Impact Of Inflation And GDP On Stock Market Returns In India." *International Journal of Advanced Research in Management and Social Sciences* 1 (6): 120–36. www.garph.co.uk

Rizal Ramadhani, W., et al.: Analysis of The Effect of Exchange Rates, E-Money and Interest Rates on the Amount of Money Supply and Its Implications on the Inflation Level in Indonesia 2012–2017, **2**(1), 1–17 (2019)

Rogalski, R.J., Vinso, J.D.: Stock Returns, Money Supply and the Direction of Causality. J. Financ. **32**(4), 1017–1030 (1977). https://doi.org/10.1111/j.1540-6261.1977.tb03306.x

Sari, M.: The Effect Of Money Supply And Interest Rate On Stock Price. Central European Management Journal **31**, 233–40 (2023). https://doi.org/10.57030/23364890.cemj.31.1.24

Setiawan, S.A.: Does Macroeconomic Condition Matter for Stock Market? Evidence of Indonesia Stock Market Performance for 21 Years. The Indonesian Journal of Development Planning. **4** (2020)

Shiblee, L.S.: The Impact of Inflation, GDP, Unemployment, and Money Supply On Stock Prices. SSRN Electronic Journal (2011). https://doi.org/10.2139/ssrn.1529254

Suseco, T.: Effect of E-Money to Economic Performance (A Comparative Study of Selected Countries). In: The 2016 International Conference of Management Sciences, pp. 9–12. (2016)

Thomas, B.N.M.I.: New Stock Market Model. SSRN Electron. J. **1**, 12 (2005). https://doi.org/10.2139/ssrn.403

Triani, L.F.: Faktor-Faktor Yang Mempengaruhi Perubahan Indeks Harga Saham Di Jakarta Islamic Index Selama Tahun 2011. Jurnal Organisasi Dan Manajemen **9**(2), 162–178 (2013)

Vatansever, H.: Determining Impacts on Non-Performing Loan Ratio in Romania. Review of International Comparative Management **20**(2), 119–129 (2020). https://doi.org/10.24818/rmci.2019.2.155

Worlu, C.N., Omodero, C.O.: A Comparative Analysis of Macroeconomic Variables and Stock Market Performances in Africa (2000–2015). International Journal of Academic Research in Accounting, Finance and Management Sciences **7**(4), 3436 (2017). https://doi.org/10.6007/ijarafms/v7-i4/3436

Yahya, M., Hussin, M.: Macroeconomic Variables and Malaysian Islamic Stock Market: A Time Series Analysis. Journal of Business Studies Quarterly **3**(4), 1–13 (2012)

Zandi, M., Sophia, K., Virendra, S., Paul, M.: The Impact of Electronic Financial Payments on Economic Growth. SSRN Electronic Journal, 1–31 (2016)

Zhou, C.: Stock Market Fluctuations and the Term Structure. Finance and Economics Discussion Series **1996**(3), 1 (1996)