The Transmission Mechanism of Sentiment from Securities Futures Market to Spot Market

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Abstract. This study aims to explore the mutual influence between securities futures market investor sentiment and spot market investor sentiment, along with its underlying mechanisms. First, by establishing a VAR model, we find that investor sentiment in securities futures markets exerts a negative effect on sentiment in spot markets. Second, by introducing three mediating variables—futures market liquidity, futures market returns, and futures market speculative activity—we investigate the transmission mechanism of investor sentiment contagion between securities futures and spot markets. The findings reveal that these three intermediary variables play a partial mediating role in the influence of investor sentiment in the securities futures market on that in the spot market. Specifically, investor sentiment in the futures market influences spot market sentiment by acting through these mediating variables. However, the direct effect of futures market sentiment on spot market sentiment remains greater than the mediating effects exerted by these variables in the transmission process.

Keywords: Futures market investor sentiment; Spot market investor sentiment; VAR; Mediating effect

1 Introduction

Investor sentiment, as a core concept in behavioral finance, is regarded as investors' misjudgment of asset values (Zhou, 2018) [1]. In recent years, it has garnered significant attention in studies examining price discovery and risk transmission mechanisms within financial markets (see, e.g., Bashir et al., 2024; Yang et al., 2024; Lachana & Schrder, 2025) [2-4]. Traditional financial theories, grounded in the Efficient Market Hypothesis (Fama, 1970) [5], struggle to explain numerous market anomalies, such as the size effect (Banz, 1981) [6], the January effect (Rozeff & Kinney, 1976)[7], the closed-end fund discount puzzle (Martin & Zweig, 1973)[8], and mean reversion in stock prices (De Bondt & Thaler, 1985)[9]. However, investor sentiment offers a crucial psychological perspective to explain these phenomena.

A substantial body of researches have demonstrated that investor sentiment can predict stock market returns and volatility (see, e.g., Huang et al., 2015; Jiang et al.,

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2019; Dong & Gil-Bazo, 2020) [10-12]. Research on investor sentiment in securities futures markets has primarily focused on its impact on securities futures returns, volatility spillovers, and basis effects (see, e.g., Bahloul & Bouri, 2016; Gao & Xie, 2020; Xiong et al., 2020) [13-15]. However, existing studies predominantly focus on either the stock spot market or the futures market, with limited research examining the transmission of investor sentiment between futures and spot markets. Furthermore, when exploring the interrelationship between these two markets, sentiment factors are often overlooked. Investigating the correlation between investor sentiment in securities futures and spot markets serves two purposes: first, it alerts investors that in addition to the spot market, the sentiment in the futures market also has an important impact on investment decisions; second, it promotes coordinated development between futures and spot markets, fostering positive economic cycles, achieving mutual emotional checks and balances, and enhancing financial system stability.

In the interaction between futures and spot markets, the futures market often plays a leading role and reacts more swiftly to new market information compared to the spot market. Gao et al. (2020) find that investor sentiment in the stock index futures market exhibits spillover effects and significantly influences future investor sentiment in other markets [14]. We contend that investor sentiment in securities futures markets influences sentiment in spot markets. From the perspective of the hedging function of the futures market, an increase in short hedging in the futures market indicates a negative outlook of securities market traders on the future trend of the spot market; an increase in long hedging means that some traders expecting a rise in the spot market lock in profits through futures. The low transaction costs and high liquidity of the futures market will attract more investors with the same expectations to enter the futures market for trading, thereby reducing their investment in the spot market at present. That is, the higher the investor sentiment in the securities futures market, the lower the investor sentiment in the securities spot market. Based on this, we propose Hypothesis 1.

H1: Investor sentiment in securities futures markets has a significant negative impact on investor sentiment in securities spot markets.

Existing researches have found that investor sentiment exerts a significant influence on market liquidity. Joseph et al. (2011) discover a positive correlation between investor sentiment and both market returns and liquidity [16]. Hu et al. (2019) observe that investor sentiment exerts a positive effect on market liquidity [17]. We propose that heightened investor sentiment in securities futures markets can enhance liquidity in futures markets. Increased futures market liquidity further encourages speculator participation. However, excessive speculator involvement in the market may, to some extent, trigger volatility in the spot market, thereby dampening investor sentiment in the spot market. That is, the higher the investor sentiment in securities futures markets, the greater the futures market liquidity; and higher futures market liquidity weakens investor sentiment in the spot securities market, and vice versa. Based on this, we propose Hypothesis 2.

H2: Investor sentiment in the securities futures markets negatively affects investor sentiment in the securities spot market by positively influencing the liquidity of the futures market.

Numerous studies have found that investor sentiment exerts a positive influence on securities returns (Chen Chen et al., 2016; Hirshleifer et al., 2020)[18-19]. We contend that heightened investor sentiment in securities futures markets tends to drive up futures market returns. Due to the common chasing behavior of Chinese investors, when the futures market is performing well, more investors will flock into the futures market for asset allocation, and more funds from the securities market will flow into the futures market, thereby reducing investment in the spot market with similar investment targets. That is, the higher the investor sentiment in the securities futures market, the higher the yield rate of the futures market; and the higher the yield rate of the futures market, the weaker the investor sentiment in the securities spot market, and vice versa. Based on this, we propose Hypothesis 3.

H3: Investor sentiment in the securities futures market negatively affects investor sentiment in the securities spot market by positively influencing the yield rate of the futures market.

Baker & Wurgler (2006) propose that speculative demand for stocks rises during periods of high investor sentiment and declines during periods of low sentiment [20]. Speculative activity manifests in both futures and spot markets as trading behavior undertaken by investors seeking abnormal returns. It not only influences investors' own investment decisions but also amplifies market volatility (Dong & Feng, 2018) [21]. Therefore, we argue that heightened futures investor sentiment promotes speculative activity in futures markets. Since speculators' actions often trigger volatility in futures markets, and securities futures markets exert volatility spillover effects on spot markets, this can induce abnormal fluctuations in spot markets. Such abnormal volatility frequently triggers panic sentiment among irrational retail investors, leading to a decline in spot market sentiment. That is, the higher the investor sentiment in securities futures markets, the greater the speculative activity in futures markets; and heightened speculative activity in futures markets weakens investor sentiment in securities spot markets. Based on this, we propose Hypothesis 4.

H4: Investor sentiment in the securities futures market negatively affects investor sentiment in the securities spot market by positively influencing the speculative activity in the futures market.

We employ the VAR model to examine the direct impact of stock index futures market sentiment on spot market sentiment, utilizing 1,415 sets of transaction data from January 1, 2018, to October 31, 2023. It further introduces three mediating variables—futures market liquidity, futures market returns, and futures market speculative activity—to delve into the underlying mechanisms of sentiment transmission. The study not only confirms the negative impact of investor sentiment in securities futures markets on spot market sentiment but also reveals the partial mediating effects of these three variables in the transmission process. This provides new empirical evidence for understanding cross-market sentiment contagion.

The remainder of this paper is organized as follows. Section 2 introduces the data sources, variables, and empirical model. Section 3 presents the empirical results. Section 4 provides the conclusions of this study.

2 Research Design

2.1 Data

We select the CSI 300 Index Futures, characterized by high trading volume and liquidity, as the research subject for the securities futures market. For the securities spot market, the research subject comprises stocks traded on China's A-share market. We utilize 1,415 sets of transaction data collected from January 1, 2018, to October 31, 2023, as the research sample. All data employed in this paper are sourced from the Wind Database.

2.2 Variables

2.2.1 Securities Futures Market Investor Sentiment (FIS). We reference the methodology of Yi and Mao (2009) for constructing a composite investor sentiment index [22], employing principal component analysis to develop a securities futures market investor sentiment indicator. Furthermore, we comprehensively evaluate data availability and its representativeness of stock index futures market demand. The selected proxy indicators include fundamental market data such as open interest (*CCL*), trading volume (*CJL*), and trading value (*CJE*) of the CSI 300 stock index futures main contract, along with technical analysis tools including *RSI*, *PSY, MACD, GAP,* and *BBI*. Baker (2006) finds that due to certain uncertainties that may lead to insufficient explanation of investor sentiment, constructing investor sentiment variables requires consideration not only of current indicators but also of lagged indicators [20]. Therefore, we employ the selected eight proxy indicators and their respective one-period lags to construct securities futures market investor sentiment indicator.

Table 1. Total Variance Explanation

Component	Initial Eigenvalue	Variance Explained (%)	Cumulative Variance Explained (%)
1	5.882	36.765	36.765
2	4.476	27.973	64.738
3	1.778	11.115	75.853
4	1.168	7.301	83.154
5	0.920	5.750	88.904
		……	
15	0.001	0.07	100
16	0.000	0.000	100

According to Table 1, the initial eigenvalues of the first four principal components all exceed 1, and their cumulative variance explained reaches 83.154%, surpassing the 80% threshold and essentially covering the original information. Therefore, we select the first four principal components as the basis for constructing the securities futures market investor sentiment index. The specific expression for the first principal component is as follows:

$$F1 = 0.136CCL + 0.152CJL + 0.161CJE + 0.015RSI + 0.015PSY - 0.016MACD - 0.04GAP + 0.124BBI$$

$$+ 0.137zCCL + 0.151zCJL + 0.16zCJE + 0.015zRSI + 0.014zPSY - 0.014zMACD - 0.041zGAP + 0.124zBBI \quad (1)$$

Here, *zCCL, zCJL, ..., zBBL* represent each proxy variable lagged by one period. Similarly, expressions for the second, third, and fourth principal components can also be obtained.[1] Combining the variance contribution rates of F1, F2, F3, and F4 at 36.765%, 27.973%, 11.115%, and 7.301%, respectively, yields the following expression for futures market investor sentiment:

$$FIS = 36.765\%F1 + 27.973\%F2 + 11.115\%F3 + 7.301\%F4 \quad (2)$$

After calculation and simplification, it is:

$$FIS = 0.072CCL + 0.07CJL + 0.063CJE + 0.064RSI + 0.031PSY + 0.061MACD + 0.055GAP + 0.019BBI + 0.074zCCL + 0.07zCJL + 0.061zCJE + 0.063zRSI + 0.03zPSY - 0.02zMACD$$

$$- 0.054zGAP + 0.018zBBI \quad (3)$$

2.2.2 Spot Market Investor Sentiment (SIS). Common methods for assessing investor sentiment in the securities spot market can be categorized into three distinct types: direct measurement methods, indirect measurement methods, and composite measurement methods. Given that the data used in this study is primarily daily data, while indirect or composite indicators typically have a monthly data frequency, we choose to employ the closed-end fund discount rate as a single indicator to represent investor sentiment in the securities spot market.

2.2.3 Mediating Variables. We employ the Amihud illiquidity index [23] to measure and characterize the current liquidity status of the stock index futures market (*AMI*). The return of the CSI 300 stock index futures is used to measure futures market return (*RET*), while the ratio of trading volume to open interest in the CSI 300 stock index futures serves as an indicator of futures market speculative activity (*ACT*).

[1] Due to space constraints, it is not displayed here. If needed, please contact the author to obtain it.

2.3 Empirical Model

2.3.1 VAR Model. To investigate the mutual influence between investor sentiment in securities futures markets and spot markets, we construct the following VAR model:

$$Y_t = C + \Phi_1 Y_{t-1} + \Phi_2 Y_{t-2} + \Phi_3 Y_{t-3} + \Phi_4 Y_{t-4} + e_t \tag{4}$$

Where $Y_t = \begin{bmatrix} SIS_t \\ FIS_t \\ AMI_t \\ RET_t \\ ACT_t \end{bmatrix}$, $Y_{t-1} = \begin{bmatrix} SIS_{t-1} \\ FIS_{t-1} \\ AMI_{t-1} \\ RET_{t-1} \\ ACT_{t-1} \end{bmatrix}$, $C = \begin{bmatrix} C_1 \\ C_2 \\ C_3 \\ C_4 \\ C_5 \end{bmatrix}$, $e_t = \begin{bmatrix} e_{1t} \\ e_{2t} \\ e_{3t} \\ e_{4t} \\ e_{5t} \end{bmatrix}$, $\Phi_i = \begin{bmatrix} \phi_{11}(i) & \cdots & \phi_{15}(i) \\ \vdots & \ddots & \vdots \\ \phi_{51}(i) & \cdots & \phi_{55}(i) \end{bmatrix}$, i = 1, 2, 3, 4, 5.

2.3.2 Mediation Effect Test Model. To investigate the mediating role of securities futures markets liquidity, return and speculative activity in the process by which securities futures markets investor sentiment influences spot market investor sentiment, we employ the stepwise regression method proposed by Wen Zhonglin (2014) [24] for verification. Additionally, a series of control variables are introduced, including market turnover rate (*TURN*), price-earnings ratio (*PER*), stock price (*CP*), and market interest rate (*SHIBOR*).

Based on H1, Model 1 is designed as the primary effect analysis framework:

$$SIS_t = \alpha_0 + \alpha_1 FIS_t + \alpha_2 TURN_t + \alpha_3 PER_t + \alpha_4 CP_t + \alpha_5 SHIBOR_t + \varepsilon_{1t} \tag{5}$$

To examine the impact of each mediating variable on spot market sentiment, replace *FIS* in Equation (5) with *AMI*, *RET*, or *ACT* respectively.

Based on hypotheses H2, H3, and H4, this paper further constructs Models 2, 3, 4, and 5. Model 2 is

$$AMI_t = \beta_0 + \beta_1 FIS_t + \beta_2 TURN_t + \beta_3 PER_t + \beta_4 CP_t + \beta_5 SHIBOR_t + \varepsilon_{2t} \tag{6}$$

Replacing the *AMI* in Model 2 with *RET* and *ACT* yields Model 3 and Model 4, respectively.

Model 5, which represents the influence of the securities futures market investor sentiment, futures market liquidity, returns and speculative activity t on the spot market investor sentiment, is as follows:

$$\begin{aligned} SIS_t = \gamma_0 + \gamma_1 FIS_t + \gamma_2 AMI_t + \gamma_3 RET_t + \gamma_4 ACT_t + \gamma_5 TURN_t + \gamma_6 PER_t + \gamma_7 CP_t \\ + \gamma_8 SHIBOR_t + \varepsilon_{5t} \end{aligned} \tag{7}$$

3 Empirical Findings

This section employs a VAR model to preliminarily examine whether investor sentiment in securities futures markets influences that in securities spot markets, based on 1,415 data sets from January 1, 2018, to October 31, 2023. If contagion effects are found between the two markets, we will further examine how investor sentiment propagates between securities futures and spot markets, conducting empirical research on whether intermediary variables exert positive or negative effects during this transmission process.

3.1 Establishment of VAR Model

3.1.1 Stationarity Test of Data. Based on the results of the ADF unit root test in Table 2, at the 1% significance level, the FIS, RET, and ACT series are stationary, while the AMI and SIS series are non-stationary. These two sets of data require first-order differencing before conducting further stationarity tests.

Table 2. ADF Unit Root Test.

	ADF test	1%level	5%level	10%level	P value	Stationarity
FIS	-4.726	-3.965	-3.413	-3.129	0.0006	YES
AMI	-3.201	-3.965	-3.413	-3.129	0.0846	NO
RET	-38.726	-3.965	-3.413	-3.128	0.0000	YES
ACT	-12.244	-3.965	-3.413	-3.128	0.0000	YES
SIS	-3.621	-3.965	-3.413	-3.129	0.0284	NO

Table 3. ADF Unit Root Test.

	ADF test	1%level	5%level	10%level	P value	Stationarity
AMI	-20.179	-3.965	-3.413	-3.129	0.0000	YES
SIS	-19.555	-3.965	-3.413	-3.129	0.0000	YES

According to Table 3, after applying first-order differencing to the AMI and SIS variables, both datasets are stationary at the 1% significance level.

3.1.2 Determination of the Optimal Lag Order. When establishing a VAR model, the first step is to determine the optimal lag order. We employ the Final Residual Error (FRE), Akaike Information Criterion (AIC), Schwarz Criterion (SC), and Hankel-Quinn Criterion (HQ) to identify the optimal lag order. As shown in Table 4, the FRE, AIC, SC, and HQ criteria all support lag 4 as the optimal choice. Therefore, we choose to establish a VAR (4) model.

Table 4. Results of Optimal Lag Order Selection for VAR Model.

Lag	FPE	AIC	SC	HQ
0	0.497731	13.49169	13.5103	13.49864
1	0.000526	6.639804	6.75147	6.681531
2	0.000312	6.117604	6.322326	6.194103
3	0.000258	5.928737	6.226515	6.040009
4	0.000235*	5.832550*	6.223384*	5.978596*

Note: Due to space limitations, this table only shows up to the 4th lag.

3.1.3 Estimation Results of VAR Model. According to Table 5, the one-period lagged and two-period lagged securities futures market sentiment (FIS(-1) and FIS(-2)) exert a significant negative impact on the securities spot market sentiment (SIS), while the three-period lagged securities futures market sentiment (FIS(-3)) exerts a significant positive impact on SIS; The two-period lagged stock spot market sentiment (SIS(-2)) exerts a significant negative impact on the futures market sentiment (FIS), while the three-period lagged stock spot market sentiment (SIS(-3)) exerts a significant positive impact on FIS. Therefore, analyzing the VAR model coefficients alone cannot definitively determine the direction of interaction between FIS and SIS; impulse response analysis is required to further examine their mutual relationship.

Regarding the influence of investor sentiment in securities futures markets on the mediating variable, FIS(-1) and FIS(-3) exert a significant positive impact on futures market liquidity (AMI), while FIS(-2) and FIS(-4) demonstrate a significant negative effect on AMI. FIS(-1), FIS(-2), and FIS(-4) exert a significant positive influence on futures market return (RET), while FIS(-3) exhibits a significant negative effect. Thus, overall, investor sentiment in the securities spot market positively impacts futures market returns. FIS(-1) significantly negatively affects futures market speculative activity (ACT), while FIS(-2), FIS(-3), and FIS(-4) have insignificant effects on ACT. Similarly, coefficient analysis via the VAR model cannot clearly determine the direction of investor sentiment's impact on the three mediating variables, necessitating further impulse response analysis.

Regarding the mediating variables' impact on investor sentiment in the spot securities market: AMI(-2) significantly negatively affects SIS, while AMI(-4) significantly positively affects SIS; RET(-4) exhibits a significant positive effect on SIS; while ACT(-2) has a negative effect on SIS and ACT(-3) has a positive effect on SIS. Similarly, impulse response analysis is required to clarify the direction of the mediating variables' effects on investor sentiment in the spot securities market.

Table 5. Parameter Estimation Results of VAR (4) Model.

	SIS	FIS	AMI	RET	ACT		SIS	FIS	AMI	RET	ACT
SIS (-1)	0.548***	0.018	-0.061	0.018	0.060	AMI (-3)	0.016	-0.06***	0.130***	-0.15***	-0.12***
	[18.819]	[0.600]	[-0.946]	[0.180]	[0.642]		[1.153]	[-4.427]	[4.321]	[-3.156]	[-2.770]
SIS (-2)	0.225***	-0.066**	-0.090	0.043	0.245**	AMI (-4)	0.035***	0.028**	0.203***	-0.28***	0.073*
	[6.811]	[-1.996]	[-1.232]	[0.375]	[2.312]		[2.777]	[2.175]	[7.196]	[-6.287]	[1.769]
SIS (-3)	0.126***	0.076**	0.116	-0.140	-0.143	RET (-1)	0.008	0.064***	-0.06***	-0.17***	-0.002
	[3.814]	[2.293]	[1.586]	[-1.229]	[-1.349]		[0.930]	[7.713]	[-2.964]	[-5.855]	[-0.085]

SIS (-4)	0.079***	-0.043	0.012	0.138	-0.047	RET (-2)	-0.006	-0.02***	-0.07***	0.036	0.021
	[2.736]	[-1.478]	[0.189]	[1.373]	[-0.500]		[-0.699]	[-2.968]	[-3.765]	[1.298]	[0.787]
FIS (-1)	-0.049*	1.458***	0.455***	0.664***	-0.204**	RET (-3)	0.010	0.019***	-0.039**	-0.033	-0.012
	[-1.824]	[53.828]	[7.627]	[7.120]	[-2.359]		[1.367]	[2.585]	[-2.409]	[-1.314]	[-0.534]
FIS (-2)	-0.086*	-0.99***	-0.34***	1.296***	0.183	RET (-4)	0.023***	0.004	-0.035**	-0.053**	-0.024
	[-1.843]	[-21.207]	[-3.247]	[8.044]	[1.221]		[3.414]	[0.567]	[-2.375]	[-2.329]	[-1.150]
FIS (-3)	0.154***	0.626***	0.267**	-2.27***	0.107	ACT (-1)	0.006	-0.002	0.048**	0.012	0.469***
	[3.223]	[13.033]	[2.519]	[-13.692]	[0.696]		[0.638]	[-0.170]	[2.359]	[0.371]	[15.953]
FIS (-4)	-0.010	-0.19***	-0.28***	0.496***	0.033	ACT (-2)	-0.03***	0.045***	-0.021	0.223***	0.076**
	[-0.334]	[-6.074]	[-4.055]	[4.645]	[0.330]		[-2.812]	[4.396]	[-0.925]	[6.351]	[2.333]
AMI (-1)	-0.007	0.036***	0.255***	0.116***	0.157***	ACT (-3)	0.026**	-0.04***	-0.014	-0.071**	0.045
	[-0.512]	[2.800]	[9.017]	[2.619]	[3.841]		[2.544]	[-3.999]	[-0.616]	[-1.984]	[1.360]
AMI (-2)	-0.07***	0.051***	0.245***	0.264***	-0.074*	ACT (-4)	0.008	0.032***	0.073***	-0.17***	0.055*
	[-5.154]	[3.750]	[8.205]	[5.650]	[-1.697]		[0.933]	[3.473]	[3.646]	[-5.410]	[1.883]

Note: ***, **, and * indicate significance at the 1%, 5%, and 10% significance levels, respectively. The same applies below.

3.2 Impulse Response Analysis

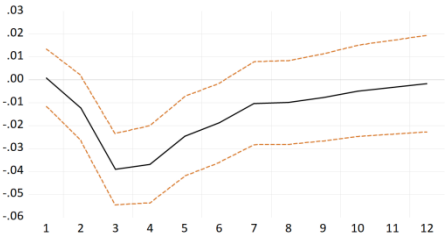


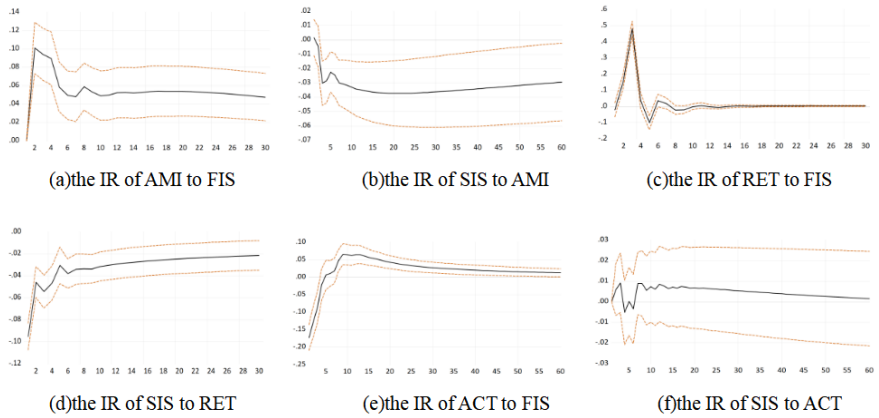
Fig. 1. Impulse Response of SIS to FIS.

According to Figure 1, following a one-unit positive shock to the investor sentiment in the securities futures market (FIS), the investor sentiment in the securities spot market (SIS) exhibits a sharp negative response over periods 0 to 3, peaking in the third period. Subsequently, the negative response of SIS to the shock from FIS gradually diminishes and stabilizes. This indicates that the investor sentiment in the securities futures market (FIS) negatively impacts the investor sentiment in the securities spot market (SIS). Hypothesis 1 is validated.

According to Figure 2(a), if the current period FIS experiences a one-unit shock, futures market liquidity (AMI) exhibits a gradually increasing positive response over periods 0–4. Thereafter, the intensity of the positive response gradually diminishes. This indicates that FIS positively influences AMI. According to Figure 2(b), when the current period AMI experiences a one-unit shock, SIS exhibits a negative response that persists over a prolonged duration. This indicates that AMI negatively affects SIS. Hypothesis 2 is validated. Specifically, investor sentiment in the securities futures markets positively influences futures market liquidity, while increased futures market liquidity dampens investor sentiment in the spot securities market.

According to Figure 2(c), when the securities futures market return (RET) is impacted by FIS, it exhibits a positive response during periods 0-4. The positive response gradually increases from periods 0-3, with a slight decrease observed in period 4.

Periods 4-6 show a relatively weak negative response, after which the impact of the shock on RET gradually approaches zero. Overall, the effect of FIS on RET remains positive. According to Figure 2(d), when SIS is impacted by RET, it exhibits a relatively strong negative response from periods 0 to 6, followed by a gradual stabilization of the negative response. Therefore, RET negatively affects SIS. Combining this with the conclusions drawn earlier, Hypothesis 3 is validated. Specifically, investor sentiment in the securities futures market positively influences futures market returns, but an increase in futures market returns leads to a decline in investor sentiment in the securities spot market.



(a)the IR of AMI to FIS (b)the IR of SIS to AMI (c)the IR of RET to FIS

(d)the IR of SIS to RET (e)the IR of ACT to FIS (f)the IR of SIS to ACT

Fig. 2. Impulse Response Diagram.

As shown in Figure 2(e), after an impact from FIS, the speculative activity in the futures market (ACT) exhibits a negative response during periods 0-5, followed by a continuous positive response. Therefore, overall, ACT has a positive impact on FIS. As shown in Figure 2(f), SIS exhibits a positive response to ACT shocks during periods 0-4. Although a slight negative response appears during periods 5-8, the overall response remains positive. Thus, ACT positively influences SIS. This empirical result contradicts Hypothesis 4: investor sentiment in securities futures markets positively impacts speculative activity in futures markets, and heightened speculative activity in securities futures markets also drives investor sentiment in securities spot markets.

3.3 Variance Decomposition

Table 6. Variance Decomposition of SIS.

Period	SIS	FIS	AMI	RET	ACT
1	99.9987	0.0013	0	0	0
2	99.6835	0.207	0.0417	0.0458	0.022
3	96.7217	1.7598	1.1791	0.0545	0.285
4	95.1955	2.6543	1.8479	0.0646	0.2377
5	94.5697	2.7407	2.0549	0.4294	0.2052

6	94.3676	2.6529	2.2942	0.494	0.1913
7	94.0978	2.4435	2.6778	0.6031	0.1778
8	93.8566	2.2689	3.0184	0.694	0.1621
9	93.6402	2.1053	3.3377	0.768	0.1489
10	93.4009	1.9557	3.6503	0.8548	0.1383
11	93.1464	1.8248	3.9603	0.9392	0.1293
12	92.8953	1.7105	4.2508	1.0217	0.1217

According to Table 6, during the first period, the variance contribution rate of SIS was nearly 100%, indicating that in the initial stage, changes in investor sentiment in the spot market were primarily attributable to its own volatility. Over time, by the twelfth period, the contribution rate declined to 92.895%, suggesting that shifts in investor sentiment were no longer solely determined by its own dynamics but were also influenced by other variables.

FIS's contribution rate in the variance decomposition of SIS initially stood at 0.0013% and showed a gradual upward trend over the first five periods, reaching 2.741% by the fifth period. Although the variance contribution rate declined slightly thereafter, it still demonstrates that FIS possesses a certain explanatory power for SIS, confirming Hypothesis 1.

The variance contribution rate of AMI reached 4.251% in the 12th period, confirming that futures market liquidity significantly impacts SIS, thus supporting Hypothesis 2. Similarly, the variance contribution rate of RET was 1.022% in the 12th period, indicating that futures market returns also possess explanatory power for SIS, suggesting that Hypothesis 3 is likely valid. The variance contribution rate of ACT was 0.285% in the 3rd period, indicating that futures market returns also possess a certain explanatory power for investor sentiment in the securities spot market, albeit smaller than the other two mediating variables. This suggests that Hypothesis 4 is likely valid.

The variance decomposition results reveal that investor sentiment in the securities futures market, futures market liquidity, futures market returns, and futures market speculative activity collectively possess explanatory power for investor sentiment in the securities spot market, constituting key factors influencing it. However, establishing a VAR model only reveals direction of influence among these variables. It is impossible to determine whether the mediating effect played by the selected mediating variables in this paper is a complete mediating effect or a partial mediating effect. Therefore, we conduct research on the mediating effect of the mediating variables in the process where the investor sentiment in the securities futures market affects the investor sentiment in the securities spot market.

3.4 Mediation Effect Test

Table 7. Regression Analysis Results of FIS on SIS and Mediating Variables.

	SIS	SIS	SIS	SIS	SIS	AMI	RET	ACT
FIS	-0.256***	-0.243***	-0.085***	-0.049***	-0.053***	0.726***	0.110***	0.086***
	(-10.53)	(-10.28)	(-2.74)	(-2.80)	(-2.95)	-27.61	-2.88	-2.6

PER	-0.042*	-0.04*	0.741***	0.747***	-0.313***	0.058	0.262**
	(-1.77)	(-1.72)	-32.49	-29.69	(-11.02)	-1.42	-6.67
TURN		-0.261***	0.202***	0.202***	-0.292***	-0.029	0.297***
		(-7.29)	-8.91	-8.95	(-10.79)	(-0.65)	-8.97
CP			-1.239***	-1.243***	0.308***	-0.049	-0.418***
			(-43.80)	(-41.86)	-10.53	(-1.07)	(-9.97)
SHIBOR				-0.013	-0.156***	-0.016	0.062***
				(-0.83)	(-7.54)	(-0.58)	-2.21

Columns (2) to (6) in Table 7 present the regression results of FIS on SIS. To ensure the objectivity and stability of the regression outcomes, we employ a stepwise regression approach. When no other variables are considered, as shown in Column (2), the regression coefficient of FIS on SIS is -0.256. This relationship is statistically significant at the 1% level, indicating a negative correlation between the two variables, consistent with previous research findings. As control variables were progressively added in columns (3) to (6), the FIS coefficient remained negative, confirming that investor sentiment in the securities futures market exerts a negative influence on sentiment in the spot market.

Columns (7) to (9) in Table 7 present the regression results of FIS on the three mediating variables. It can be observed that the regression coefficients of FIS on AMI, RET, and ACT are all positive, indicating that an increase in investor sentiment in the securities futures market leads to an increase in futures market liquidity, futures market returns, and futures market speculative activity.

Table 8. Regression Analysis Results After Adding the Mediating Variable.

	SIS	SIS	SIS	SIS
FIS	-0.052***	-0.046***	-0.050***	-0.042***
	(-2.91)	(-2.57)	(-2.79)	(-2.38)
AMI	-0.046**			-0.046**
	(-2.26)			(-2.26)
RET		-0.066***		-0.069***
		(-3.76)		(-3.99)
ACT			0.087***	0.090***
			(5.15)	(5.40)
PER	0.737***	0.751***	0.719***	0.723
	(26.93)	(30.00)	(28.34)	(28.66)
TURN	0.173***	0.200***	0.162***	0.160
	(7.15)	(9.00)	(6.99)	(6.96)
CP	-1.217***	-1.25***	-1.120***	-1.202
	(-39.03)	(-42.35)	(-39.37)	(-39.89)
SHIBOR	-0.011	-0.014	-0.017	-0.018
	(-0.74)	(-0.90)	(-1.11)	(-1.20)

According to Column (1) in Table 8, after incorporating AMI, the absolute value of the regression coefficient for FIS on SIS is 0.052, which is smaller than the absolute value (0.053) in the basic regression model without the mediating variable. Similarly, after incorporating RET and ACT in columns (2) and (3), the absolute values of the regression coefficients for FIS on SIS are 0.046 and 0.050, respectively, both smaller than the absolute values in the basic regression model without mediating variables. This indicates that the negative impact of FIS on SIS weakens after incorporating mediating variables. This occurs because AMI, RET, and ACT, as mediating variables influencing SIS, partially absorb the impact.

Column (4) in Table 8 presents the results of simultaneously incorporating all three mediating variables into the basic regression analysis. The regression coefficient for FIS on SIS is -0.042, significant at the 1% level. Comparing the absolute value of this coefficient with those from models without mediating variables, or with only AMI, RET, or ACT included, reveals that the absolute value is smallest when all three mediating variables are added. This indicates that when all three mediating variables are considered simultaneously, the influence of securities futures market investor sentiment on securities spot market investor sentiment weakens, while the mediating effect strengthens. The mediating variables exert a partial mediating effect on the relationship between FIS and SIS. Specifically, the impact of FIS on SIS comprises both direct and indirect effects: the direct effect acts upon SIS directly, while the indirect effect is mediated through AMI, RET, and ACT. Specifically, the direct effect of FIS on SIS accounts for $0.042 \div 0.053 = 79.25\%$ of the total effect, while the mediating effect constitutes 20.75%. This result indicates that the direct effect of FIS on SIS is greater than the mediating effect exerted by the mediating variables in the influence process.

4 Conclusion

We employ principal component analysis to construct an indicator representing investor sentiment in the securities futures markets, while utilizing the closed-end fund discount rate to reflect investor sentiment in the securities spot market. Additionally, we select liquidity, yield, and speculative activity in the futures market as mediating variables to explore the mutual influence between investor sentiment in the securities futures markets and that in the securities spot market, along with its underlying mechanisms.

Empirical results indicate that investor sentiment in securities futures markets exerts a negative influence on spot market sentiment. The three selected mediating variables play a partial mediating role in the influence of investor sentiment in the securities futures market on that in the spot market. Moreover, the direct effect of investor sentiment in the securities futures market on that in the spot market is greater than the mediating effect played by the mediating variables in the influencing process.

This paper adopts a novel research perspective to examine the direct impact of investor sentiment in securities futures markets on spot market sentiment. We further analyze how this influence indirectly affects spot market sentiment through three mediating factors: futures market liquidity, futures market returns, and futures market

speculative activity. We hope our research will enrich the field of investor sentiment studies and provide regulators and investors with a fresh perspective. Regulatory authorities can effectively leverage the mutual influence mechanism between investor sentiment in securities futures markets and spot securities markets. During periods of excessive speculation in futures markets, relevant departments can employ public opinion guidance and media outreach to prevent downturns or heightened volatility in spot market sentiment, and promote the securities spot market investor sentiment to develop in an optimistic direction, thereby facilitating positive interaction between the investor sentiment of the two markets and achieving overall balance of market sentiment. Similarly, when securities futures markets overheat, investors should consider whether short-term market fever stems from speculative hype or other irrational behaviors. They should shift some focus to the spot securities market and selectively pursue investment opportunities at opportune moments.

A limitation of this paper is that we employ a single metric—the closed-end fund discount rate—to measure securities spot market investor sentiment. Compared to comprehensive investor sentiment indicators, this approach may affect the precision of sentiment measurement. We plan to address this shortcoming in future research.

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