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The Impact of Investor Sentiment on Stock Returns in the Indonesian Stock Market During the Period (2001-2022): An Econometric Study

Abdelkader Bagheffar[1], Cheikh Saous [2*]

[1] Algerian African economic integration Laboratory, University of Ahmed Draya – Adrar(Algeria), a.kaderbagheffar@univ-adrar.edu.dz

[2] University of Ahmed Draya –Adrar(Algeria), saous_cheikh@univ-adrar.edu.dz

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Abstract:

The study aims to test the impact of financial investors' sentiment on the returns of IDX Index (JKSE) stocks in the Indonesia Stock Exchange during the period from 2001-2022 using the autoregressive model conditional on the generalized inhomogeneity of variance (GARCH). The study was based on the monthly data of each of the consumer confidence index, which expresses investor sentiment, and the returns of the (JKSE) index.

The results showed that there was a statistically significant positive effect of the changes in investor sentiment on the returns of the (JKSE) index during the study period.

Keywords: behavioral finance; investor sentiment; stock returns; traditional finance.

(JEL) Classification : G14 ; G11; G12.

1. Introduction:

The history of the stock market is full of events amazing enough to earn it special names: the Great Crash of 1929, the Tonic's boom of the early 1960s, the Go-Go years of the late 1960s, the Nifty Fifty bubble in the early 1970s, the crash of Black Monday in October 1987, the Internet bubble or Dot .com in the 1990s. Each of these events indicates a dramatic level or change in stock prices that seems to defy explanation.

The traditional financial model, that assumes that investors are perfect and sensitive in their investment decisions in the stock market, and therefore they are insensitive to the impact of return and risk so that they have integrated all the necessary information available according to the efficient market hypothesis and that they are unbiased in stock analysis and selecting winning stocks.

* Corresponding author

But the appearance of anomalies and the existence of systematic mispricing in capital markets resulting from emotional factors and the failure of traditional finance to explain it revealed that investors are not always rational. These anomalies can be explained by an emerging field called behavioral finance or behavioral finance which considers how different psychological characteristics influence the behavior of individuals or groups as investors, analysts and portfolio managers. It seeks to understand how emotions and cognitive errors influence the behavior of individual investors, and attempts to explain why and how investors act outside the bounds of rationality in ways opposite to what they should do. Behavioral finance literature indicates that investor sentiment affects trading decisions, and the impact of future expectations of investors can lead to an increase or decrease in stock prices and thus influence pricing models.

1.1. Research Problematic:

In line with what has been mentioned, the following problem can be raised: **Is there an impact on investor sentiment on the returns of the IDX Composite Index (JKSE) in the Indonesian Stock Exchange?**

1.2. Study Hypotheses:

The study is based on the following hypotheses:

- There is a statistically significant relationship between the sentiment of financial investors and the returns of the **IDX** Composite Index (**JKSE**) at a significant level (0.05).
- There is a significant effect at the level (0.05) of the sentiment of financial investors on the returns of shares of the **IDX** Index (**JKSE**).

1.3. The aim of the study:

Based on the above in addition to the problematic raised, the main objective of this study is to determine the impact of investor sentiment on the volatility of stock prices and returns in the Indonesian stock market, by examining the relationship between investor sentiment and stock returns and trying to explain it within the framework of behavioral finance theory that appeared to explain the anomalies witnessed by the financial markets and were unable to be explained by the traditional theory.

1.4. Study methodology:

We used the descriptive approach to review the theoretical side of investor sentiment, and relied on the statistical and econometric approach on the applied side to analyze and model the study data to find out the nature of volatility using the **GARCH** model**.**

1.5. Previous studies:

-A study (Perez-Liston, Huerta, & Haq, 2014)titled: Does investor sentiment impact the returns and volatility of Islamic equities?

This study sought to examine whether investor sentiment affects the returns and volatility of the **Dow Jones** Islamic American stock index using the GARCH and VAR model during a period from 1996-2012. And those upward shifts in investor sentiment in the current period are accompanied by conditional fluctuations in the subsequent period.

-Study (Mathieu, 2015): Investor Sentiment and the Return and Volatility of REITs and Non REITs during the financial Crisis

This study aimed to study the effect of investor sentiment on returns and conditional fluctuations of financial assets in an unstable market environment, using the **GARCH-M** model to determine to what extent returns and conditional fluctuations are affected by investor sentiment. The financial crisis of 2007 and results indicate that the impact of investor sentiment on returns is higher during a crisis than in a calm market environment for both Equity **REIT** and **S&P500**, and **NASDAQ** returns are affected by market sentiment.

Study (Corredor, Ferrer, & Santamaria, 2015): The impact of investor sentiment on stock returns in Emerging markets. The case of Central European markets

This paper examines the impact of consumer confidence as an indicator of investor sentiment on stock returns in three emerging European markets: the Czech Republic, Hungary and Poland. The results show that investor sentiment is a major variable in the prices of stocks traded in these markets and its impact is stronger than it was in the more developed European markets Stock.

-Study (Aydogan, 2016): Sentiment dynamics and volatility of international stock markets

This study analyzed the effect of investor sentiment on the conditional volatility of stock market returns in both The United States, the United Kingdom, France, Germany, Spain, Ireland, Greece, and Turkey during the period 2004-2015 Using the **TGARCH** sentiments supported model, the model showed that there is an asymmetry feature in a trace Shocks for all markets, and the estimated coefficient of the consumer confidence index as a proxy for investor sentiment is significant Statistically and negatively for France and Germany, and statistically significant and positive for Ireland alone.

-Study (Anusakumar, Ali, & Wooi, 2017): The Effect Of Investor Sentiment On Stock Returns: Insight from Emerging Asian Markets.

This paper aims to study the relationship between investor sentiment and stock returns in emerging Asian markets: Malaysia, India, Indonesia, Philippines, Taiwan, South Korea and China, from 2001 to 2011. Trading volume as an indicator of investor sentiment, and in order to test the relationship, the longitudinal data model was used and the fixed effects model, and the results showed a statistically significant positive relationship between investor sentiment and stock returns in the markets under study, and significant differences were revealed between those countries in the impact of sentiment.

-Study(Gao, Zhao, Sun, & Zhao, 2022): Effects of investor sentiment on stock In China's green stock markets volatility: new evidences from multi source data

This study aims to investigate the effects of investor sentiment on different types of stock volatility, with focus On 106 stocks from the renewable energy and environmental protection sectors, two indices of investor sentiment were built using Internet texts and stock trading data, and the results show that both sentiment indicators exert positive effects Significant fluctuations achieved and continued.

2. Theoretical foundations of financial investor sentiment:

2.1. Investor sentiment and stock returns:

Many studies examine the relationship between investor sentiment and stock returns investors from behavioral finance in response to the failure of the traditional view to interpret noise, anomalies in Market, arbitrage and other psychological characteristics of stock market investors (Ansari, Al Hashfi, & Setiyono, 2020). So that the traditional financial model believes that rational investors always guide the price of the underlying market to be equal to the present value of the expected cash flow. And today it is difficult for him to explain many crises that occurred in the past. This has led researchers in behavioral finance to propose an alternative model structure on two basic assumptions (Baker & Wurgler, 2007): the first assumption was made in a study (DeLong, Andrei, Lawrence, & Robert, 1990). Investors submit to feelings. The second hypothesis confirmed by (SHLEIFER & VISHNY, 1997) that betting for emotional investors is expensive and risky.

The development of behavioral finance theory sparked a discussion about the impact of investor sentiment on asset returns in financial market securities. Investor sentiment is the investor's confidence in the financial market, and is usually affected by emotions and investment risks and future cash flows (Ansari, Rizal; Tulasmi; Sawitri, 2022).

For both theoretical and empirical research, investor sentiment strongly influences stock prices, with inevitable consequences for choice Portfolio and asset management, where psychological differences between heterogeneous investors have implications on the pricing of assets in the market (P H & Rishad, 2020).

The presence of investor sentiment creates such noise in the valuation of a stock or portfolio that the price deviates from its price basically, empirically, the effect of investor sentiment on stock returns may be a temporary variable that it tends to be positive at the concurrent level but negative at the delayed level (Ansari, Al Hashfi, & Setiyono, 2020).

The results are related to how investors react to noise and mispricing stocks, in the short term the early adopters take advantage of the noise to earn positive returns, cause it to increase positive sentiment. At the same time it pushes the stock beyond its fundamental value, however in the long run the rational investment operations will result in the disposal of overvalued shares through an arbitrage transaction. This is why excessively positive sentiment will be followed by low returns for stocks in the run-up to arbitrage with one step (Miwa, 2016).

As a psychological factor, it is difficult to estimate the morale of investors due to its own and qualitative nature. However, it has been done use different indicators to measure morale. These morale indicators are divided into direct and indirect, or direct standards, the researchers measure the investor's feeling through the techniques great samples, and the chances of errors in sampling are high, on that they may be able from giving a general picture of the prevailing feelings, and among these indicators, we find: consumer confidence index, investigation The American Association for Individual Investors. While indirect metrics use the morale indicators that he market is determined by the market, such as trading volume, contact rates, market size, and stock size.

3. Applied framework for study:

3.1. Study methodology:

Several studies have tried to measure the effect of the behavioral bias for investors on the performance of the capital market, but given that the feelings of investors cannot be observed directly, specific measurement indicators have not been obtained as a multiple way reference to measure investor morale on the capital market, previous studies have used morale Investors.

Some studies relied on media reports, events and other available documents the public has to collect information about investors' behavior as a study (Ansari, Rizal; Tulasmi; Sawitri, 2022) (Mathieu, 2015)and (Perez-Liston, Huerta, & Haq, 2014).

Other studies have been made and opinion polls among investors for the same thing. Some other researchers used indicators based on the market is like price

movements and trading activities to build feelings indicators as a study (Anusakumar, Ali, & Wooi, 2017).

In this current study, we will try to use the consumer confidence index as an investor morale indicator as it was adopted by several studies, including (Corredor, Ferrer, & Santamaria, 2015) and (Aydogan, 2016), because the consumer confidence index reflects the behavioral financial philosophy, as it includes beliefs The individual, including emotional and cognitive biases, in addition - a large number of traders in the capital markets indicate that the consumer confidence index may help find what individual investors think about the economy and capital markets.

3.2. User Model:

In order to study how investor morale interacts with financial market returns, this study relied on the GARCH model, which is a generalization of the ARCH model (Generalize Autoregressive Conditional Heteroscedasticity).

3.2.1 Generalized Autoregressive Model for Non-Static Conditional Variances GARCH: The generalized autoregressive model or GARCH model was first introduced by Bollerslev (1986) and developed to examine fluctuations in returns. The output of the GARCH (p,q) model estimates the predictability of the stock's future returns and determines the nature of volatility, in other words if volatility is persistent or not. This model combines autoregressive p-labeled variance with q-labeled mean squared error. The variance equation was determined in the following equation (Alexander & Simon, 2018):

$$\sigma_t^2 = \omega + \sum_{j=1}^{q} \beta_j \sigma_{t-j}^2 + \sum_{i=1}^{p} \alpha_i \varepsilon_{t-i}^2$$

Where: ω is the constant, $\sigma_{t-j}^2$the value of variance expected in a previous day formed by GARCH, ε_{t-i}^2squared of the residual from the equation of the mean formed by ARCH.

The GARCH (1, 1) model is a simplified form of the general autoregressive model for conditional data that is not fixed, where the value of (p = 1) indicates that the auto regression from the first cycle of the slow variance $\sigma_{t-1}^2$and the

value of (q = 1) The moving average is of the first order of the square of the slowed error ε_{t-1}^2. After selecting the best model in the (GARCH) family using the (AIC) criterion, an impact test (ARCH) is performed to test the validity of the model to conduct the study on.

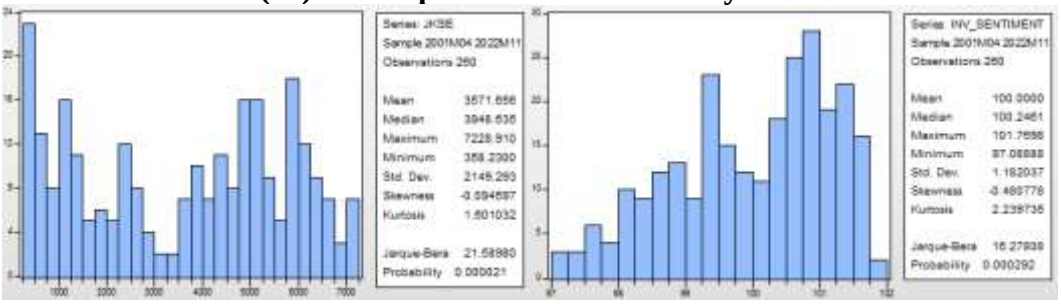
4. Results and discussion:

In this part, we will attempt to build a standard model to measure the impact of financial investor sentiment as an independent variable on the dependent represented by the returns of the JKSE index, and then verify the validity of the standard model in order to interpret the relationship between the variables of the study by conducting the ARCH impact test, or instead rely on the GARCH model.
The monthly data of the Consumer Confidence Index for Indonesia from 01/04/2001 to 11/01/2022 were used, which expresses the investor sentiment variable. Data were obtained from the website: https://fred.stlouisfed.org/
As for the returns of the (JKSE) index, it was relied on its monthly closing prices during the period from 01/04/2001 to 01/11/2022, and data was obtained from the website: https://sa.investing.com/

4.1. Description of the study variables:

The description of the study variables involves the examination of the characteristics of the Consumer Confidence Index, which serves as an indicator of investor sentiment, and the monthly returns series of the (JKSE) index. This is achieved by utilizing descriptive statistics for both series.

Table (01): Descriptive Statistics of Study Variables.



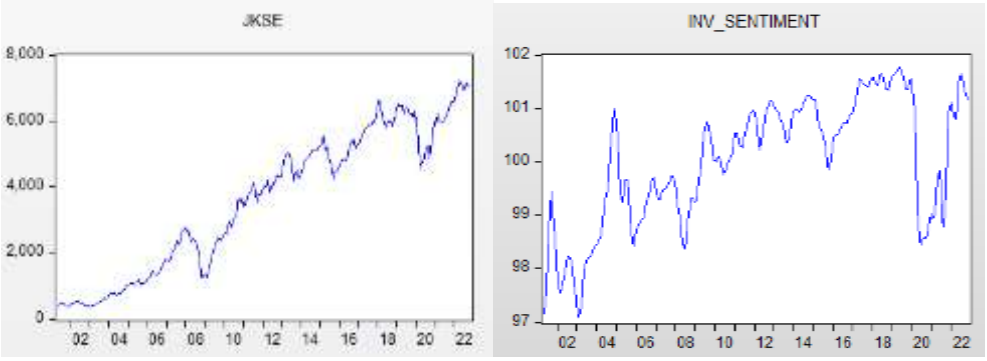
Source: Prepared by the researchers based on the outputs of the EVIEWS program

The figure above illustrates the descriptive statistics of the study variables, indicating that the average monthly returns of the (JKSE) index during the study period amounted to 3571.556. The table also reveals the risk (measured by standard deviation), which reached a value of 2149.293, suggesting that investing in (JKSE) index stocks involves a certain level of risk. Furthermore, the skewness coefficient (Skewness) was negative for both series, indicating a lack of symmetry in their distribution and a leftward skewness with kurtosis values lower than the kurtosis of a normal distribution (value of 3). Thus, the distribution of both series exhibits leptokurtosis. Regarding the test for normal distribution, the Jarque-Bera statistical results yielded a probability value less than 5% for both series, suggesting that the returns series of the (JKSE) index and the Consumer Confidence Index do not adhere to a normal distribution.

4.2. Testing the Stability of Time Series for Study Variables:

The stability of time series is evaluated by examining the graphical representation of the historical curve of the phenomenon. This procedure allows for the identification of specific characteristics within the series, such as the presence or absence of a general trend, variability instability, and the occurrence of extreme or outlier values. If necessary, appropriate transformations are applied to ensure stability. The following figure depicts the graphical representation of the time series for the study variables.

Figure (01): Graphical Representation of the Returns Series of the (JKSE) Index and the Consumer Confidence Index (Investor Sentiment)



Source: Prepared by the researchers based on the outputs of the EVIEWS program

Upon examining the graphical representation of the returns series of the (JKSE) index and the Consumer Confidence Index (Investor Sentiment) shown above, it becomes evident that these series are non-stationary or unstable, as they demonstrate a tendency towards upward movement with a certain level of variability. This observation implies that the mean and variance of these time series are not stable.

However, assessing the stability of a time series requires more than just relying on graphical representation. Additional tests must be conducted to confirm the presence or absence of a unit root. These tests can be categorized into parametric and non-parametric unit root tests, including the simple and augmented Dickey-Fuller tests, the Elliott-Rothenberg-Stock GLS test, the Phillips-Perron test, and the KPSS test.

In this study, we will utilize the augmented Dickey-Fuller (ADF) test, which relies on t-statistics for the autoregressive coefficient, to test the following hypotheses:

- Null Hypothesis (H0): The indicator series under study are non-stationary and contain a unit root during the study period.
- Alternative Hypothesis (H1): The indicator series under study are stationary during the study period and do not contain a unit root.

If the null hypothesis is rejected and the alternative hypothesis is accepted, the series of the two indicators will be stationary and do not contain a unit root (Bagheffar & Saous , 2022)

The results of the study are presented in the following table:

Table (02): Results of the Augmented Dickey-Fuller (ADF) Test for the Returns Series of the (JKSE) Index and the Consumer Confidence Index (Investor Sentiment).

ADF test results for (JKSE) index return series					
ADF	t-Statistic	α=1%	α=5%	α=10%	p-value
Intercept	-0.463140	-3.455486	-2.872499	-2.572684	0.8947
Trend and Intercept	-3.223435	-3.994026	-3.427339	-3.136978	0.0821
None	1.864884	-2.573921	-1.942054	-1.615882	0.9853
ADF test results for indicator series (INV_SENTIMENT)					

Intercept	-2.289102	-3.455786	-2.872630	-2.572754	0.1763
Trend and Intercept	-3.276063	-3.994310	-3.427476	-3.137059	0.0726
None	0.310982	-2.574026	-1.942069	-1.615872	0.7749

Source: Prepared by the researchers based on the outputs of the EVIEWS program

The results of the augmented Dickey-Fuller (ADF) test for the returns series of the (JKSE) index and the Consumer Confidence Index indicate that they are non-stationary and contain a unit root. This is evident as the p-values exceed the significance levels of 1%, 5%, and 10%. Consequently, there is insufficient evidence to reject the null hypothesis of data non-stationarity. This suggests that the statistical properties of the studied indicators exhibit changes over time and are likely influenced by time-dependent trends or other time-varying factors. Therefore, it is necessary to take the first differences of the series under study to achieve stationarity and stabilize their variance.

Table(03): Results of the Augmented Dickey-Fuller (ADF) Test for the Returns Series of the (JKSE) Index and the Consumer Confidence Index (Investor Sentiment) after performing first differences.

ADF test results for (JKSE) index return series					
ADF	t-Statistic	α=1%	α=5%	α=10%	p-value
Intercept	-13.85206	-3.455585	-2.872542	-2.572707	0.0000
Trend and Intercept	-13.82687	-3.994026	-3.427339	-3.136978	0.0000
None	-13.60538	-2.573956	-1.942059	-1.615878	0.0000
ADF test results for indicator series (INV_SENTIMENT)					
Intercept	-7.665791	-3.455786	-2.872630	-2.572754	0.0000
Trend and Intercept	-7.637762	-3.994310	-3.427476	-3.137059	0.0000
None	-7.683485	-2.574026	-1.942069	-1.615872	0.0000

Source: Prepared by the researchers based on the outputs of the EVIEWS program

The results of the augmented Dickey-Fuller (ADF) test, as presented in the table above, indicate that for the returns series of the (JKSE) index and the Consumer Confidence Index after performing first differences, the calculated ADF value is negative and smaller than the critical values from the Mackinnon distribution at all significance levels (10%, 5%, 1%) for both series. This implies

the rejection of the null hypothesis, indicating that the returns series of the (JKSE) index and the Consumer Confidence Index after first differences do not contain a unit root. Hence, they are stationary and stable, which is applicable to all three models.

4.3. The ordinary linear correlation test between investor sentiment and JKSE index returns:

The correlation matrix provided in the table below reveals a positive correlation between the returns of the (JKSE) index and the Consumer Confidence Index, representing investor sentiment, at a significance level of 17%. This indicates the existence of a somewhat moderate correlation between the variables. It suggests that investor sentiment, represented by the Consumer Confidence Index, is correlated and can partially explain the overall variations in (JKSE) index returns.

Table (04): Linear Correlation Coefficient between (JKSE) Returns and the Consumer Confidence Index (Investor Sentiment).

	JKSE	INV_SENTIMENT
JKSE	1	0.171259
INV_SENTIMENT	0.171259	1

Source: Prepared by the researchers based on the outputs of the EVIEWS program

4.4. Simple Regression Analysis between Investor Sentiment and (JKSE) Returns:

The simple linear regression model using the method of least squares was employed to estimate the standard model for measuring the impact of investor sentiment on (JKSE) index returns. The estimation results are presented in Appendix (Table 05):

- The coefficient value of the investor sentiment variable is positive and equals 130.1427, indicating a significant positive relationship between investor sentiment and (JKSE) index returns with a probability value less than 0.05, statistically significant at a 1% significance level. This implies that (JKSE) index returns are affected by investor sentiment with a confidence level of

99%, such that a one-unit change in investor sentiment leads to a positive change in (JKSE) index returns.

- The correlation coefficient indicates a positive correlation between investor sentiment and (JKSE) index returns, with a value of 0.292 (R-squared). The adjusted R-squared value (0.292106) suggests that 29.2% of the variations in (JKSE) index returns can be explained by changes in investor sentiment, while the remaining percentage is explained by other factors.
- The F-statistic is 7.765513, with a probability value less than 0.05, indicating the significance of the regression and the significant impact of investor sentiment on (JKSE) index returns. This confirms the statistical acceptability of the model.

4.5. Test the autocorrelation between randomization errors:

The linear autocorrelation of errors is among the most important problems that scales face when estimating models, which leads to standard errors and thus wrong statistical tests. The model estimated using the ARCH effect, and the results of the ARCH test are shown in Table 06, that the probability value of the remainder Prob. F is less than 0.05, which indicates the existence of a problem of autocorrelation of the residuals, and this means that the model is invalid to explain the relationship between the variables of the study, which leads us to rely on the GARCH model to address this problem.

Table (06): Results of the ARCH effect test for the regression model

Heteroskedasticity Test: ARCH			
F-statistic	21.60478	Prob. F(1,256)	0.0000
Obs*R-squared	20.07902	Prob. Chi-Square(1)	0.0000

Source: Prepared by the researchers based on the outputs of the EVIEWS program

4.6 . Results of GARCH Model Estimation:

The GARCH (1,1) model was used to estimate the impact of investor sentiment on (JKSE) index returns. The GARCH model helps analyze the volatility characteristics of datasets, especially for financial data, as it exhibits unique features such as heteroskedasticity and volatility clustering. The estimation results of the GARCH (1,1) model, shown in Appendix (Table 07), indicate that

all the model parameters are statistically significant. This means that the past errors and conditional variances of previous returns can predict the persistence of volatility. The results also show a significant positive effect of investor sentiment changes on (JKSE) index returns.

The estimated value of α_1 is positive and statistically significant, equal to 0.113. This indicates the presence of time persistence in the return generation process, suggesting that shocks to (JKSE) index returns have a short-term impact and response. The value of β_1, for the model, is 0.905, indicating that the volatility resulting from fluctuations will be followed by another high volatility in the subsequent period. As for the nature of volatility (volatility persistence), the sum of the coefficients ($\alpha_1 + \beta_1$)is greater than one, implying that shocks experienced by (JKSE) index returns have more persistent effects, and the volatility diminishes at a slower rate.

To confirm the validity of the GARCH (1,1) model, an ARCH effect test was conducted on the residuals. The probability value of the residuals F-statistic in the ARCH test was greater than 0.05, indicating the absence of an ARCH effect. This leads us to conclude that the model is valid for interpreting the relationship between the study variables.

Table (08): Results of the ARCH Effect Test on the Residuals of the GARCH (1,1) Model.

Heteroskedasticity Test: ARCH			
F-statistic	2.980510	Prob. F(1,257)	0.0855
Obs*R-squared	2.969226	Prob. Chi-Square(1)	0.0849

Source: Prepared by the researchers based on the outputs of the EVIEWS program

The positive relationship between investor sentiment and JKSE returns can be explained by the fact that when sentiment is positive, investors actively participate in the market with the expectation of higher returns. However, this causes more speculative activities in the markets and may cause an overvaluation of stocks. Negative sentiment Investors turn away from the market due to negative expectations of market returns, so it can be assumed that during positive sentiment, companies explore the opportunity to enter the market through IPOs, and similarly,

announcing dividends and issuing bonuses also raise positive sentiment for investors.

5. Conclusion:

The effect of investor sentiment on the formation of stock market prices has been the subject of interest for many academics and practitioners, especially after the emergence of the behavioral financial theory literature, Investor sentiment on the returns of the Composite IDX Index (JKSE) in the Indonesian Stock Exchange. 11/2022, and the study reached, through the use of the GARCH model, the following results:

- There is a positive correlation between the returns of the (JKSE) index and the consumer confidence index that expresses the sentiments of investors, so that 29.2% of the changes in the returns of the (JKSE) index were explained by changes in the sentiments of investors, while the remaining 42% is explained by other factors.
- There is a statistically significant positive effect of the changes in investor sentiment on the returns of the (JKSE) index during the study period.
- The results indicate that when investors are more optimistic about the market achieving excessive returns, their optimism leads to more speculative activities that change them to invest more.
- The study also found the continuity of market volatility and the sentiment index, which indicates the effect on sentiment and excess market returns.
- Appropriate examination of investor sentiment helps fund managers determine investment entry and exit points. By taking into account investor sentiment as an important factor for stock market volatility in asset price models, investors can improve the performance of their portfolios.

Thus sentiment is a critical component that directly influences market behavior, as the traditional capital asset pricing model theory states that investors should be rewarded according to their risk-based behavior, however the effect of sentiment on market volatility may cause uncertainty in the market and lead to returns Less, if the market participants fail to earn the market risk premium due to its expected volatility, they will move away from the market, which leads to more volatility in

the market. This vicious circle may cause a downward trend and poor growth and development of the market. Traditional capital supports behavioral finance theory.

6. Recommendations:

Based on the results obtained in this study, the following suggestions can be made:

- Incorporating investor sentiment within the external variables affecting the Indonesian stock market.
- Conducting more studies on the feelings of investors in the financial markets, especially the emerging Arab financial markets, as the issue of investor feelings is a fertile field for study for the two researchers.
- Using other measures to estimate investor sentiment and comparing these measures.

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8. Appendices :

Table (5): Results of estimating the simple linear slope in the way of small squares

Dependent Variable: DJKSE
Method: Least Squares
Date: 09/28/23 Time: 10:33
Sample (adjusted): 2001M05 2022M11
Included observations: 259 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DINV_SENTIMENT	130.1427	46.70191	2.786667	0.0057
C	23.96021	10.41890	2.299688	0.0223

R-squared	0.293297	Mean dependent var	25.95784
Adjusted R-squared	0.292106	S.D. dependent var	169.4580
S.E. of regression	167.2789	Akaike info criterion	13.08489
Sum squared resid	7191434.	Schwarz criterion	13.11236
Log likelihood	-1692.494	Hannan-Quinn criter.	13.09594
F-statistic	7.765513	Durbin-Watson stat	1.766352
Prob(F-statistic)	0.005723		

Source: Prepared by the researchers based on the outputs of the EVIEWS program

Table (7): GARCH model estimation results (1,1)

Dependent Variable: DJKSE
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 09/28/23 Time: 10:21
Sample (adjusted): 2001M05 2022M11
Included observations: 259 after adjustments
Convergence achieved after 31 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
DINV_SENTIMENT	21.28137	21.00222	1.013292	0.0031
C	14.01707	5.025720	2.789068	0.0053
Variance Equation				
C	55.73039	50.22406	1.109635	0.2672
RESID(-1)^2	0.113566	0.020913	5.430474	0.0000
GARCH(-1)	0.905993	0.015649	57.89488	0.0000

R-squared	0.040924	Mean dependent var	25.95784
Adjusted R-squared	0.039682	S.D. dependent var	169.4580
S.E. of regression	169.4396	Akaike info criterion	12.68957
Sum squared resid	7378411.	Schwarz criterion	12.75823
Log likelihood	-1638.299	Hannan-Quinn criter.	12.71718
Durbin-Watson stat	1.718756		

Source: Prepared by the researchers based on the outputs of the EVIEWS program