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Noise Trader Risk-Evidence from China's Stock Market

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Abstract: Research Question: This paper examines the prevalence of noise trading and volatility asymmetry in the Chinese stock market. **Motivation:** Noise trader risk is a pervasive risk in the world's stock markets. It is driven by emotions and run counter to market stability. Noise trading has its practical repercussions. Hence, it is imperative for policymakers and investors to understand the behaviour and causes of noise risk to enhance market efficiency and optimize the financial decision-making process. Although most studies have confirmed the existence of noise in China's stock market, the volatility response findings have been mixed. Besides, prior studies found that China's stock market's volatility response behaves differently from its Western counterparts. **Idea:** In an attempt to examine the asymmetrical volatility response over different market conditions, we build our study on Feng *et al.* (2014) but over a different market sentiment period. Additionally, we combine our quantitative research with qualitative analysis. Hence, our paper verifies the existence of noise trading in China's stock market and dissects the plausible rationales behind the findings, keeping China's unique historical developments and market conditions in mind. **Data:** Our sample data comprises the daily Shanghai Stock Exchange (SHSE) A-share index between 2nd January 2014 to 1st July 2019. **Methods:** We first employ a variance ratio method to test for noise trading evidence and subsequently develop an EGARCH-M model to detect yield asymmetry in the SHSE A-share market. **Findings:** Our result suggests that noise trading is prevalent in China's stock market and that market returns are more volatile in the face of good news than bad news. Hence, our findings are similar to Chen and Huang (2002) but contradict Feng *et al.* (2014). We attribute our findings to the investor's irrational investment psychology and behaviour, such as the widespread "catch up and kill down" operations among the noise traders and the market's deficiencies. **Contributions:** Hence, our results provide important indications to investors and policymakers to assess the market conditions and devise optimal strategies.

Keywords: Noise trading, variance ratio, volatility asymmetry, EGARCH-M, market efficiency, behavioural finance.
JEL classification: G14, G40

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1. Introduction

Noise trader risk is recognized as a pervasive risk in the world's stock market. Its most direct impact is challenging the market efficiency theory. If noise trading is prevalent and persistent, it will tend to overturn the random walk theory. One of the most significant and often undesirable implications of noise trading is volatility-evoking. Volatility induces instability of stock markets. Therefore, it is not surprising that this hot research of many decades has attracted attention from a wide range of interested parties, including investors and policymakers. Due to its practical implication, it is imperative for policymakers and investors to gain a more in-depth understanding of the behaviour and causes of noise risk to enhance the market efficiency and to optimize the financial decision-making process.

Noise is a concept as opposed to information. Noise is distorted and false information, and noise traders are the investors who form a wrong idea about the future return distribution of risky assets. Noise traders select portfolios of securities based on their own ideas, as opposed to arbitrageurs whose optimal strategy is to take advantage of such mistakes by noise traders to push the price of securities back to a level consistent with their underlying value.

The theory of efficient markets has been controversial since its introduction. It is contended that the view does not correspond to reality. The logic goes like this. When investors trade with noise traders who engage in short-term arbitrage, they encounter the main risk of further price distortions in the short run as noise trader trades in the market based on their own, often distorted views. Under the assumption of noise trader’s unpredictable investing behaviours, when they make wrong judgments about the market, their behaviour will inevitably drag prices further away from the fundamentals. They may even cause the price to go to the extremes before returning to normal. In such circumstances, the arbitrageurs bear the risk caused by the noise traders' misbehaviour. Thus, arbitrage trading becomes much less attractive, and noise trader's trading activities may further aggravate the price deviation from its underlying value. The spiralling effect causes a less efficient market.

In the early days of noise theory, scholars argued that noise traders did not exist for long. Fama (1970) argued that noise traders could not survive persistently because of market selection and arbitrage behaviour, as they were pushed out of the market by rational traders. These earlier researchers contend that noise traders are in a weaker position than arbitrage investors. Arguably, when noise traders are in an interactive game with arbitrage investors, the former often make errors in judgment. Such errors will result in noise traders continuously losing money and disappearing from the market. Numerous empirical studies show that noise trading is widespread in the world's financial markets (Lee *et al.*, 1991; Baker and Stein, 2004). Some recent studies have reported that investors' irrational behaviour could even lead to noise generation and persistence (Long *et al.*, 1990b).

Noise trading affects the stability of the stock market. Researchers have found that noise traders cause a stock price to deviate from its intrinsic value, causing market bubbles (Shiller *et al.*, 1984; West, 1988; Binswanger, 1999). The phenomenon is expected to be more pronounced and impactful in less competitive and efficient markets. At present, China’s stock market is one of the largest markets in the world. Of interest is that the market distinguishes itself by its unique development history and market characteristics. For context, China's stock market has an enormous influence on the country’s overall economy, and policymakers have been continuing to implement various reform policies to improve the market competitiveness and efficiency, and ultimately promote overall economic development. However, some imperfections and deficiencies exist in the Chinese stock market, limiting its progress towards achieving optimal functions and efficiency. One of the most intuitive manifestations is the stock price deviation from the fundamental value and irregular fluctuations with stock returns. It is noteworthy that the market is dominated by a substantial proportion of small investors and speculative trading, which implies that the irrational investment psychology and investing behaviour may be more severe than other developed counterparts. Hence, noise trading is likely to be more prevalent in the market. Thus, the paper's first objective is to verify the prevalence of noise trading in China, which carries significant implications for both the regulators and investors.

When noise traders affect prices and thus returns, the risk they cause is volatility. Market yield volatility asymmetry is a widespread phenomenon in the world's stock markets. Studies show that volatility asymmetries exist in most developed countries' stock markets. In China, there have been some empirical studies on the market's volatility. Although most studies have confirmed the existence of noise in China's stock market, the volatility response findings have been mixed. Studies found that volatility response in China's stock market mostly behaves differently from Western counterparts. Even for the China market, studies on the topic have not provided conclusive evidence on how the market behaves in the face of good news and bad news. While some studies reported that fluctuations in China's stock market react more strongly to positive shocks than adverse shocks (Chen and Huang, 2002), other studies documented contrary evidence (Feng *et al.*, 2014). Our paper is similar to Feng *et al.* (2014). The authors tested noise behaviour from 2008 to 2013, a bearish era surrounding the Global Financial Crisis.

The authors reported a more robust response of market volatility to adverse shocks than positive shock. It is worth noting that after a seven-year of bearish sentiment, the year 2014 earmarked a significant turning point for China's stock market. In November 2013, China's government launched a "Deepening Reform," of which part of the resolution revitalized the stock market through a series of active system reforms. Due to the reforms, China's economic growth was stimulated, and a new round of economic growth in China began. Since then, market sentiment was lifted, and the market has transitioned from predominantly bearish to bullish. Against such a backdrop, we are motivated to gain insight into how noise trades' behaviour changes. This paper uses new data from 2014 to 2019 to investigate behavioural issues of noise trading and endeavour to depict a complete picture of the issue.

The extant literature of noise trading models and empirical studies agree on the existence of noise trading. It is argued that the fundamental characteristic that defines a noise trader is irrationality (Brown, 1999). Nonetheless, there is a lack of a classification of the psychological factors that explain noise trading. Furthermore, previous studies of noise trading entities in financial markets have mostly been market endogenous, with noise arising from innate incomplete rationality and information asymmetry that cannot be eliminated entirely. Looking at the capital markets of various countries, especially the Chinese capital market, which is in a phase of emerging-plus-transition, there is a large amount of exogenous policy noise in the market. Hence, it is worth studying how such noise affects the capital market. Empirical studies of stock market yield volatility confirm the GARCH-type model's ability to detect asymmetries. However, most studies omit the analysis of investor psychology and behaviour behind volatility asymmetries. Since China's stock market has been changing at breakneck speed in the past decade, and regulators have been implementing active reforms, our motivation is to engage more recent data that may better reflect the current market's real circumstances. We are also motivated to investigate the reasons behind the unsystematic noise trading and yield asymmetry, viewing from the angles of investors and market mechanisms.

The stock market in mainland China mainly consists of companies listed on the Shenzhen Stock Exchange (SZSE) and Shanghai Stock Exchange (SHSE). The market also comprises companies listed on the Hong Kong Stock Exchange (HKSE) in the Hong Kong Special Administrative Region. Aside from the first-tier markets, the Chinese stock market also consists of a second-tier market, mainly for the Chinese SMEs. The second-tier market was established in 2004. The third-tier market was initially established for delisting and OTC trading. In 2006, the China government set up another third-tier market (the new third-tier market) for non-listed share-holding companies. Three years later, the Shanghai Stock Exchange (SHSE) established the Growth Enterprises Market (GEM) to offer small and medium-sized private companies financial services. The Ke Chuang Ban was established in 2019, focusing on new tech firms that are usually smaller. In China, A-share and B-share are the two major segments in the Chinese stock market. A-share refers to the share of domestic companies listed on the SZSE or SHSE, while B-share refers to the Chinese companies' shares allowed to be owned by foreigners, and they are usually traded in foreign currencies. The number of A-share stocks traded is much larger than the B-share stocks.

China's stock market has become one of the largest stock markets in the world. It has grown rapidly in recent years but has also been volatile at the same time. The depth of government intervention in the early stages of market formation and the unique circumstances define the market's peculiarities. At present, the market is still suboptimally functional, and the multifaceted systems are still imperfect, which has led to information asymmetry and speculative trading being very common in China's stock market.

The contributions of our paper are as follows. First, we confirm the Chinese stock market's noise existence. Second, our result indicates that market volatility is more responsive to positive shocks than adverse shocks. We posit that volatility characteristics are conditional upon the market state. Third, we explore the underlying reasons for China's stock market's noise trading and volatility asymmetry, mainly from an individual investor's perspective. Our work has normative implications for policymakers and investors. It will be conducive to the policymakers' accurate assessment of the causes when the market is abnormal or even dysfunctional to introduce relevant policies for necessary market intervention. Our work is also applicable for investors who can apply the findings to decision marking in future investments and adjust their investing behaviours and investing strategies to optimize their investment returns.

The remainder of the paper is structured as follows. The following section describes the data and descriptive statistics. Methodologies and empirical analysis are presented in Section 3. In Section 4, we discuss the findings from a mainly behavioural perspective. Section 5 concludes.

2. Data and Descriptive Statistics

We test the stock market returns' noise behaviour using the SHSE (Shanghai Stock Exchange) A-share index. The data is sourced from the RESSET database. We use 1340 daily observations of the SHSE A-share index between 2nd January 2014 to 1st July 2019 to compute the market returns. The market return is calculated as the logarithm yield rate of day t, namely r_t. Table 1 shows the descriptive statistics for the SHSE A-share index return over the investigation period.

$$r_t = lnP_t - lnP_{t-1} \tag{1}$$

where P_t is SHSE A-share index of day t.

Table 1: Descriptive statistics for SHSE A-share index return

Mean	0.0003	Kurtosis	9.7549
Median	0.0007	Jarque-bera	2838.8790
Maximum	0.0560	Probability	0.0000
Minimum	-0.0887	Sum	0.3679
Std.dev	0.0150	Sum sq.dev	0.3005
Skewness	-1.1503	Observation	1338

Figure 1 displays the volatility of r_t. As can be seen from Figure 1, the yields' volatility exhibits asymmetry. According to the skewness and kurtosis of the histogram of r_t (not displayed here), the skewness and kurtosis of r_t are -1.15 and 9.75. Hence, we conclude that r_t is not normally distributed.

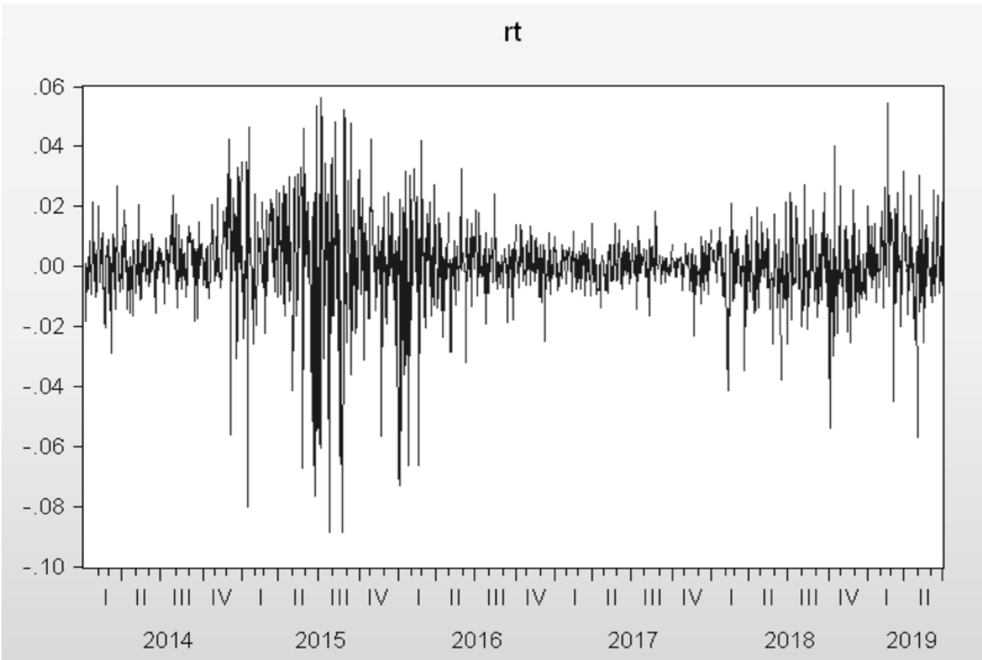

Figure 1: Volatility of r_t

3. Methodology and Empirical Results

This subsection delineates the econometric methodologies and empirical results. Following Lo and MacKinlay (1989), we first employ a variance ratio method to test the noise trading's prevalence and subsequently develop an EGARCH-M model to detect yield asymmetry in the SHSE A-share market. If yield asymmetry is detected, we investigate whether market yield volatility is more responsive in good news or bad news.

3.1 Variance Ratio as Random Walk Test

The variance ratio test is used to test the random walk hypothesis of r_t. The method's fundamental logic is that variance is a linear function of time when a random walk is assumed. The variance ratio VR(q) can be expressed as follows, where q is the lag phase:

$$VR(q) = \frac{\sigma^2(q)}{\sigma^2(1)} \tag{2}$$

where

$$\sigma^2(1) = Var(p_t - p_{t-1})$$
$$\sigma^2(q) = 1/q \times \ Var\left(p_t - p_{t-q}\right)$$

The equations to compute $\sigma^2(1)$ and $\sigma^2(q)$ are as follows:

$$\sigma^2(1) = \frac{1}{nq-1}\sum_{t=1}^{nq}(P_t - P_{t-1} - \hat{\mu})^2 \quad (3)$$

$$\hat{\mu} = \frac{1}{nq}\sum_{t=1}^{nq}(P_t - P_{t-1}) = \frac{1}{nq}(P_{nq} - P_0 \quad (4)$$

$$\sigma^2(q) = \frac{1}{nq-1}\sum_{t=1}^{nq}(P_t - P_{t-1} - \hat{\mu})^2 \quad (5)$$

$$m = q(nq - q + 1)\left(1 - \frac{q}{nq}\right) \quad (6)$$

There are nq+1 observations in the data time series, which starts from P_0, ends at P_{nq}. The null hypothesis of the variance ratio test is VR(q) equals 1. When VR(q) equals 1, the time series of yield conforms to a random walk, which implies that the market follows a random walk. If VR(1) does not equal 1, the market is not efficient at the statistical level. The standard normal test statistic Z(q) is applied to test the null hypothesis of random walk in the situation of homoscedasticity, while Z*(q) is applied to test the null hypothesis in the situation of heteroscedasticity of a random walk.

Table 2 clearly shows that the Z statistics are statistically significant, and therefore the random walk null hypothesis is rejected for the market. This result implies that the index does not conform to the random walk, the market is not efficient, and there are noises in the market. It is worth noting that the variance ratios monotonically decrease when q becomes progressively larger: the variance ratio decreases from 0.5492 (q=2) to 0.0189 (q=60). Correspondingly, the Z statistic's absolute value also progressively reduces as q gets larger. The declining variance ratios may be interpreted as the index showing a negative serial correlation in multi-period returns. Therefore, our results corroborate the earlier studies, confirming that the Chinese stock market exhibits non-random walk behaviour.

Table 2: Variance ratios for daily SHSE A-series index return

q	VR	Z	Z*
2	0.5492	-16.4845***	-8.2122***
3	0.3449	-16.0681***	-8.2906***
4	0.2410	-14.8355***	-7.8498***
5	0.2112	-13.1646***	-7.1003***
10	0.1132	-9.6038***	-5.4961***
15	0.0698	-8.0070***	-4.7524***
20	0.0478	-7.0055***	-4.2566***
30	0.0380	-5.7046***	-3.5717***
50	0.0222	-4.4456***	-2.8853***
60	0.0189	-4.0616***	-2.6760***

Notes: q denotes lag phase, VR is the variance ratio of r_t, Z and Z* stand for the conditions of homoscedasticity and heteroscedasticity. *** denotes 1% significance level.

3.2 EGARCH-M Model as Volatility Asymmetry Test

Before we construct the regression model, we applied a few preliminary tests on the data to ensure model suitability. We used the Augmented Dickey-Fuller (ADF) unit root test on the market return to test for data stationarity. The ADF test has p-values nearly equal to 0, which shows that the data is stable and ready to be used for further analysis. The following shows the regression model of the market return of day t and day t-1.

$$r_t = c + r_{t-1} + u_t \quad (7)$$

where c is a constant term, u_t is residual. The estimation results of the regression are shown below. It is observed that both the constant term and the coefficient of r_{t-1} are not significant at a five per cent level.

$$r_t = 0.0003 + 0.0496 r_{t-1} \quad (8)$$

t-Sta (0.66) (1.81)

R^2 = 0.002 *AIC*=-5.563 *SC*=-5.555

Next, we test the heteroscedasticity of the residual error of u_t. The volatility of the residuals in the regression is depicted in Figure 2. From Figure 2, it can be seen that there may exist heteroscedasticity in the residuals. We then use the ARCH LM test to confirm the heteroscedasticity's existence. As shown in Table 3, our result rejects the null hypothesis that there is no ARCH effect in the error term, thereby confirming heteroscedasticity in the residuals and supporting the GARCH-type model's use for our subsequent study.

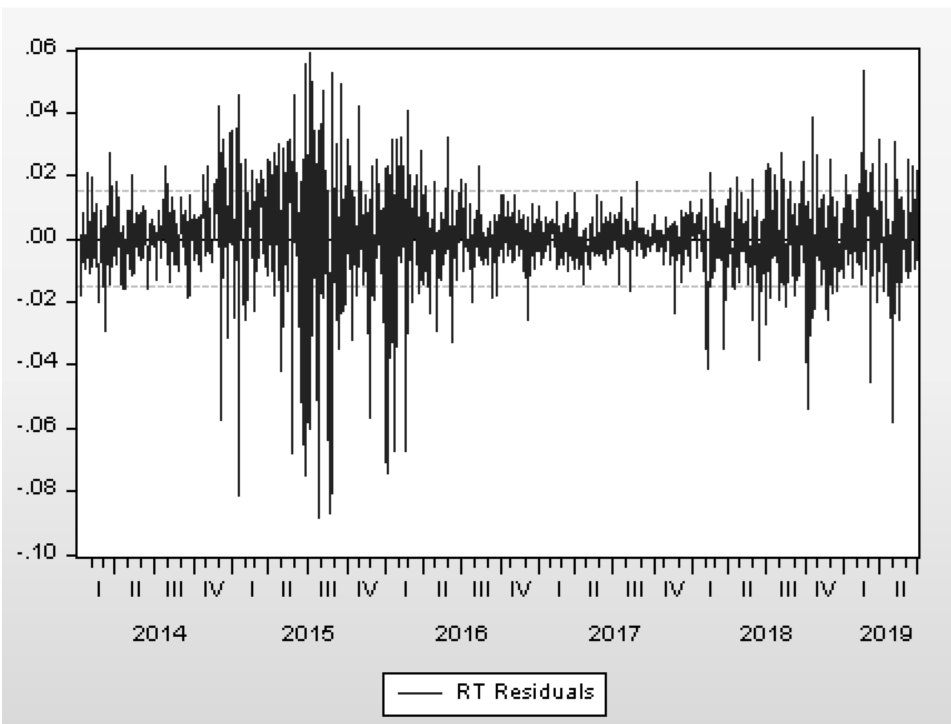

Figure 2: Residuals of r_t

Table 3: Heteroscedasticity test results - original model

F-statistic	68.1825	Prob. F(1,1334)	0.0000
Obs*R-squared	64.9643	Prob. Chi-Square (1)	0.0000

3.2.1 EGARCH-M Model

The GARCH model is a time series modelling method with heteroscedasticity in the ARCH model family. An essential characteristic of the GARCH (p,q) model is that the random error term's conditional variance obeys an ARMA (p,q) process. The GARCH (p, q) model supposes the conditional variance is a function of the squared lagged residuals, which, in this case, the variations are not influenced by the sign of residuals, and the conditional variance should be symmetrical in terms of responding to positive and negative price fluctuations. However, empirical studies have shown that volatility in yields caused by equal degrees of positive and negative information shocks tends to be asymmetrical. Therefore, the linear GARCH model cannot portray this asymmetry in the return's conditional variance fluctuation. Engle *et al.* put forward the GARCH-M model in 1987. Some functional form of h_t, $f = (h_t)$ is used as an explanatory variable for y_t, to characterize time series as affected by their conditional variance. Since security returns incorporate compensation for risk, security returns and risks are closely related. The risks can be measured appropriately using the conditional variance of yields. Therefore, the GARCH-M model is well suited to study the relationship between security returns and risk. Nelson put forward the Exponential GARCH model (EGARCH) in 1991, and it can better depict the fluctuations' asymmetric phenomenon in the conditional variance of yields in the stock market.

To quantitatively describe the asymmetry in the market yield, we use the EGARCH-M model. The EGARCH-M model is based on the EGARCH model, and it takes the conditional variance on the conditional mean equation. The M-item in the conditional mean equation must conform to the Akaike information criterion (AIC) and Schwarz information criterion (SIC), reducing AIC and SIC after modification. Compared with the GARCH-M and EGARCH models, the EGARCH-M model has fewer constraints on the parameters, conforms better to the financial market's actual situation, and can describe its asymmetry well. Engle and Ng (1993) argued that GARCH-type models are good at estimating the properties of risk when the lagged order of ε_t and σ_t is one. As a result, EGARCH-M (1, 1) is selected. The following equation (9) shows the expression of conditional variance.

$$ln(\sigma_t^2) = \omega + \beta ln(\sigma_{t-1}^2) + \alpha \left|\frac{u_{t-1}}{\sigma_{t-1}}\right| + \gamma \frac{u_{t-1}}{\sigma_{t-1}} \tag{9}$$

The γ stands for the size of the asymmetric effect. If γ is close to 0 significantly, no asymmetry exists in shock. On the contrary, when $\gamma < 0$, it suggests that bad news induces a greater volatility response in yields than do good news to the same extent. In the opposite case, when $\gamma > 0$, it suggests that the good news response is more robust than the response to bad news to the same extent. The expression of the conditional mean equation of the model is:

$$r_t = \mu + \rho r_{t-1} + \varphi ln\sigma_t^2 + u_t \tag{10}$$

The results of estimation shown in Table 3 can be summarized as below:

$$ln(\sigma_t^2) = -0.1422 + 0.9959\ln(\sigma_{t-1}^2) + 0.1460 \left|\frac{u_{t-1}}{\sigma_{t-1}}\right| + 0.0168 \frac{u_{t-1}}{\sigma_{t-1}} \tag{11}$$

p-value: (0.00) (0.00) (0.00) (0.03)

$$r_t = 0.0004 + 0.0114 r_{t-1} - 0.0868 ln\sigma_t^2 \quad (12)$$

p-value: (0.22) (0.66) (0.97)

R^2 = 0.001 *AIC* = -6.060 *SC* = -6.033

Compared with equation (8), the value of *AIC* and *SC* both declined, suggesting that the model's effectiveness is enhanced by introducing M-item to the mean equation. Also, referring to the variance equation results, γ equals 0.0168 with p-value equals 0.03. As demonstrated before, when $\gamma > 0$, it suggests that the response to positive shocks leads to more yields' volatility than adverse shocks' response to the same extent. The empirical results confirm the asymmetry in the SHSE A-share market. Table 4 illustrates the results of the model.

Table 4: Results of EGARCH-M model

	Coefficient	Std. Error	P-value
Conditional mean equation			
μ	0.0004	0.0003	0.2196
ρ	0.0114	0.0262	0.6627
φ	-0.0868	2.3935	0.9711
Conditional variance equation			
ω	-0.1422***	0.0206	0.0000
β	0.9959***	0.0023	0.0000
α	0.1460***	0.0119	0.0000
γ	0.0168**	0.0078	0.0315

Notes: μ, ρ and φ are the coefficients in the conditional mean equation. ω is the constant term, β, α and γ are the coefficients in the conditional variance equation. ** and *** denote 5% and 1% significance level.

After the model has been modified by adding the M item, we applied the heteroscedasticity test on the modified model to detect any heteroscedasticity problem in the residual. The results are shown in Table 5. With lag phase equals to 1, neither F-version nor LM-statistic provides significant values. Thus, the null hypothesis cannot be rejected, suggesting that the ARCH effect does not exist in the residual. We then conclude that there is no more heteroscedasticity in the residuals, and the model is optimized.

Table 5: Heteroscedasticity test result on modified model

F-statistic	0.5954	Prob. F(1,1334)	0.4405
Obs*R-squared	0.5960	Prob. Chi-Square (1)	0.4401

3.2.2 The Information Impact Curve

We demonstrate the yield volatility's asymmetry through a curve. Figure 3 depicts the information's impact curve derived from the previously developed EGARCH-M model. As shown in the figure, the horizontal axis is the value of lagged shock, representing the market's information shock. A positive sign implies good news in the market, and a negative sign indicates an opposite meaning. The higher the absolute value, the greater the news (shock).

The vertical axis implies the conditional variance, representing yield volatility's response to the market's information shocks. When lagged shock value is positive, the slope's absolute value is larger, and the curve is relatively steeper. On the contrary, when the lagged shock shows a negative number, the slope's absolute value is smaller, and the curve is relatively flatter. It implies that when there are two values of lagged shock with the same absolute value and opposite signs, the volatility of returns corresponding to positive information is more responsive to the information shock than the volatility corresponding to negative information.

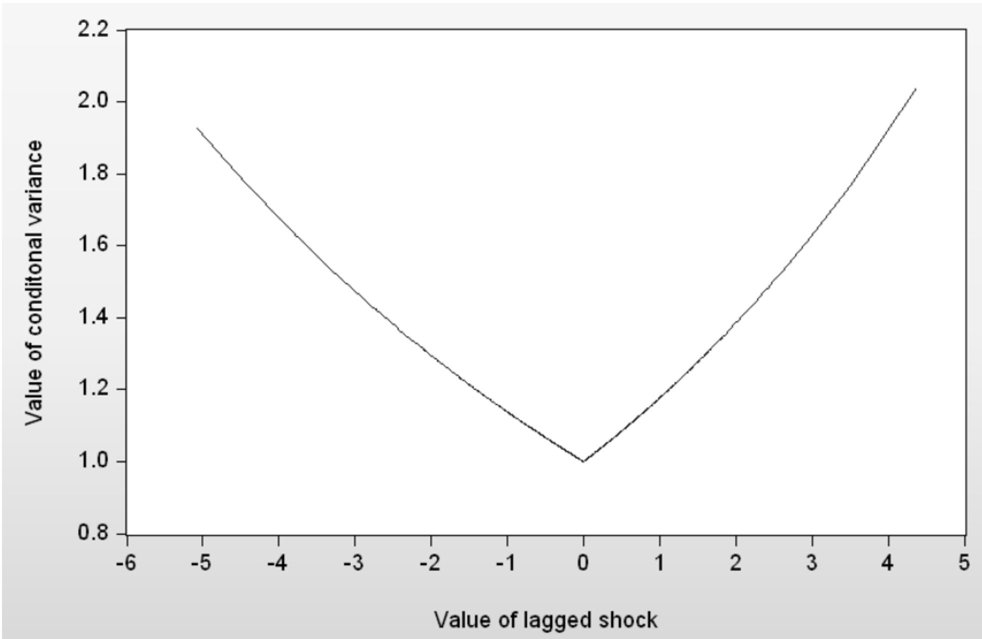

Figure 3: Information impact curve

The differences in the degree of responsiveness of yield volatility to different information embodied in the information's impact curves are consistent with the previous conclusions drawn from modelling observation parameters. The asymmetry exists, and market yield volatility is more responsive to positive information (good news), given the same degree of information shock in our study. This finding contrasts with Feng *et al.* (2014), who found that bad news has a more significant impact on market yield volatility than good news. This apparent contradiction, however, matches our initial conjecture. We have earlier mentioned that the prior study was conducted for the "seven-year bear market" of China in which market sentiment is believed to be severely impaired. Thus, the leverage effect was at play. Although our study produces an opposite finding, namely, good news induces a more robust volatility response than do bad news, we argue that it is caused by a more favourable market condition of our study period, a period when the market momentum has picked up due to the recent recovery from the global crisis and active reforms by the government. Based on the above, we suggest that noise behaviour, particularly volatility asymmetry, is conditional upon the market condition.

4. Discussions

Noise trading can be classified into systemic noise trading and non-systemic noise trading. Systemic noise trading cannot be eliminated, and in fact, it is necessary to enhance market liquidity so long as it is not excessive. Non-systemic noise trading is closely related to human decision-making. It undermines market efficiency but can be eliminated. From the results in the previous empirical study, it is shown that the SHSE A-share market is not efficient, and there are prevalent noise trading and asymmetry of the yield volatility in the market. In the next section, we evaluate the causes and explanations of the non-systemic noise trading and asymmetry in China's stock market. Combined with the characteristics of the current development of China's stock market mentioned above, such as China's stock market as an emerging market, the imperfect laws and systems, the majority of individual investors, and an intense atmosphere of speculation, the irrational psychology and behaviour of investors can influence China's stock market significantly.

4.1 Investors' Expectation, Composition, and Psychology

4.1.1 Investors' Expectation

The significant market yield volatility is a manifestation of positive feedback trading behaviour (Long *et al.*, 1990a). Positive feedback trading behaviour builds on adaptive expectations, as past price growth generates expectations of further price growth and vice versa. It is characterized by over-anticipation of prices or follow-up to price movements too aggressively. This feedback is primarily a reaction to a sustained price growth pattern rather than occasional changes in prices. For example, in a bull market, a sustained rise in prices creates an expectation of further price rises, and investors follow through aggressively. This kind of operation is often called "catch up. " A decline in price in a bull market is perceived by investors as a random change in price and does not create expectations that prices will fall further. Therefore, the reaction to market yield volatility to negative shocks in a bull market is not very strong. In a bear market, falling prices create expectations of further price declines, and investors race to sell their stocks, this kind of operation is often called "kill down." When prices rise, investors do not have a sustained expectation of further price increases. Thus, the volatility of market yields in a bear market is more sensitive to bad news, and prices tend to fall further. Positive feedback trading has led to an intensification of the tendency to increase the magnitude of price movements.

Our finding shows that China's market return volatility is more responsive to positive information than negative information. The prevalence of the "catch up and kill down" operations in the market is likely to be one of the underlying rationales. When the market maintains upward momentum, bad news does not suppress investors' enthusiasm to "catch up," making the effect of negative information at this juncture less prominent. When the market is depressed, bad news can prompt some investors to sell their stocks. However, at the same time, a part of the investors may have "reluctant to sell" psychology in the market, which reduces market participation, offsetting some of the volatility in market yields due to "kill down" operations.

4.1.2 Investors' Composition

The investors' composition in China's stock market can be primarily divided into two categories. The first category is institutional investors that have absolute advantages in capital and information. Next is the category that consists of small and medium-sized investors with quantitative advantages, relatively small amounts of capital, weak access to information and analytical capacity, and concerted action difficulties. Since they are at a disadvantage considering the promptness and correctness of the information they receive, small and medium-sized investors believe that institutional investors' operations contain information they have not yet received. Thus, small and medium-sized investors are prone to actively keep up with institutional investors' operations, resulting in a "catch up and kill down" operation style for small and medium-sized investors. To achieve excess returns, institutional investors are likely to take split positions against each other, creating false volume practices, artificially creating lagging or even false information to lure small and medium investors into keeping up with the trend. Small and medium investors will then turn positive feedback traders, thereby increasing the stock market's volatility.

4.1.3 Investors' Psychology

From the viewpoint of investors' psychology, studies show that the market often participates in decisions that are not based on its own best value judgments but first extrapolates other participants' judgments. This herding behaviour is also called the herding effect (Banerjee, 1992). Apart from the psychological factors, there are also factors such as news media messaging, market gossip, and market popularity that lead to crowd behaviour. Crowd behaviour generates a signal amplification mechanism. A piece of information that is not very important in the market is likely to resonate much among market investors through this amplification mechanism. That is to say, good news in a bull market and bad news in a bear market can easily create a herding effect.

4.2. Trading Mechanism of China's Stock Market

The short-selling mechanism and bilateral mechanism introduced in China's stock market are still in the embryonic development stage and have not yet matured. It leads to the asymmetry in the direction of the Chinese stock prices' fluctuations and exacerbates single-item market price fluctuations. The one-way operation leads to excessive speculation and short-term behaviour such as the "catch up and kill down," thus exacerbating the magnitude of price volatility. The biggest problem caused by an immature short-selling mechanism is eliminating systemic risk in the stock market. Moreover, the Chinese financial derivatives market is still underdeveloped, which means that investors have limited hedge risk options. Investors can only hedge systemic risk by exiting the stock market in the absence of a mature short-selling mechanism and sufficiently sophisticated risk-hedging tools.

4.3 Aggressive Investment Atmosphere in the Market

China's economy is growing at close to 10% per year, and investing in the Chinese economy can often achieve 20% or more annual returns. This makes the opportunity cost of investing in the stock market very high. As a result, equity funds management tends to adopt a more aggressive investment style, and investors tend to trade more aggressively.

4.4 Shortage of Financial Products in the Market

China's capital market follows a gradual reform path, with the pace of innovation and the introduction of financial products lagging behind its economic development. The breadth and depth of the current range of financial products on the market may still not meet the diversity of investors' appetites and preferences. This constraint may have led to significant market interest and overreaction whenever a new financial product class is launched. The temporary popularity of new products in the market, while not affecting the market's long-term trend, exacerbates the positive correlation between volatility and returns.

5. Conclusion

This study's central question is whether noise trading exists in China's stock market and its surrounding issues. We applied the variance ratio test on SHSE A-share yields to test the market's prevalence of noise risk. We show that the stock yields do not conform to a random walk, and the relevant information contained in the stock price is not fully reflected in the current stock price. There is also information content embedded in historical stock prices that is useful for future stock prices' prediction, which indicates that the market is not efficient. Noise is one of the critical factors that cause a stock's price to deviate from its intrinsic value, and it supports the fact that in the SHSE A-Share market, noise and noise trading are prevalent.

EGARCH-M model provides a good description of the yield volatility asymmetry in China's stock market. Numerous empirical studies have shown that one of the most critical manifestations of noise trading affecting the stock market is the yield volatility asymmetry. In this paper, by constructing the EGARCH-M model, we show that the results of both conditional variance and conditional mean equations in the EGARCH-M model are significant at 5% confidence intervals. The EGARCH-M model is optimized to give a better fit than the regression model before modelling. The results indicate an asymmetry in the SHSE A-share market, and the market shocks’ impact on risk is asymmetric. Our result demonstrates that SHSE A-share return volatility reacts firmer to positive surprises than adverse shocks. In other words, good news has a more significant influence on market risk than bad news to the same extent. This finding corroborates with earlier studies on the Chinese stock market.

After concluding that noise trading and market return asymmetries are prevalent in SSE, this paper explores and analyzes this finding in greater depth. Based on the uniqueness of the Chinese stock market, the paper focuses on the reasons that underlie unsystematic noise trading and yield asymmetry from the perspective of investors and market mechanisms and combines with knowledge from behavioural finance. We posit that many small and medium-sized investors in China's stock market have led to the proliferation of irrational investment behaviour and speculation. Investors generally have irrational expectations of returns, which has resulted in the widespread "catch up and kill down" operations. To some extent, irrationality has also become an unstable factor that causes the stock market turmoil, explaining the asymmetry of market returns.

One of the contributing factors of noise trading is the imperfect market mechanisms of the China stock market. The typical ones are the imperfect short-selling mechanism and the lack of financial products, making investors lack risk-hedging options and thus increases market volatility.

This study explores noise trading in the Chinese stock market and the asymmetry of yields using the A-share index and throughout an active market reform period of China. Future research can consider examining market volatility over multiple time frames, particularly during the pandemic crisis. It will be interesting to observe how divergent investor psychology and investment behaviour can be over such an unprecedently turbulent period.

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