# The Dynamic Impact of Macroeconomic Factors on the Stock Market

**Derun Wang**
*School of Statistics and Mathematics, Shandong University of Finance and Economics, Jinan, Shandong, China*

**Abstract: In financial markets, the stock market serves as a "barometer" of the economy, with its fluctuations influenced by a multitude of macroeconomic factors. Accurately capturing the dynamic impact of macroeconomic factors on the stock market is crucial for investor decision-making and regulatory policy formulation. In the current operation of financial markets, stock prices change rapidly, often exhibiting high-frequency characteristics in data and time series, whereas macroeconomic variables such as GDP, GDP growth rate, unemployment rate, and price levels typically manifest as low-frequency data. This disparity in data frequency can easily lead to estimation errors when studying the dynamic impact of macroeconomic factors on the stock market. This paper summarizes previous research findings on the impact of macroeconomic factors on the stock market and compares the accuracy of mixed-frequency data models with traditional GARCH-family models. It selects appropriate macroeconomic factors affecting the stock market, focusing on four primary factors—Producer Price Index (PPI), Consumer Price Index (CPI), Macroeconomic Climate Index—and secondary factors such as monetary policy and macroeconomic fundamentals like GDP growth rate. The study further explores the long-term impact of the overall macroeconomic environment on stock market volatility. The research indicates that mixed-frequency data models outperform traditional GARCH-family models in reflecting the impact of macroeconomic factors like PPI on stock market volatility. The realized volatility of the stock market significantly amplifies its long-term fluctuations. Both the level and volatility of PPI, CPI, and the Macroeconomic Climate Index exert a notable influence on the long-term volatility of the stock market, with the volatility dimension showing strong persistence. The interbank lending rate, however, only weakly affects the long-term component of stock market volatility in terms of its level.**

**Keywords: Macroeconomic Factors; Mixed-Frequency Data Model; Time Series; Long-Term Volatility**

## 1. Introduction

In recent years, influenced by factors such as the COVID-19 pandemic, macroeconomic downturns, and ongoing Sino-U.S. trade frictions, China's stock market has experienced continuous volatility. Consequently, accurately grasping the dynamic impact of macroeconomic factors on the stock market has become increasingly important. Existing research has shown some limitations in addressing macroeconomic structural changes and market extreme events.

This study aims to delve into the dynamic relationship between macroeconomic factors and the stock market, comprehensively revealing the mechanisms through which macroeconomic variables affect stock market prices, volatility, and risk under different frequencies and market conditions. By employing advanced econometric models and analytical methods, it addresses the issues arising from data frequency mismatches in traditional research, providing investors with more forward-looking and accurate decision-making tools and offering robust theoretical support for regulators to formulate sound macroeconomic and financial regulatory policies.

This paper contrasts the strengths and weaknesses of traditional GARCH models with those of the improved GARCH-MIDAS model, emphasizing the latter's introduction of time-varying parameters to meet the need for integrating long-term low-frequency and short-term high-frequency data. It selects five

key macroeconomic variables—PPI, CPI, Macroeconomic Climate Index, and interbank lending rate—and uses the GARCH-MIDAS model to explore their dynamic impact on the stock market.

The paper first outlines the theoretical linkages between macroeconomic variables and stock market volatility, then compares the two models to identify differences, and finally presents the research findings while summarizing trends and proposing future research directions.

## 2. Partial Linkages Between Macroeconomic Factors and Stock Market Volatility

### 2.1 Monetary Policy

The impact of monetary policy on the stock market is often reflected in changes in market liquidity due to shifts in policy direction, affecting stock prices.

2.1.1 Interest rate adjustments:

When central banks lower interest rates, businesses and individuals exhibit stronger investment inclinations, leading to increased capital inflows into the stock market and higher stock prices. Conversely, rising interest rates drive investors toward more stable assets like bonds, reducing stock market liquidity and potentially suppressing prices.

2.1.2 Investor expectations:

When central banks signal favorable economic policies, investors are more willing to take risks, boosting market liquidity and stock prices. Conversely, adverse signals dampen investment enthusiasm and liquidity.

### 2.2 Macroeconomic Fundamentals

2.2.1 Economic cycle (GDP growth):

During recovery phases, accelerated GDP growth boosts corporate profits and investor confidence, driving stock prices up. During recessions, investors seek safe havens, leading to market declines.

2.2.2 Fiscal policy:

Expansionary policies like tax cuts and subsidies enhance investor expectations of market recovery, improving liquidity and raising stock prices. Austerity measures have the opposite effect.

### 2.3 Inflation and Expectations

CPI and PPI exert bidirectional effects on the stock market through actual returns and policy adjustments.

2.3.1 CPI:

Rising CPI driven by demand benefits consumer stocks, whereas cost-driven inflation pressures corporate profits and raises financing costs, hurting the stock market. Falling CPI signals weak consumption, prompting shifts to defensive sectors and potential central bank rate cuts to stimulate growth stocks.

2.3.2 PPI:

Rising PPI benefits cyclical stocks if cost increases are passed downstream; otherwise, mid- and downstream firms face profit squeezes. Falling PPI reflects weak industrial demand, hurting cyclical stocks but aiding mid- and downstream firms through lower input costs.

## 3. External Shocks

### 3.1 Exchange Rate Fluctuations

3.1.1 Divergence in import/export firm profits:

Currency depreciation benefits exporters by increasing local-currency revenues but hurts importers through higher costs. Appreciation has the opposite effect.

3.1.2 External debt pressure and market sentiment:

Firms with high foreign debt face repayment cost hikes, increasing financial risks and stock price pressures. Sharp currency swings may trigger panic and short-term liquidity crunches.

### 3.2 Global Commodity Prices

Rising prices benefit resource-heavy upstream firms but squeeze mid- and downstream manufacturers' margins, potentially depressing their stock prices.

Given that macroeconomic factors like CPI, PPI, and exchange rates are typically low-frequency (monthly/quarterly) data while stock market changes are high-frequency, this study employs the GARCH-MIDAS (Mixed Data Sampling) model to analyze these factors [1].

## 4. Limitations of Traditional GARCH Models and Innovations of GARCH-MIDAS

The GARCH (Generalized Autoregressive Conditional Heteroskedasticity) model and its variants such as EGARCH and TGARCH are important tools applicable in financial time series analysis, with their core focus lying in capturing the conditional heteroskedasticity and volatility of the series.

GARCH: It describes the dynamic structure of

volatility through lagged residual squared terms (ARCH terms) and lagged conditional variance terms (GARCH terms). The formula is:

$$\sigma_t^2=\omega+\sum_{i=1}^{q}\alpha_i\epsilon_{t-i}^2+\sum_{j=1}^{p}\beta_j\sigma_{t-j}^2[2] \quad (1)$$

When analyzing the impact of macroeconomic factors on the dynamic stock market, the introduction of macroeconomic variables is relatively straightforward. Typically, variables such as interest rates, GDP growth, and inflation rates are directly incorporated as exogenous variables into the mean or variance equations. For example:

In the mean equation, stock returns are linearly associated with lagged terms of macroeconomic variables to depict the direct influence of macroeconomic factors on returns.

In the variance equation, macroeconomic variables are introduced as driving factors to examine their impact on volatility. In studying the dynamic effects of macroeconomic factors on the stock market, macroeconomic data such as quarterly GDP and monthly CPI are mostly low-frequency, while stock market data like daily returns are high-frequency. Traditional models require downsampling or interpolation of low-frequency macroeconomic data, which can lead to information loss or artificial errors. Moreover, these models assume that macroeconomic variables exert only short-term shocks on market volatility, failing to dissociate the long-term trends of macroeconomics—such as structural transformations and policy regime shifts—from the short-term daily fluctuations of the market itself. This results in model misjudgments regarding these data and trends.

As previously mentioned, the time-varying characteristics of macroeconomic factors cannot be ignored when studying their dynamic impact on the stock market. However, the parameters of traditional GARCH-family models are relatively fixed, making it difficult for them to reflect the influence of changing macroeconomic environments on volatility.

In summary, traditional GARCH-family models are more suitable for characterizing short-term stock market volatility. However, given the pressing need in this research to address the mixed-frequency processing of low-frequency macroeconomic factors and high-frequency stock market data, traditional GARCH models fall short. They are better suited for depicting short-term market fluctuations. Therefore, the GARCH-MIDAS model is required to resolve this issue by integrating high-frequency financial data with low-frequency macroeconomic variables. Formula: GARCH-MIDAS Model:

### 4.1 Short-Term Volatility Component (GARCH Part)

Captures the short-term volatility clustering of high-frequency data and follows the structure of the traditional GARCH model, broussonetia papyrifera, to depict the short-term dynamic characteristics of the market itself. Formula: $\sigma_t^2=\omega+\alpha\epsilon_{t-1}^2+\beta\sigma_{t-1}^2$ + short-term residual term.

### 4.2 Long-term Volatility Component (MIDAS Part)

Introduces low-frequency macroeconomic variables (such as quarterly GDP and monthly CPI) and maps them to the high-frequency time dimension through the MIDAS weighting function, capturing the long-term trend impact of macroeconomic factors on volatility.

$$\sigma_t^2=\text{short-term component}+\theta\sum_{k=0}^{K}\omega(k;\lambda)x_{t-k}^{M}[3] \quad (2)$$

Traditional models cannot distinguish between the short-term shocks and long-term trends of macroeconomic factors on stock market volatility, whereas the GARCH-MIDAS model can quantitatively analyze the difference between the decline in the long-term component of the stock market caused by macroeconomic policies and the short-term market response, parazacco spilurus subsp. spilurus. Moreover, the GARCH-MIDAS model can further introduce time-varying parameters to capture the differences in the intensity of macroeconomic factors at different stages, parazacco spilurus subsp. spilurus, making it more aligned with the non-symmetry of policy effects in reality.

By preserving high-frequency data information, it more accurately reflects the economic implications of macroeconomic variables at their original frequency, phoxinus phoxinus subsp. phoxinus. The economic interpretation is clear: the long-term component directly corresponds to the trend impact of macroeconomic fundamentals, while the short-term component corresponds to market micro-level volatility, facilitating policy analysis. Additionally, the model's predictive capability is enhanced, significantly outperforming traditional models in forecasting stock market volatility during periods of abrupt changes in macroeconomic structure, broussonetia papyrifera.

## 5. Application of the GARCH-MIDAS Model to Analyze Five Representative Macroeconomic Characteristics

In the study of the dynamic impact of macroeconomic factors on the stock market, the research is conducted based on the GARCH-MIDAS model, starting with the estimation of both single-factor and multi-factor GARCH-MIDAS models. First, the benefits of GARCH-MIDAS in studying long-term stock market volatility are explained. The single-factor model initially verifies the explanatory power of individual macroeconomic indicators on stock market volatility, while the multi-factor model further expands this by integrating polydactyly indicators through principal component analysis, providing a more comprehensive depiction of the impact of macroeconomics on stock market volatility and supporting the analysis of individual variable effects. The estimation of both single-factor and multi-factor GARCH-MIDAS models serves as a crucial basis for data analysis and assessing impact effects.

Simultaneously, the article qualitatively analyzes five macroeconomic factors from both single-factor and multi-factor perspectives.

**Table 1. Estimation Results of the Multi - Factor GARCH-MIDAS Model Incorporating Macroeconomic Variables[4]**

| Window | Fixed Window | Rolling Window | Fixed Window | Rolling Window | Fixed Window | Fixed Window |
|---|---|---|---|---|---|---|
| μ | 0.00028* | 0.00028* | 0.00030* | 0.00029* | 0.00029* | 0.00029* |
| | (1.738) | (1.731) | (1.845) | (1.760) | (1.791) | (1.779) |
| α | 0.0933*** | 0.0896*** | 0.0833*** | 0.0942*** | 0.0873*** | 0.0909*** |
| | (14.437) | (14.084) | (13.161) | (13.678) | (14.690) | (14.110) |
| β | 0.8676*** | 0.8644*** | 0.8778*** | 0.8569*** | 0.8842*** | 0.8724*** |
| | (79.900) | (65.935) | (76.532) | (64.449) | (89.534) | (79.354) |
| θ_R | 0.0386*** | 0.0336*** | 0.0230*** | 0.0385*** | 0.0280*** | 0.0321*** |
| | (11.981) | (13.199) | (8.087) | (13.071) | (7.462) | (9.513) |
| ω_R | 6.9539*** | 9.7276*** | 6.3314*** | 9.6168*** | 7.6983*** | 8.0711*** |
| | (6.074) | (4.545) | (4.006) | (5.002) | (4.121) | (4.937) |
| θ_L | –0.0039*** | 0.0096*** | 0.0046*** | 0.0007*** | -0.0045*** | –0.0096* |
| | (–3.071) | (3.393) | (2.748) | (2.885) | (–2.636) | (–1.909) |
| ω_L | 43.4580 | 8.7039*** | 24.1950 | 1.2535*** | 4.5047* | 2.4361* |
| | (1.128) | (2.738) | (1.587) | (2.644) | (1.935) | (1.910) |
| θ_V | –0.0627*** | 0.1651*** | –0.0634*** | –0.0016 | 0.0202 | 0.0341* |
| | (–2.091) | (5.048) | (–6.974) | (–1.589) | (1.180) | (2.252) |
| ω_V | 5.5916** | 5.9886*** | 1.1915*** | 39.6990 | 49.7172** | 27.8350** |
| | (2.100) | (3.666) | (11.776) | (0.943) | (2.368) | (2.166) |
| m | 0.00008*** | 0.00007*** | 0.00015*** | 0.00005*** | 0.00008*** | 0.00006*** |
| | (5.298) | (6.235) | (8.488) | (5.367) | (4.882) | (5.528) |
| LLF | 13792.9 | 13797.7 | 13769.5 | 13790.5 | 13798.8 | 13809.7 |
| AIC | –5.1718 | –5.1736 | –5.1706 | –5.1709 | –5.1733 | –5.1781 |
| BIC | –5.1595 | –5.1613 | –5.1582 | –5.1586 | –5.1609 | –5.1658 |

The above table presents the estimation results of the multi-factor GARCH-MIDAS model incorporating macroeconomic variables. PPI (Producer Price Index)

From the perspectives of both single-factor and multi-factor estimations of the model, the estimation results indicate the following: In the single-factor GARCH-MIDAS model, the parameter estimates related to PPI show a significant impact on the long-term component of stock market volatility. The estimation results of the multi-factor model demonstrate that the volatility of PPI is transmitted to the long-term component of stock market volatility through the model.

At the same time, as can be intuitively observed from Table 1, after the PPI shock, the impact on the long-term component of stock market volatility varies with the lag period—showing a larger effect in the earlier stages and gradually diminishing in later stages. This reflects that PPI fluctuations have a persistent yet diminishing

effect on long-term stock market volatility, demonstrating the prolonged influence of industrial product price transmission on stock market fluctuations. This aligns with the model's logic where PPI serves as a factor explaining stock market volatility—that is, PPI changes affect stock market volatility over the long term by influencing corporate costs and profit expectations.

CPI (Consumer Price Index)

Under the single-factor model, the absolute values of CPI's level and volatility parameters are large, indicating a significant impact on the long-term component of stock market volatility. Multi-factor model analysis reveals that CPI, as an indicator reflecting consumer-side prices, transmits its fluctuations through the model.

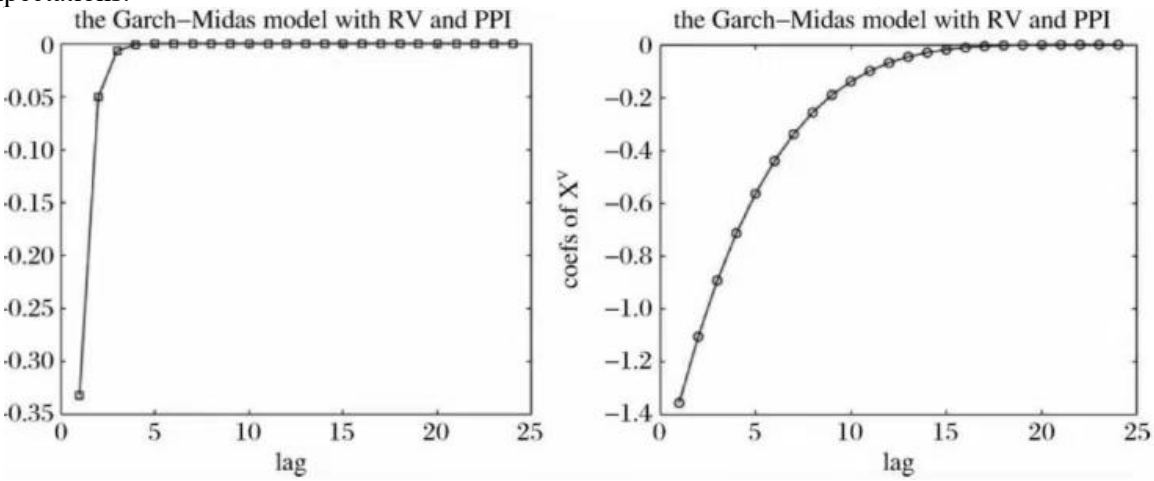


**Figure 1. Changes in Lag Coefficients of the GARCH-MIDAS Model Incorporating PPI**

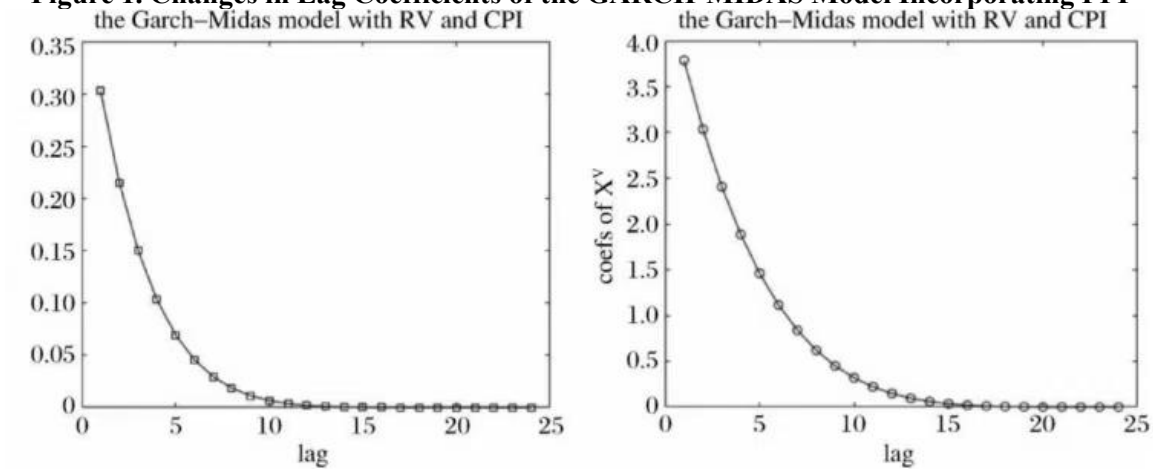


**Figure 2. Changes in Lag Coefficients of the GARCH-MIDAS Model Incorporating CPI**

Based on the changes in the lagged coefficient after incorporating CPI into the model in Figure 2, it can be concluded that following a CPI shock, the impact on the long-term component of stock market volatility exhibits a phased pattern—rapid manifestation in the early stage followed by gradual attenuation. This indicates that changes in consumer prices affect stock markets over the long term by influencing market expectations regarding inflation and consumer demand. The CPI factor in the model effectively captures this long-term transmission effect from the consumption side, which aligns with the model's mechanism for depicting the relationship between macroeconomic conditions and stock market volatility. This finding is also consistent with the earlier discussion on the dynamic impact of CPI on the stock market.

RATE (Interest Rate-Related Indicators)

In the model estimation, RATE exhibits a unique influence on the long-term component of stock market volatility. The parameters of the single-factor model reflect the long-term effect of interest rates on the cost of capital and valuation logic in the stock market. In the multi-factor model, combined with principal component analysis of macroeconomic indicators, RATE serves as a monetary environment indicator. Its fluctuations are transmitted through the model.

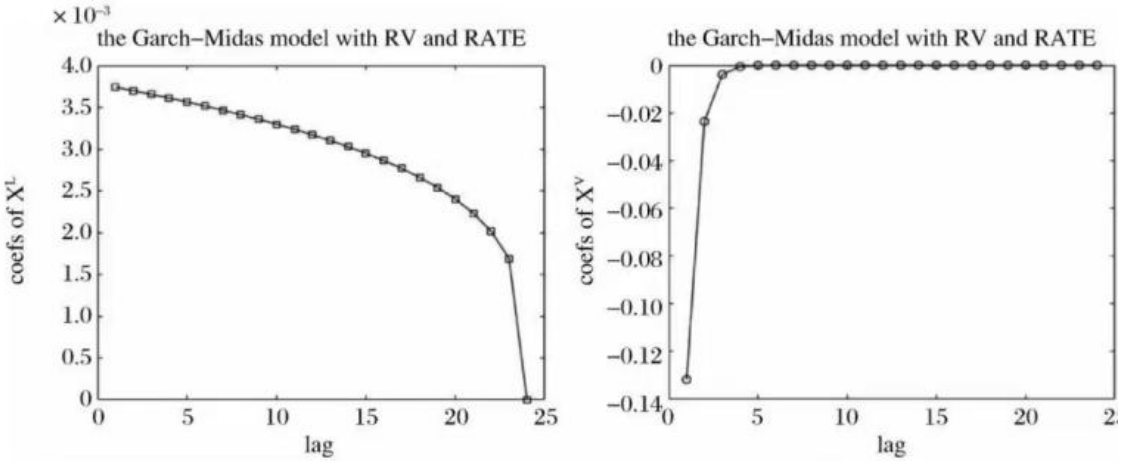


**Figure 3. Changes in Lag Coefficients of the GARCH-MIDAS Model Incorporating RATE**

Based on the changes in the lagged coefficient after incorporating the RATE into the model in Figure 3, it can be concluded that the impact of interest rate shocks on the long-term component of stock market volatility is initially strong and then weakens. This reflects that interest rate changes influence the characteristics of stock market volatility over the long term by affecting capital flows and corporate financing costs, demonstrating that the model effectively captures the long-term effects of interest rate transmission.

CONS (Macroeconomic Climate Index)

As a representative of macroeconomic climate, CONS influences the long-term component of stock market volatility in both single-factor and multi-factor models, reflecting the transmission of economic climate. The model results indicate that fluctuations in CONS, when transmitted through the model, have a long-term effect on stock market expectations of macroeconomic conditions.

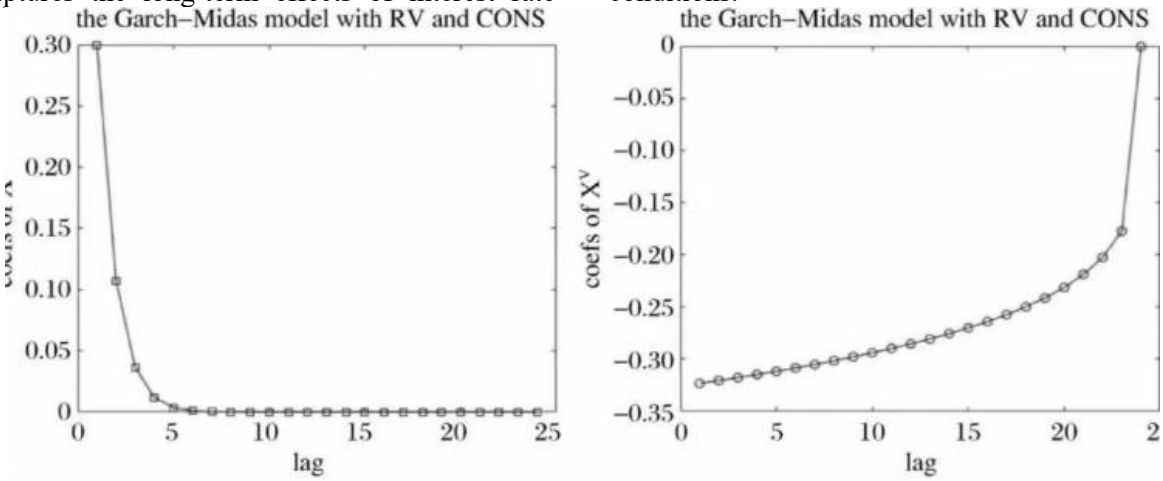


**Figure 4. Changes in Lag Coefficients of the GARCH-MIDAS Model Incorporating CONS**

Meanwhile, based on the lag period changes of the GARCH-MIDAS model incorporating CONS, it can be observed that after a CONS shock, the impact on the long-term component of stock market volatility exhibits a persistent attenuation characteristic. This indicates that economic prosperity affects stock market volatility over the long term by influencing market confidence and corporate profit expectations, which aligns with the earlier depiction of how the economic prosperity index impacts the stock market. Moreover, the CONS factor in the model effectively links macroeconomic prosperity with long-term stock market fluctuations, consistent with the model's logic of capturing the comprehensive influence of macroeconomics.

PC and MACRO (indicators reflecting the overall macroeconomic conditions)

As indicators of the overall macroeconomic conditions, PC and MACRO demonstrate their influence on the long-term component of stock market volatility under both single-factor and multi-factor models, reflecting the transmission mechanism of the overall economy.

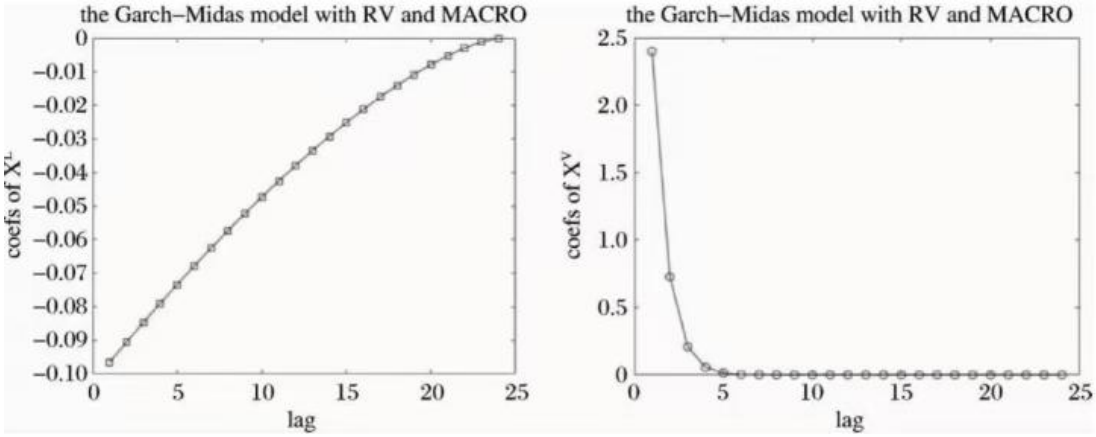


**Figure 5. Changes in Lag Coefficients of the GARCH-MIDAS Model Incorporating MACRO**

Its level value is closely correlated with the long-term component of stock market volatility, with post-shock effects decaying over lag periods, reflecting how the overall economic conditions shape stock market volatility in the long run by influencing corporate operating environments and market risk preferences. These factors in the model integrate macroeconomic information and effectively explain the long-term trends of stock market volatility.

In summary, the above five variables, through the GARCH-MIDAS model, each exert long-term influence on stock market volatility via their respective transmission channels and shared impact on the long-term volatility component. Meanwhile, the model parameters and the changing coefficients of lagged macroeconomic factors precisely capture the direction, intensity, and dynamic characteristics of these influences, validating the complexity of macroeconomic variables' long-term impact on stock market volatility and the effectiveness of the model's representation. Additionally, it well reflects.

## 5. Conclusion

To summarize, this paper first explores the impact of certain macroeconomic factors, such as monetary policy and macro fundamentals, on the dynamic stock market. It reveals that, within the complex ecosystem of financial markets, the relationship between the stock market and macroeconomic factors is both tight and dynamically variable. Focusing on the dynamic influence of macroeconomic factors on the stock market, this study yields substantial findings and insights through in-depth investigation.

From the research process, traditional GARCH-family models excel in capturing short-term stock market volatility but fall short when addressing the mixed-frequency challenge of low-frequency macroeconomic data and high-frequency stock market data.[5] In contrast, the GARCH-MIDAS model, leveraging its ability to integrate high- and low-frequency data, accurately captures the long-term trend effects of macroeconomic factors on stock market volatility, making it a powerful tool for this research. Through analyzing indicators such as the Producer Price Index (PPI), Consumer Price Index (CPI), interest rates (RATE), Macroeconomic Climate Index (CONS), and composite indicators like PC and MACRO reflecting overall macroeconomic conditions, the study clearly demonstrates how each macroeconomic variable influences the long-term volatility component via unique transmission paths. The model parameters and lagged coefficient variations vividly illustrate the direction, intensity, and dynamic features of these influences.

This series of studies confirms the complexity of macroeconomic variables' long-term impact on stock market volatility while highlighting the effectiveness of the GARCH-MIDAS model in characterizing such relationships. Practically, it provides investors with more forward-looking and accurate decision-making references, helping them understand the logic of stock market behavior under macroeconomic fluctuations and optimize investment strategies. For regulators, it offers theoretical support for formulating macroeconomic and financial regulatory policies, enabling them to maintain financial market stability by grasping the dynamic macroeconomic impact on the stock market.

However, the research also leaves room for expansion. The post-pandemic era and shifting international dynamics have rendered the

macroeconomic environment more complex, with emerging economic forms and policy tools—such as digital economy indicators and green finance policies—warranting deeper exploration regarding their impact on the stock market. Moreover, model applications could be further innovated by incorporating machine learning and other methods, potentially enhancing the accuracy of stock market volatility predictions and the depth of macroeconomic factor analysis. Moving forward, continuous exploration of the dynamic relationship between macroeconomics and the stock market, along with methodological and perspectival refinements, will better align with financial market development, providing more valuable insights for market participants and regulators and promoting a healthy, orderly, and efficient financial market.

## References

[1] Liu Wei, Huang Shao'an. Research on the Dynamic Correlation Between the Stock Market and Macroeconomics [J]. Journal of University of Jinan (Social Science Edition), 2020, 30(3): 114–128.

[2] Hao Hai. Econometrics (VII) — Time Series GARCH Model [EB/OL]. [2024-10-16 21:09:00].

[3] Liu Fenggen, Wu Junchuan, Yang Xite, Ouyang Zisheng. Research on the Long-Term Dynamic Impact of Macroeconomics on Stock Market Volatility Based on Mixed-Frequency Data Models [J]. Chinese Journal of Management Science, 2020, 28(10): 65–76.

[4] Liu Fenggen, Wu Junchuan, Yang Xite, Ouyang Zisheng. Research on the Long-Term Dynamic Impact of Macroeconomics on Stock Market Volatility Based on Mixed-Frequency Data Models [J]. Chinese Journal of Management Science, 2020, 28(10): 65–76.

[5] Conrad, C., & Loch, F. (2015). Macroeconomic Volatility and Stock Market Volatility. Journal of Financial and Quantitative Analysis, 50(5), 1203–1231.