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Analysis of the Impact of Macroeconomic Indicators on the Volatility of China's Stock Market

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Abstract: *This paper investigates the impact of macroeconomic indicators on the volatility of China's stock market. Seven macroeconomic variables are selected: industrial value-added, consumer price index, money supply, Shanghai Interbank Offered Rate (SHIBOR), US Dollar/Renminbi exchange rate, import volume, and export volume. The volatility of the stock market is measured by the Shanghai Stock Exchange Composite Index price return. Monthly data from January 2010 to December 2023 are used to construct a Vector Autoregressive (VAR) model for empirical analysis. The results indicate that compared to market-driven price fluctuations, the influence of these macroeconomic indicators on stock market volatility is relatively small. However, over time, as the stock market matures and evolves, their impact gradually increases. Among the seven indicators, import volume has the most significant effect on stock market volatility, followed by industrial value-added, consumer price index, SHIBOR, money supply, export volume, and the US Dollar/Renminbi exchange rate. Based on these findings, policymakers should pay attention to these macroeconomic indicators and utilize effective market management and policy optimization to regulate the stock market. Investors should also monitor these economic data and adjust their investment strategies to maximize asset value and manage risks.*

Keywords: *Macroeconomic Indicators, Stock Market, Volatility, Impact Analysis*

1. Domestic and International Research

1.1. Foreign Research Status

Extensive research has been conducted on the relationship between macroeconomic indicators and stock markets, primarily focusing on developed countries with mature markets, while research on emerging markets is relatively limited. Overall, studies suggest that macroeconomic indicators indeed impact stock markets, although specific research perspectives and conclusions vary.

For instance, Chen, Wang, and Lu (2022)[1] utilize the Arbitrage Pricing Theory to demonstrate that macroeconomic variables can systematically influence stock market returns. They explain how this influence is exerted through changes in discount rates, corporate cash flows, and profitability, ultimately affecting investor decisions and market volatility. They also identify a long-term equilibrium relationship between stock market prices and macroeconomic variables. Pramod Kumar Naik and Tapas Kumar Sethy (2022)[2] employ the cointegration method to prove the existence of a long-term equilibrium relationship between stock market prices and macroeconomic variables. Duc Hong Vo et al. (2022)[3] utilize the Vector Error Correction Model to study the long-term equilibrium relationship between these variables and stock market development levels, finding a long-term balance between US national economic indicators and stock market prices. Zhang Hua et al. (2022)[4]analyze the relationship between US stock market returns and inflation and money supply using multiple regression analysis, concluding that these economic indicators influence the stock market through their impact on real economic growth. Wafa S et al. (2022) [5]investigate the impact of unexpected trade balances on the mean returns of bond, foreign exchange, and stock markets, revealing an asymmetrical effect of unexpected trade balances on the three markets. Caner Demir (2019)[6] utilizes the Vector Autoregressive (VAR) model to explore the influence of macroeconomic factors on the volatility of the BIST-100 index. The selected macroeconomic variables include GDP growth rate, inflation rate, interest rate, and money supply. The study finds that GDP growth rate and interest rate have a significant impact on the volatility of the BIST-100 index, while the influence of other macroeconomic variables is less pronounced. Fernando A (2018)[7] uses the VAR model to investigate how macroeconomic indicators affect the volatility of the Sri Lankan stock market, concluding that interest rates and money supply contribute to macroeconomic risk and impact stock market volatility. These findings emphasize the importance of macroeconomic stability for financial market stability.

1.2. Domestic Research Status

China's stock market, despite its significant size after three decades of development, still faces challenges such as investor structures and investment concepts, leading to its "barometer" function not being fully realized. These issues might result in unique price volatility characteristics compared to mature stock markets. To understand the relationship between China's macroeconomic indicators and the stock market, domestic scholars have conducted extensive research on this topic. Liu Tianyu (2023)[8]selects the Shanghai Stock Exchange Composite Index return as the indicator and employs a Realized Volatility model with time-varying persistence (TVP-REGARCH-MIDAS) to analyze the relationship between the stock market and the macroeconomy from the perspectives of interest rates, exchange rates, macroeconomic sentiment index, consumer price index, money supply, and economic policies. The study compares the results with GARCH and EGARCH models and concludes that macroeconomic variables have a significant impact on stock market volatility. Xiao Meifang (2019)[9]utilizes the Vector Autoregressive (VAR) model to analyze the factors influencing the volatility of China's stock market. The study defines the measure of market volatility as the fluctuation of the Shanghai Stock Exchange Composite Index return and employs interest rates, exchange rates, macroeconomic sentiment index, and money supply to discuss the impact of macroeconomic conditions on stock market volatility. Xie Shiqing (2021)[10]uses the SVAR model and selects monthly price index, manufacturing purchasing managers' index, non-manufacturing business activity index, and total retail sales of consumer goods as macroeconomic variables to analyze the relationship between stock market volatility and macroeconomic volatility. The results show that positive macroeconomic volatility has a positive cumulative impact on stock market returns, but there is also a reversal impact interval within one year. Zhang Lin (2020)[11]chooses price-related variables (CPI and PPI), economic growth-related variables (M2, fixed asset investment, and PMI), and foreign trade variables (imports, exports, and trade surplus) for empirical analysis. The conclusions are that stock market returns have an "inflation hedging" function, and PPI, fixed investment, and money supply also significantly impact index returns, while trade surplus is significantly correlated with return volatility. Jiang Fuwei (2021)[12]selects manufacturing purchasing managers' index, consumer price index, urban registered unemployment rate, 1-year treasury bond yield, US Dollar/Renminbi midpoint rate, and Wind All A Index static price-earnings ratio as macroeconomic indicators, combined with the Shanghai Stock Exchange Composite Index return for empirical analysis. The study finds that macroeconomic indicators have a positive impact on the stock market.

1.3. Literature Review

Combining domestic and foreign research, it can be observed that, similar to foreign stock markets, macroeconomic indicators account for a certain proportion of the factors influencing market volatility in China's stock market. Compared to the decades-long development of China's stock market, foreign stock markets have developed for a long time and have become mature, with a strong connection between macroeconomic indicators and the market. Therefore, analyzing macroeconomic indicators can effectively predict stock market volatility. However, the volatility of China's stock market is not only related to macroeconomic indicators but is sometimes more influenced by the price changes of the stock market itself. However, as China's stock market develops and matures, its correlation with macroeconomic indicators gradually increases, and we can also use various models to predict stock market volatility.

2. Empirical Analysis of the Impact of Macroeconomic Indicators on the Volatility of China's Stock Market

2.1. Indicator Selection and Data Sources

2.1.1. Selection of Macroeconomic Indicators and Data Sources

Firstly, the Gross Domestic Product (GDP), which best reflects the operation and development level of a country's economy, is often considered the best indicator for measuring economic development.

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However, in practical research, GDP data is usually collected annually or quarterly, making it difficult to obtain monthly data. Therefore, following the approach of Yang Tianxing (2022) and Shi Qiang (2019), this study uses the year-on-year growth rate of industrial value-added as a substitute for GDP.

Inflation is a key indicator for measuring the health of a macroeconomy. Considering this factor, the Consumer Price Index (CPI) is chosen as the indicator. Considering the impact of monetary indicators on stock market volatility, indicators such as money supply (M_2), SHIBOR, repo rate, discount rate, and rediscount rate can be selected. Many scholars currently select money supply and interest rate as indicators, such as Jiang Yu and Chen Peng (2020) and Yang Peitao (2020).

Meanwhile, considering the potential impact of the maturity of monetary indicators on the influence of stock market volatility, this study considers using money supply as a medium and long-term indicator of monetary indicators and SHIBOR as a short-term indicator of monetary indicators to study their impact on stock market volatility.

In the era of globalization, as an open economy, exchange rates and imports and exports also have an important impact on the stock market. Based on the research insights of Li Li (2019) and Xu Yuxuan (2022), this study selects the US Dollar/Renminbi midpoint rate as the exchange rate data to represent international capital market indicators and uses import volume and export volume as foreign trade indicators. At the same time, in terms of data processing, this study selects the growth rate of each macroeconomic indicator to maintain unit consistency.

Therefore, the macroeconomic indicators selected in this study are the year-on-year growth rate of industrial value-added, the month-on-month growth rate of the consumer price index, the month-on-month growth rate of money supply, the month-on-month growth rate of the Shanghai Interbank Offered Rate (SHIBOR), the month-on-month growth rate of the US Dollar/Renminbi exchange rate, the month-on-month growth rate of import volume, and the month-on-month growth rate of export volume. As shown in Table 1, these indicators are represented by IP, CPI, M_2, SHIBOR, ER, IX, and EX, respectively. The data covers the period from January 2010 to December 2023, with monthly data collected each month. These data are all sourced from the National Bureau of Statistics and Eastmoney.com.

2.1.2. Selection of Stock Market Volatility Indicators and Data Sources

In terms of the selection of stock market volatility indicators, this study, following the research of scholars such as Zhao Yuxuan (2022) and Han Chenyu (2020), chooses the monthly return of the Shanghai Stock Exchange Composite Index closing price as a measure of stock market volatility. The monthly return of the Shanghai Stock Exchange Composite Index closing price is calculated as the ratio of the difference between two monthly closing prices to the closing price of the previous month. The return is represented by Rt, and the data covers the monthly closing prices from January 2010 to December 2023. The data are all sourced from Eastmoney.com.

Table 1: Indicators Corresponding to Each Macroeconomic Variable

Year-on-Year Growth Rate of Industrial Value-Added	Month-on-Month Growth Rate of Consumer Price Index	Month-on-Month Growth Rate of Money Supply	Month-on-Month Growth Rate of Shanghai Interbank Offered Rate (SHIBOR)	Month-on-Month Growth Rate of USD/CNY Exchange Rate	Month-on-Month Growth Rate of Import Quota	Month-on-Month Growth Rate of Export Quota
IP	CPI	M2	SHIBOR	ER	IX	EX

2.2. Model Construction

2.2.1. VAR Model Construction

This study constructs a VAR model to analyze the impact of macroeconomic indicators on the volatility of China's stock market from 2010 to 2023. The mathematical expression of the VAR model is as follows:

$$\begin{aligned}\mathbf{Y_{Rt}^{t}} = \mathbf{c} + \mathbf{A_1} * \mathbf{x_{IP}^{t-1}} + \mathbf{A_1} * \mathbf{x_{CPI}^{t-1}} + \mathbf{A_1} * \mathbf{x_{M2}^{t-1}} + \mathbf{A_1} * \mathbf{x_{SHIBOR}^{t-1}} + \mathbf{A_1} * \mathbf{x_{ER}^{t-1}} + \mathbf{A_1} * \mathbf{x_{IX}^{t-1}} + \mathbf{A_1} * \mathbf{X_{EX}^{t-1}} \\ + \mathbf{A_1} * \mathbf{X_{Rt}^{t-1}} + \cdots + \mathbf{A_p} * \mathbf{X_{IP}^{t-p}} + \mathbf{A_p} * \mathbf{X_{CPI}^{t-p}} + \mathbf{A_p} * \mathbf{X_{M2}^{t-p}} + \mathbf{A_p} * \mathbf{x_{SHIBOR}^{t-p}} + \mathbf{A_p} * \mathbf{x_{ER}^{t-p}} \\ + \mathbf{A_p} * \mathbf{x_{IX}^{t-p}} + \mathbf{A_p} * \mathbf{x_{EX}^{t-p}} + \mathbf{A_p} * \mathbf{x_{Rt}^{t-p}} + \mathbf{e_t}\end{aligned} \tag{1}$$

Where, Y_{Rt}^{t} represents the target variable of the Shanghai Stock Exchange Composite Index price

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return at time t. Y_{t-1}, Y_{t-2}, ⋯, Y_{t-p} represent the lagged values of Yt. c is a constant vector.A_1, A_2, ⋯, A_p are k*k-dimensional matrices to be estimated. p is the lag order (p starts from 1 to p).e_t is a k-dimensional error vector.

2.2.2. Unit Root Test

Before establishing the VAR model, a unit root test is required to determine whether the time series data is stationary. Non-stationary data may lead to the failure of standard assumptions in classical regression analysis, such as homoscedasticity and independence of error terms, resulting in unreliable regression results. This study uses the Augmented Dickey-Fuller (ADF) test for unit root testing. The ADF statistic is a value calculated during the test, which is usually compared with specific critical values. If the ADF statistic is less than the critical value, we reject the null hypothesis, concluding that the sequence has no unit root, i.e., the sequence is stationary. The ADF statistic measures the probability of observing the current sample or a more extreme sample under the null hypothesis (the sequence has a unit root, i.e., non-stationary). If the P-value is less than the set significance level (usually 0.05 or 0.01), we reject the null hypothesis, concluding that the sequence is stationary.

As shown in Table 2, the ADF test statistics for Rt, IP, CPI, M_2, SHIBOR, ER, IX, and EX are all significantly less than the 1%, 5%, and 10% critical values, and the P-values are all 0.0000, indicating that these sequences can be considered stationary at any common significance level. Among these economic sequences, M_2, IX, and EX become stationary after first-order differencing, while the other economic sequences are already stationary themselves. At the same time, as shown in Figure 1, after establishing a model using these seven macroeconomic indicators and the Shanghai Stock Exchange Composite Index price return indicator, since all points are within the unit circle, the model is stable.

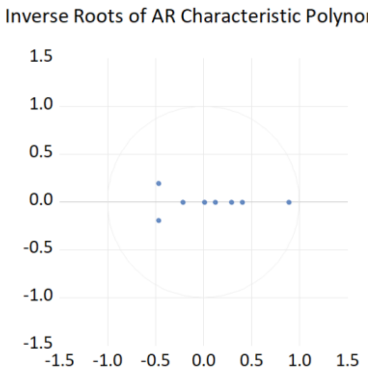

Figure 1: Stability Test

Table 2: Unit Root Test Results

Variable	ADF Test Statistic	1%	5%	10%	P Value	Conclusion
Rt	-11.4357	-2.5788	-1.9427	-1.6154	0.0000	Stationary
IP	-4.58629	-4.0139	-3.4369	-3.1426	0.0015	Stationary
CPI	-8.52111	-3.4701	-2.8789	-2.5761	0.0000	Stationary
M_2	-11.6726	-4.0179	-3.4388	-3.1437	0.0000	Stationary
SHIBOR	-4.38193	-2.5793	-1.9428	-1.6154	0.0000	Stationary
ER	-7.86169	-2.5788	-1.9427	-1.6154	0.0000	Stationary
IX	-8.3657	-4.0187	-3.4392	-3.1439	0.0000	Stationary
EX	-9.9845	-4.0183	-3.4390	-3.1438	0.0000	Stationary

2.2.3. Cointegration Test

As shown in Tables 3 and 4, whether it is the trace statistic test result or the maximum eigenvalue statistic test result, all P-values are less than 0.1, indicating that all null hypotheses can be rejected. This suggests that there must be at least seven cointegration relationships among these variables. Therefore, we can proceed with the subsequent modeling.

The cointegration equation is:

$$Y_{Rt} = 1 * X_{IP}(-1) + 0.592228 * X_{CPI}(-1) - 0.337926 * X_{M2}(-1) - 0.296989 * X_{SHIBOR}(-1) + 0.245714 * X_{ER}(-1) - 1.775079 * X_{IX}(-1) + 0.002444 * X_{EX}(-1) \quad (2)$$

As shown by the formula, the variable IP has been standardized to have a coefficient of 1, meaning that IP and YRt have a 1:1 relationship. When IP changes by one unit, YRt will also change by one unit.

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The coefficient of CPI is 0.592228, indicating that when CPI changes by one unit, YRt will increase by 0.592228 units. The coefficient of M2 is -0.337926, indicating that when M2 changes by one unit, YRt will decrease by approximately 0.337926 units. The coefficient of SHIBOR is -0.296989, indicating that when SHIBOR increases by one unit, YRt will decrease by nearly 0.3 units. The coefficient of ER is 0.245714, indicating that when ER increases by one unit, YRt will increase by about 0.25 units. The coefficient of IX is -1.775079, indicating a strong negative correlation between IX and YRt. When IX increases by one unit, YRt will decrease by about 1.78 units. The coefficient of EX is 0.002444, a very small positive number, indicating that when EX increases by one unit, YRt will increase by about 0.0025 units.

Table 3: Trace Statistic Test Results

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.** Critical Value
None *	0.466322	423.7707	159.5297	0.0000
At most 1 *	0.394974	320.7849	125.6154	0.0000
At most 2 *	0.336546	238.3777	95.75366	0.0000
At most 3 *	0.305503	171.0892	69.81889	0.0000
At most 4 *	0.217761	111.3003	47.85613	0.0000
At most 5 *	0.210082	71.02281	29.79707	0.0000
At most 6 *	0.145700	32.34741	15.49471	0.0001
At most 7 *	0.038988	6.521934	3.841465	0.0107

Table 4: Maximum Eigenvalue Statistic Test Results

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.** Critical Value
None *	0.466322	102.9858	52.36261	0.0000
At most 1 *	0.394974	82.40727	46.23142	0.0000
At most 2 *	0.336546	67.28843	40.07757	0.0000
At most 3 *	0.305503	59.78895	33.87687	0.0000
At most 4 *	0.217761	40.27747	27.58434	0.0007
At most 5 *	0.210082	38.67540	21.13162	0.0001
At most 6 *	0.145700	25.82547	14.26460	0.0005
At most 7 *	0.038988	6.521934	3.841465	0.0107

2.2.4. Determining Lag Order

Lag: The number of lags used in the model.

LogL: The log-likelihood of the model, indicating the degree of fitness between the model and the data. The higher, the better.

LR: A likelihood ratio test statistic used to compare the fit of two models. It tests whether adding more parameters (such as additional lags) significantly improves the model.

FPE: An indicator used to estimate the prediction accuracy of the model. The lower, the better.

AIC: An indicator used to compare models. It balances model complexity and fitness. The lower the AIC value, the better the model.

SC: Also known as the Bayesian Information Criterion (BIC), it is another indicator used for model selection, which penalizes free parameters more strongly than AIC. The lower the value, the better the model.

HQ: Similar to AIC and SC, it is used for model selection but penalizes complexity differently. The lower the value, the better the model.

As shown in Table 5, the model with one lag (corresponding to the row with lag=1) has asterisks next to multiple standards (log-likelihood, likelihood ratio, final prediction error, Akaike information criterion, Schwarz criterion, Hannan-Qu，Quinn criterion), indicating that these values may be the best in these standards. Although the absolute log-likelihood is lower, this model may provide the best balance between fit and complexity. As shown in Figure 1, when the lag is 1, all roots are within the unit circle, indicating that the established model is stable. Therefore, the optimal lag order is determined to be 1.

Table 5: Lag Order Test Results

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-3608.515	NA	8.92E+08	43.31155	43.46092	43.37218
1	-3373.45	444.7937*	1.15e+08*	41.26287*	42.60716*	41.80849*

As shown in Table 6, the model formula is:

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$$Y_{Rt} = -0.079838 * X_{IP}(-1) + 0.894464 * X_{CPI}(-1) - 0.197875 * X_{M2}(-1) - 0.007603 * X_{SHIBOR}(-1) + 0.013207 * X_{ER}(-1) - 0.038366 * X_{IX}(-1) + 0.02721 * X_{EX}(-1) + 0.128476 * X_{Rt}(-1) + 0.804243 \quad (3)$$

Table 6: Model Parameter Estimation Results

	Rt	EX	IX	ER	SHIBOR	M2	CPI	IP
Rt(-1)	0.128476	0.268595	0.291783	-0.022661	-0.125459	0.010469	-0.001093	-0.026058
	-0.08187	-0.22662	-0.16489	-0.01244	-0.29759	-0.01288	-0.00681	-0.0252
	[1.56927]	[1.18524]	[1.76959]	[-1.82233]	[-0.42158]	[0.81312]	[-0.16044]	[-1.03413]
EX(-1)	0.02721	-0.521253	-0.110986	-0.000681	0.080649	-0.009731	-0.000632	0.017233
	-0.03262	-0.09029	-0.0657	-0.00495	-0.11857	-0.00513	-0.00271	-0.01004
	[0.83414]	[-5.77295]	[-1.68936]	[-0.13737]	[0.68017]	[-1.89688]	[-0.23295]	[1.71653]
IX(-1)	-0.038366	0.217426	-0.314187	-0.000842	0.022075	-0.007499	0.007466	-0.02482
	-0.046	-0.12734	-0.09265	-0.00699	-0.16722	-0.00723	-0.00383	-0.01416
	[-0.83399]	[1.70747]	[-3.39105]	[-0.12046]	[0.13201]	[-1.03658]	[1.95026]	[-1.75294]
ER(-1)	0.013207	2.194598	0.588092	0.404185	-0.633619	0.039004	0.002482	-0.113143
	-0.48764	-1.3498	-0.98212	-0.07407	-1.77256	-0.07669	-0.04058	-0.15009
	[0.02708]	[1.62587]	[0.59880]	[5.45689]	[-0.35746]	[0.50860]	[0.06115]	[-0.75385]
SHIBOR(-1)	-0.007603	-0.051515	-0.023827	-0.003521	-0.149957	-0.005093	0.002697	0.003958
	-0.02259	-0.06253	-0.0455	-0.00343	-0.08212	-0.00355	-0.00188	-0.00695
	[-0.33655]	[-0.82379]	[-0.52367]	[-1.02596]	[-1.82606]	[-1.43336]	[1.43429]	[0.56916]
M2(-1)	-0.197875	-2.526179	-2.172329	0.041671	-2.318278	-0.131983	0.092167	0.000429
	-0.51881	-1.43607	-1.04489	-0.0788	-1.88585	-0.08159	-0.04318	-0.15968
	[-0.38140]	[-1.75909]	[-2.07900]	[0.52880]	[-1.22930]	[-1.61762]	[2.13469]	[0.00269]
CPI(-1)	0.894464	-11.46465	-2.041121	0.095228	-0.758305	-0.022125	0.280637	0.400606
	-1.06573	-2.94995	-2.1464	-0.16188	-3.87388	-0.1676	-0.08869	-0.32801
	[0.83930]	[-3.88638]	[-0.95095]	[0.58828]	[-0.19575]	[-0.13201]	[3.16422]	[1.22133]
IP(-1)	-0.079838	0.233804	0.475292	-0.031206	0.775492	0.044208	0.002801	0.880159
	-0.12105	-0.33507	-0.2438	-0.01839	-0.44001	-0.01904	-0.01007	-0.03726
	[-0.65954]	[0.69778]	[1.94954]	[-1.69723]	[1.76244]	[2.32221]	[0.27800]	[23.6243]
C	0.804243	5.513453	0.665636	0.214744	-1.557394	0.753901	0.002253	0.819836
	-1.08224	-2.99565	-2.17965	-0.16438	-3.93389	-0.1702	-0.09006	-0.33309
	[0.74313]	[1.84049]	[0.30539]	[1.30636]	[-0.39589]	[4.42954]	[0.02501]	[2.46131]

As shown by the formula, industrial value-added, money supply, Shanghai Interbank Offered Rate (SHIBOR), and import volume show a negative correlation with the Shanghai Stock Exchange Composite Index return. This is mainly because 2010 was the first year of national real estate regulation, and the inflation caused by the real estate bubble led to a decline in economic growth. The increase in industrial value-added increased market inflation, leading to a downward trend in the entire market, thus having a negative impact on stock market returns. The increase in money supply exacerbated inflation under the circumstances, affecting the performance of the stock market. On the Shanghai Interbank Offered Rate, it increased risk aversion in the financial market, leading to a decrease in capital flowing into the stock market. The increase in import volume led to an expansion of trade deficits under the circumstances, having a negative impact on the stock market.

Consumer price index, US Dollar/Renminbi exchange rate, export volume, and the Shanghai Stock Exchange Composite Index price itself show a positive correlation with returns, indicating that the increase of these indicators can lead to an increase in the Shanghai Stock Exchange Composite Index return.

2.3. Granger Causality Analysis

2.3.1. Granger Causality Test

As shown in Table 7, only the p-values of the hypotheses "ER is not a Granger cause of Rt" and "IX is not a Granger cause of Rt" are less than 0.05, rejecting the null hypothesis, while the p-values of other hypotheses are all greater than 0.05, so the null hypothesis is accepted. Therefore, it can be concluded that there is only a unidirectional causal relationship between interest rates and the Shanghai Stock Exchange Composite Index return, as well as a unidirectional causal relationship between import volume and the Shanghai Stock Exchange Composite Index return. Other economic indicators have no significant causal relationship with the Shanghai Stock Exchange Composite Index return. This further indicates that interest rates and import volume have a significant connection with stock market volatility.

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Table 7: Granger Causality Test Results

Null Hypothesis	F-Test Statistic	p-value
Rt is not a Granger cause of IP	0.4349	0.5095
IP is not a Granger cause of Rt	1.0694	0.3011
Rt is not a Granger cause of CPI	0.7044	0.4013
CPI is not a Granger cause of Rt	0.0257	0.8725
Rt is not a Granger cause of M2	0.1454	0.7029
M2 is not a Granger cause of Rt.	0.6611	0.4162
Rt is not a Granger cause of SHIBOR.	0.1132	0.7365
SHIBOR is not a Granger cause of Rt.	0.1777	0.6733
Rt is not a Granger cause of ER.	0.0007	0.9784
ER is not a Granger cause of Rt	5.3926	0.0202
Rt is not a Granger cause of IX	0.6955	0.4043
IX is not a Granger cause of Rt	4.3222	0.0376
Rt is not a Granger cause of EX	0.6958	0.4042
EX is not a Granger cause of Rt	1.40479	0.2359

2.3.2. Impulse Response Analysis

As shown in Figure 2[1], when a positive shock of one standard deviation is applied to industrial value-added, the impact on the Shanghai Stock Exchange Composite Index return starts to decline from the first period. From the second to the eighth period, it begins to have a slow positive impact, leading to an increase in the Shanghai Stock Exchange Composite Index price, and this impact gradually decreases until the ninth to the tenth period approaches zero.

As shown in Figure 3, when a positive shock of one standard deviation is applied to the consumer price index, it has a positive impact on the Shanghai Stock Exchange Composite Index return from the first to the second period, promoting the increase of the Shanghai Stock Exchange Composite Index price. Then, from the second to the third period, it has a negative impact, promoting a decline in the price. From the fourth period to the tenth period, the impact gradually decreases.

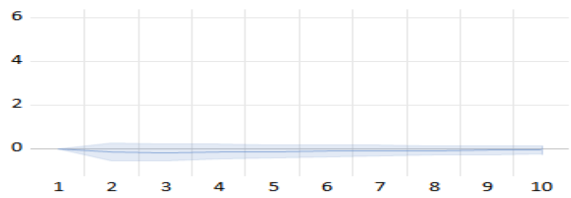

Figure 2: The impact of IP on the disturbance of Shanghai Composite Index prices

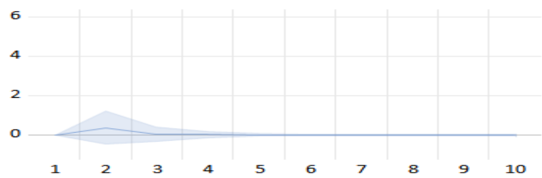

Figure 3: The impact of CPI on the disturbance of Shanghai Composite Index prices

As shown in Figure 4, when a positive shock of one standard deviation is applied to money supply, it has a negative impact on the Shanghai Stock Exchange Composite Index return from the first period. Then, from the second to the third period, it has a slow positive impact, promoting the increase of the Shanghai Stock Exchange Composite Index price. From the third period to the tenth period, this impact gradually weakens and fluctuates near zero.

As shown in Figure 5, when a positive shock of one standard deviation is applied to the Shanghai Interbank Offered Rate, from the first to the second period, the interbank offered rate has a negative impact on the Shanghai Stock Exchange Composite Index return. Then, this impact gradually becomes positive from the second to the third period, and then falls from the third period and the impact gradually decreases, finally approaching zero.

[1] Note: In Figure 2, the vertical axis represents the positive standard deviation shock, and the horizontal axis represents the period. The same axis representations will be used in subsequent graphs.

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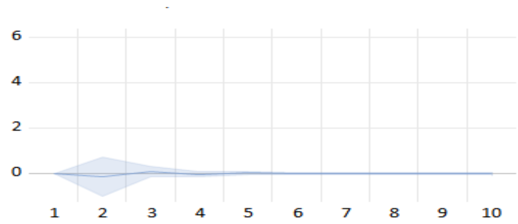

Figure 4: The impact of M2 on the disturbance of Shanghai Composite Index prices

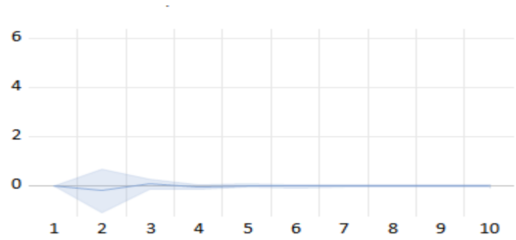

Figure 5: The impact of SHIBOR on the disturbance of Shanghai Composite Index prices

As shown in Figure 6, when a positive shock of one standard deviation is applied to the US Dollar/Renminbi exchange rate, the impact of the exchange rate on the Shanghai Stock Exchange Composite Index return fluctuates slightly near zero at a low level between the first and the tenth period, as the monthly exchange rate changes are not significant.

As shown in Figure 7, when a positive shock of one standard deviation is applied to import volume, from the first to the second period, import volume has a negative impact on the Shanghai Stock Exchange Composite Index return. Then, from the second to the third period, this impact gradually turns positive, and then from the third period, the impact gradually weakens, and by the fourth period, the impact is close to zero. From the fourth period to the subsequent periods, it fluctuates slightly near zero.

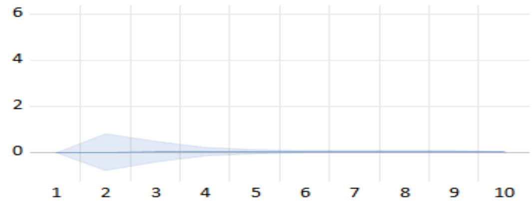

Figure 6: The impact of ER on the disturbance of Shanghai Composite Index prices

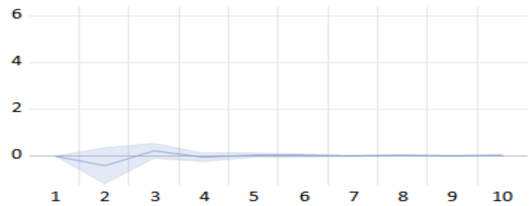

Figure 7: The impact of IX on the disturbance of Shanghai Composite Index prices

As shown in Figure 8, when a positive shock of one standard deviation is applied to export volume, from the first to the second period, export volume has a slight negative impact on the Shanghai Stock Exchange Composite Index return. Then, from the second to the third period, this impact slowly turns positive and approaches zero. From the third to the fourth period, a slight negative impact appears again, and then from the fourth to the fifth period, this impact gradually approaches zero, and the impact gradually weakens, starting to approach zero.

As shown in Figure 9, when a positive shock of one standard deviation is applied to the Shanghai Stock Exchange Composite Index price, in the first period, the impact of the Shanghai Stock Exchange Composite Index price on itself is positive and extremely large, and then it gradually weakens from the

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first period until the third period approaches zero, and in the subsequent periods, it approaches zero.

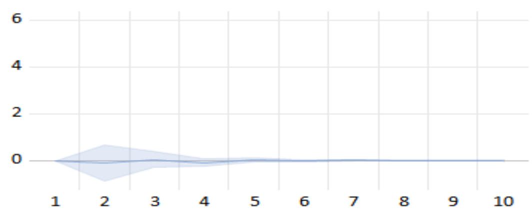

Figure 8: The impact of EX on the disturbance of Shanghai Composite Index prices

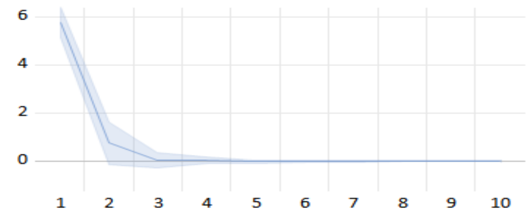

Figure 9: The impact of Shanghai Composite Index prices on their own disturbance

From the above, we can easily see that the seven macroeconomic indicators selected in this study all have an impact on the volatility of the stock market at the beginning, and the impact is the largest at the beginning, and then the fluctuation begins to weaken over time, and finally, it tends to zero.

3. Conclusions and Implications

3.1. Conclusions

By constructing a Vector Autoregression (VAR) model, this study measures the impact of seven macroeconomic indicators on stock market volatility. Granger causality tests reveal that among the indicators examined, only exchange rate and export volume exhibit significant causal relationships with the price fluctuations of the Shanghai Composite Index, while other indicators demonstrate no discernible causality. Impulse response analysis further indicates that these economic indicators do exert shocks on the volatility of the Shanghai Composite Index, thereby influencing stock market fluctuations. Specifically, the Consumer Price Index (CPI) displays the most pronounced positive response to the index's yield fluctuations, whereas import volume initially exerts the strongest negative impact before transitioning to a positive effect. The 7-day Shanghai Interbank Offered Rate (SHIBOR), money supply (M2), export volume, and industrial added value all initially produce minor negative impacts that gradually reverse to positive over time. The USD/CNY exchange rate, however, exhibits negligible overall influence throughout the observation period.

As time progresses, the volatility amplitudes of these indicators' impacts diminish significantly, with subsequent fluctuations becoming almost imperceptible. Among these, import volume demonstrates the most significant influence, followed by industrial added value, CPI, SHIBOR, M2, export volume, and the USD/CNY exchange rate. Notably, while some macroeconomic indicators initially exhibit negative effects on stock market volatility, these effects eventually turn positive and gradually approach zero, albeit at varying growth rates. This phenomenon can be attributed to the continuous improvement of China's stock market mechanisms and institutions over decades, which are progressively aligning with national economic factors. Consequently, as evidenced by variance decomposition, the explanatory power of macroeconomic factors on stock market volatility increases over time, rather than being driven solely by intrinsic price dynamics.

In conclusion, while the current influence of macroeconomic indicators on stock market volatility remains modest, this study projects a gradual augmentation of their explanatory power in the future. This finding underscores the evolving integration between China's financial markets and broader economic conditions, suggesting that macroeconomic factors will play an increasingly critical role in shaping stock market dynamics moving forward.

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3.2. Implications

3.2.1. Rational Investment

Before investing in stocks, investors should rationally analyze based on their actual economic situation and current market conditions to make their investment strategies. However, under the current situation where China's stock market is not yet mature, many investors often follow others to invest or invest at will. This kind of non-rational investment behavior without independent thinking and blindly following the crowd often faces huge risks and may result in significant losses for investors. Stock market volatility is often affected by macroeconomic factors, so when investing in stocks, it is necessary to pay attention to the release of macroeconomic data at different times, so as to rationally analyze the stock market situation, and then comprehensively consider the current domestic and foreign economic situation to establish their investment strategies. This way, there is a chance to achieve good returns. To obtain returns in the volatile stock market, it is necessary to analyze various related information, strictly follow the established investment strategy, and invest rationally.

3.2.2. Understanding the Market

Before investing in stocks, investors need to understand the current market conditions, including macroeconomic conditions, industry development trends, and other factors that may affect the stock market. By understanding this information and conducting comprehensive analysis, investors can better assess the risks and returns of stocks, thereby making wiser investment decisions. When selecting stocks, several important factors need to be considered, including the company's financial condition, price-earnings ratio, dividend rate, debt ratio, and growth. In addition, investors should also pay attention to information such as industry prospects, policy environment, and competitiveness, and have a certain understanding of market trends.

3.2.3. Risk Control

Before investing in stocks, investors should set clear investment plans and goals, and carefully analyze investment risks and returns. This helps to keep a clear mind and effectively avoid asset losses caused by haphazard investment. At the same time, capital should be diversified across different asset classes or industries to reduce the risk of a single stock or industry, avoiding significant losses due to a single investment failure. Making money takes time and patience. Don't pursue short-term windfall profits. Too frequent trading often faces huge risks. Only by holding high-quality assets for a long time and continuously paying attention to market dynamics can you obtain more stable returns. Investing blindly is a behavior that contains great risks. Investors need to understand a series of relevant indicators of the market for risk management, so as to choose high-quality assets for investment and reduce risks.

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