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Study on Influence of Investor Sentiment on Price Discovery Function of CSI 300

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Abstract: In recent years, as an important tool of macro-control, fiscal policy has played a key role in shaping the dynamic relationship of financial market prices and regulating market operation mechanism. Because of its high information transmission efficiency and flexible trading mechanism, the stock index spot market has become an important platform to study the impact effect of policy. Whether the stock index futures can effectively and stably play its function is the foundation of its establishment in the capital market, which is far more worthy of attention than its own price and yield changes. This paper discusses the investor sentiment of csi 300 stock index futures and spot market prices the influence of the dynamic relationship, focus on fiscal policy issued to the futures market price discovery ability and volatility spillover effect adjustment. Taking the fiscal policy announcement event on September 24, 2024 as the core node, combined with the 5-minute high-frequency data of CSI 300 index and stock index futures, a multidimensional sentiment index reflecting the changes in market sentiment was constructed, and the VAR-VECM model was used to analyze the dynamic changes of price discovery function. The results showed that: (1) fiscal policy issue cause market mood significantly, promote rapid reflect of the futures market to the policy information, and through the information transmission reinforcement on the spot market price guide, the futures market price discovery ability significantly increased. (2) There is a significant difference in the correlation between the market before and after the fiscal policy. After the policy is released, the asymmetry of sentiment is further highlighted. High sentiment accelerates the absorption and diffusion of information in the futures market by increasing trading activity and enhancing liquidity, while low sentiment can reduce volatility and improve price equilibrium.

Keywords: Fiscal policy, Stock index futures, Price discovery, Investor sentiment.

1. Introduction

Since the introduction of CSI 300 stock index futures contract, the first stock index futures contract in China, stock index futures in China have been widely concerned by the academic community. Scholars hold different views on whether stock index futures can stabilize the spot market. Some scholars believe that the listing of stock index futures increases investors' choice of resource allocation and provides investors with more market information, which can effectively reduce the systemic risk of the stock market (Dong Yue and Yang Baochen, 2006 [1]; Antoniou and Garrett, 1998 [2]. Li Jinliang et al., 2018 [3]). However, some other scholars believe that the high leverage of stock index futures will stimulate investors' speculative sentiment, increase market noise, and exacerbate the volatility of the spot market (Zhang Xiaoyan and Shen Zhonghua, 2011) [4].

In a frictionless, rational capital market, the futures market and the spot market should have the same reaction to the new information shock. But because of market friction, different markets react to information at different speeds. When new information enters the capital markets, if one market receives information more quickly, its price changes will be more sensitive than other markets. If there are arbitrage opportunities in more than two markets, market prices will quickly move in the same direction. Therefore, if prices in one market respond to information faster than in another market, then the price discovery ability of this market is better than that of other markets.

In 2010, China's first futures contract CSI 300 stock index futures was officially introduced, and scholars have gradually carried out research on the relationship between CSI 300 stock index futures and spot. Gu Jing and Ye Delei (2013) [5] used the methods of regression cointegration and factor analysis to point out that the CSI 300 index occupies a major position in price discovery. With the gradual improvement of China's financial market, this position will become more prominent (Tao Libin, Pan Wanbin and Huang Yunzhe, 2022) [6]. Fan Teqi and Han Fuling (2014) [7] used VECM model to explore the relationship between price discovery in two markets, and combined with the results of causality test, they found that stock index futures had more advantages in price discovery, and the advantage of futures market in price discovery was long-term. Dai Hongxia and Lin Xiangyou (2012) [8] also found the variability of the price guidance ability of stock index futures, and a large number of scholars searched and studied the factors that could directly or indirectly affect the price discovery function of stock index futures: For example, in addition to the "transaction cost hypothesis", there are market factors, such as the relative activity of the futures market (Tao Libin etal., 2014) [9], volatility (Chakravartyetal., 2009) [10], and the number of open positions of the main contract of stock index futures (Li Jinliang etal., 2012) [11]. The root of macro phenomena in the market is the trading behavior of micro individuals participating in the market, and the influence of investor sentiment is more exogenous than that of market factors. The research of Zheng Zhenlong et al. (2015) [12] supports this view, believing that emotional factors may lead to investors' cognitive bias, which in turn leads to financial valuation bias. For the stock market, according to the studies of Baker&Wurgler (2006) [13], Wang Meijin (2004) [14], Chen Xiaohong et al. (2016) [15], Min Feng et al. (2017) [16], investor sentiment has an impact on the return rate, volatility and turnover of the stock market.

From the existing studies, the impact of investor sentiment

on the price discovery function of futures is mainly reflected in two aspects, one is transaction cost, and the other is from the perspective of information. The existing literature in foreign countries shows that when investor sentiment is high, it does have an impact on the price discovery function of futures, while China has rarely set foot on how investor sentiment dynamically affects the price discovery function of futures market. Considering that there are few research on how investor sentiment affects the price discovery of stock index futures in China, and the special financial market environment in China provides an excellent "natural experiment" opportunity for its research, this paper makes an in-depth study on how investor sentiment affects the price discovery function of stock index futures market in China from the above two perspectives.

2. Research Hypothesis and Design

2.1. Research Hypothesis Equation Section2

When the current price deviates, arbitrageurs among informed traders will choose the futures market with lower transaction cost and better liquidity to trade, so that the futures market can reflect external information and investor opinions more quickly, and the futures price leads the spot price. When investor sentiment is high, there will be more noise trading in the market, and the expectation and behavior of noise traders will be unpredictable, which will create a potential risk that may lead to further separation of asset prices, which is reflected in the weakened price discovery ability of stock index futures, and arbitrage traders will exit the trade in order to avoid the risk. At the same time, when the increase of noise trading driven by high sentiment will increase the volatility of asset prices, hedgers will actively withdraw from the market due to the increase of trading risk, and information traders will further reduce. When investor sentiment decreases, on the one hand, noise traders reduce transactions and improve investor structure; on the other hand, investors' pessimistic attitude is more easily expressed through the convenient short-selling mechanism of futures, making stock index futures show stronger price discovery ability. Therefore, investor sentiment generally has a negative impact on the price discovery ability of the futures market. Therefore, this paper makes hypothesis 1: Before and after the release of fiscal policy, investor sentiment will have an impact on the price discovery ability of stock index futures.

In the context of gradual policy relaxation, on the one hand, the relatively loose trading market environment will attract more investors to trade, including more speculators and traders, and the market volatility will intensify while the trading volume increases (Fang Xianming and Feng Xiangyu, 2021 [17]; Liu Muhan and Xiong Xiong, 2021 [18]), according to the limited trading theory, when volatility increases, informed traders leave the highly leveraged market for risk avoidance, which has a negative effect on the price discovery ability of the stock index futures market. On the other hand, the loose fiscal policy also attracts more investors to carry traders. As information traders, they can make better use of the basic functions of futures. Moreover, attracting more transactions can supplement market liquidity and make price adjustment more sensitive, which is conducive to the play of the price discovery function of stock index futures. Therefore, the change of fiscal policy has a non-negligible impact on the price discovery ability of stock index futures. Fiscal policy is a macro tool used by the government to regulate economic activities by adjusting expenditure or tax levels.

There have been many relevant literature studies that high investor sentiment has a negative impact on the price discovery ability of the futures market. However, high sentiment may not be a single result, under certain market conditions (such as favorable policies or bull markets), high sentiment may stimulate more speculative trading and arbitrage activities, so that the futures market's role in guiding the spot is enhanced, and the price discovery ability is improved.

Therefore, hypothesis 2 is made in this paper: under the background of favorable fiscal policy release, high investor sentiment will instead strengthen the price discovery efficiency of the current market.

2.2. Research Design

2.2.1. Data discussion

This paper introduced sentiment index as the key variable, selected the fiscal policy conference on September 24, 2024 as the event node, and used the 5-minute high-frequency data of the CSI 300 index and CSI 300 stock index futures to analyze the dynamic impact of sentiment fluctuations before and after the release of fiscal policy on price discovery and volatility spillover effect between future markets.

In order to accurately measure the impact of fiscal policy announcements and sentiment fluctuations, this paper constructs two 18-trading day event Windows: Event 1 (August 27 to September 23, 2024) represents the market situation before the policy announcement, with low sentiment level and small volatility; Event 2 (September 24 to October 24, 2024) represents the market reaction after the policy announcement, with a significant increase in sentiment and increased volatility. The research data comes from the Wind database, which contains 5-minute closing prices of the CSI 300 index and CSI 300 stock index futures. In this paper, HS300fp is used to represent the logarithmic price of CSI 300 stock index futures, and HS300p is used to represent the logarithmic price of CSI 300 index and CSI 300 index. In order to ensure the comparability of data, this paper calculates the logarithmic return rate of the closing price of CSI 300 index and stock index futures respectively. HS300Futurechange=100*(fp, t-fp, t-1) and HS300change=100*(sp, t-sp, t-1) represent the yield of the futures market and the spot market, respectively.

As an important indicator to reflect the changes in market expectations, investor sentiment indicators are measured by Baidu Index. This paper takes "CSI 300 index" and "CSI 300 stock index futures" as keywords, climbs the search volume of Baidu index, takes the aggregate search volume as the measure of investor sentiment indicator, and uses the dummy variable Sent to represent investor sentiment.

2.2.2. Model design of the influence of policy events on price discovery of stock index futures

In this paper, a vector error correction model (VECM model) is established to study the contribution of the CSI 300 current market to price discovery in the short term. In addition, this paper introduces investor sentiment into the error correction item to study whether the price discovery ability of the two markets before and after the policy release is influenced by investor sentiment and the magnitude of the effect. In order to verify whether the relationship between stock index period is changed after the occurrence of an emergency, this paper first constructs a bivariate VAR model

using the high-frequency yield data of CSI 300 stock index futures and spot before constructing the VECM model, so as to determine the optimal lag order. This paper takes September 24, 2024 as the time node, divides the samples into two sample periods before and after the policy release, and tests the price discovery function of the two markets before and after the emergency

Let ecmt-1=HS300p, T-1-HS300F, t-1, the model for constructing vector error correction model is mainly as follows:

$$HS300change_t = \theta_1 + \gamma_1 ecm_{s,t-1} + k_1 sent * ecm_{s,t-1} + \sum_{i=1}^{t} \varphi_{1i} HS300Futurechange_{t-i} + \sum_{i=1}^{t} \lambda_{1j} HS300change_{t-j} + \varepsilon_{s,t}$$

$$HS300Futurechange_t = \theta_2 + \gamma_2 ecm_{f,t-1} + k_2 sent * ecm_{f,t-1} + \sum_{i=1}^{t} \varphi_{2i} HS300change_{t-i} + \sum_{j=1}^{t} \lambda_{2j} HS300Futurechange_{t-j} + \varepsilon_{f,t}$$

(γi+k1*sent) *ecmt-1 indicates the short-term dynamic change of the price of the CSI 300 stock index futures and CSI 300 spot market towards the equilibrium price. Gamma-i coefficient indicates the adjustment ability of CSI 300 stock index futures and CSI 300 market to equilibrium price when the market sentiment is in a normal state. The greater gamma-i is, the greater the adjustment amplitude of the market to equilibrium price is. The short-term dynamic price discovery ability of the market is weak, and the market is not prominent in price discovery. ki indicates the impact of investor sentiment on prices in both markets. Gamma i+ki represents the short-term adjustment ability of the CSI 300 stock index futures and CSI 300 market to the equilibrium price, considering the level of investor sentiment.

3. Empirical Analysis

3.1. Descriptive Statistics

This paper makes descriptive statistics on the 5-minute yield of the CSI 300 Index (HS300) and CSI 300 stock index futures (Future) within the event window to capture the volatility characteristics of the market before and after the release of fiscal policy. The results are shown in the following table:

Table 1. Descriptive statistics of behavioral information

	Mean	**Median**	**Min**	**Max**	**Kurtosis**	**Skewness**
HS300 Change	.00009	-.00001	-0.02817	.08902	229.58092	10.0394
Future Change	.0001	0	-0.02173	.07882	119.49686	5.42096
August 27- September 23						
	Mean	Median	Min	Max	Kurtosis	Skewness
HS300 Change	-.00004	-.00008	-0.00582	.00497	7.82679	-.08795
Future Change	-.00004	-.00006	-0.00555	.00514	6.84682	.24782
	Mean	Median	Min	Max	Kurtosis	Skewness
September 23- October 8						
HS300 Change	.00022	.00016	-0.02817	.08902	129.17367	7.63826
Future Change	.00022	.0001	-0.02173	.07882	67.99527	4.125

First, from the overall statistical data, the average return rate of HS300 is 0.00009, and the average return rate of stock index futures is 0.0001, with a low average and close to zero, indicating that the 5-minute return rate of the two markets is generally stable during the event window. The minimum values of HS300 and futures markets are -0.02817 and -0.02173 respectively, and the maximum values are 0.08902 and 0.07882 respectively, indicating that the yields of the two markets are highly volatile in some periods, which may be affected by the expectation and release of fiscal policy. The kurtosis of HS300 is 229.58092 and that of futures is 119.49686, both of which deviate significantly from the normal distribution, indicating the existence of peak characteristics. In addition, the skewness of HS300 and futures market is 10.0394 and 5.42096 respectively, showing an obvious right-skew phenomenon, indicating that most of the yield fluctuations tend to be positive, but the yield fluctuations in a few time periods are significantly negative.

Further, the event window is segmented. In the 18 trading days before the release of the fiscal policy (August 27 - September 23, before September 23), the average yield of HS300 and stock index futures was -0.00004, the average is slightly lower and close to zero, indicating that the market is stable before the release of the policy. The minimum and maximum values of HS300 are -0.00582 and 0.00497, while the minimum and maximum values of the futures market are -0.00555 and 0.00514, respectively, indicating relatively little market volatility before the policy announcement. During the period before September 23, the kurtosis of HS300 and futures market was 7.82679 and 6.84682 respectively, which was significantly lower than the overall sample kurtosis value, indicating that the yield distribution was relatively flat. In terms of skewness, HS300 is slightly skewed to the left (-0.08795), while the futures market is slightly skewed to the right (0.24782), indicating a neutral market sentiment before the policy announcement. In contrast, within 18 trading days after the release of the fiscal policy (September 24 - October 24, after September 23), the average yield on both the HS300 and futures markets rose to 0.00022, and the yield volatility increased significantly. During the period after September 23, the kurtosis of HS300 and futures market was 129.17367 and 67.99527, respectively, and the skewness reached 7.63826 and 4.125, respectively, indicating that the peak of market volatility and positive volatility increased significantly after the policy release, reflecting investors' positive response to the fiscal policy.

3.2. Empirical Analysis of The Influence of Policy Events on Price Discovery of Stock Index Futures

3.2.1. Adf test

In time series analysis, ensuring the stationarity of data is the key to model reliability. This paper uses Augmented Dickey-Fuller (ADF) test to test the return series of CSI 300 index (HS300) and CSI 300 stock index futures (Future). The test results are as follows:

Table 2. ADF inspection result

Variable	Event Period	Observations	Test Statistic	1%CriticalValue	5%CriticalValue	10%CriticalValue	p-value
Future Change	Full Sample	1,805	-30.734	-3.43	-2.86	-2.57	0
HS300 Change	Full Sample	1,805	-33.669	-3.43	-2.86	-2.57	0
HS300 Change	Before September 23rd (Aug27-Sep23, 2024)	862	-19.13	-3.43	-2.86	-2.57	0
Future Change	Before September 23rd (Aug27-Sep23, 2024)	862	-18.453	-3.43	-2.86	-2.57	0
HS300 Change	After September 23rd (Sep24-Oct24, 2024)	943	-24.562	-3.43	-2.86	-2.57	0
Future Change	After September 23rd (Sep24-Oct24, 2024)	943	-22.387	-3.43	-2.86	-2.57	0

In the whole sample period (full sample), the results of ADF test on the return series of stock index futures (the change of stock index futures) and Shanghai and Shenzhen 300 Index (HS300Change) show that the test statistics of the two are -30.734 and -33.669, respectively. All were well below the critical values of 1%, 5%, and 10% significance levels (-3.43, -2.86, and -2.57) with a P-value of 0. This shows that during the overall sample period, the return series of CSI 300 index and stock index futures are significantly stable, which meets the analysis requirements of the subsequent time series model. During event window 1 (August 27 to September 23, 2024), the ADF test statistics of Shanghai and Shenzhen 300 Index (HS300Change) and stock index futures (change of stock index futures) are -19.13 and -18.453, respectively, which are also significantly lower than the critical values of each significance level, and the P-value is 0. It is shown that the two sequences exhibit stationarity during event 1. This result shows that in the period of market stability before the release of fiscal policy, the yield series of CSI 300 index and stock index futures are stable, and there is no obvious trend.

During event window 2 (September 24 to October 24, 2024), the ADF test statistics of CSI 300 index and stock index futures are -24.562 and -22.387, respectively, which are significantly lower than the critical values of 1%, 5% and 10%, and the P-value is 0, indicating that during the market period after the release of fiscal policy, Both sequences continue to remain stable. During Event 2, although the volatility of the market return series increased, the series remained stable. These results provide a reliable stationarity basis for subsequent time series analysis. To sum up, both in the overall sample period and in the two window periods before and after the fiscal policy event, the yield series of CSI 300 index and stock index futures have passed the ADF test, showing a stable series, which provides good data support for the VAR-VECM model. It helps to capture the dynamic changes of price discovery and volatility spillovers in the market before and after fiscal policy events.

3.2.2. Optimal lag order selection

In this study, we select the optimal lag order for the return series of CSI 300 and CSI 300 stock index futures in event window 1 (August 27 to September 23, 2024). Akaike information criterion (AIC), Hannan-Quinn information criterion (HQIC) and Schwarz Bayesian Information Criterion (SBIC) were used to screen the lag order of the model to determine the optimal lag order.

Table 3. Bivariate information estimation results before policy release

Lag-OrderSelectionCriteriafor before September 23rd==1								
Lag	LL	LR	df	p-value	FPE	AIC	HQIC	SBIC
0	10198.9				1.40E-13	-23.9363	-23.9321	-23.9252
1	10228.7	59.68	4	0	1.30E-13	-23.997	-23.9842	-23.9635*
2	10236.7	15.91	4	0.003	1.30E-13	-24.0063*	-23.9849*	-23.9505
3	10237.5	1.76	4	0.779	1.30E-13	-23.9989	-23.9691	-23.9209
4	10240.2	5.29	4	0.259	1.30E-13	-23.9958	-23.9573	-23.8955
5	10242.4	4.51	4	0.341	1.30E-13	-23.9917	-23.9447	-23.8691
6	10246.7	8.49	4	0.075	1.30E-13	-23.9922	-23.9367	-23.8474
7	10248.5	3.57	4	0.468	1.30E-13	-23.987	-23.923	-23.8199
8	10251.8	6.62	4	0.157	1.30E-13	-23.9854	-23.9128	-23.796
9	10256.9	10.15	4	0.038	1.30E-13	-23.9879	-23.9068	-23.7762
10	10256.9	0.12	4	0.998	1.30E-13	-23.9787	-23.889	-23.7446
11	10257.8	1.79	4	0.774	1.30E-13	-23.9714	-23.8732	-23.7151
12	10258.9	2.13	4	0.712	1.30E-13	-23.9645	-23.8578	-23.6859

According to the results of hysteretic order selection, the performance of each hysteretic order under different criteria

is as follows: When the hysteretic order is 2, the values of AIC and HQIC reach the minimum, which are -24.0063 and -23.9849 respectively. The minimum value of SBIC is -23.9635 when the lag order is 1. This shows that order 2 lag is the best choice in terms of AIC and HQIC, while SBIC recommends order 1 lag.

Since AIC and HQIC are usually more sensitive in evaluating the goodness of fit of models and are mostly used for the order determination of VAR models, this paper selects the lag order of 2 as the optimal lag order of event window 1. This choice will be used in the construction of VAR-VECM models to ensure high explanatory power and stability in the analysis of current market relationships under market conditions prior to the release of fiscal policies.

Table 4. Results of bivariate information estimation after policy release

Lag-OrderSelectionCriteriafor before September 23rd==2								
Lag	LL	LR	df	p-value	FPE	AIC	HQIC	SBIC
0	8002.41				1.50E-10	-16.968	-16.9641	-16.9577
1	8030.73	56.65	4	0	1.40E-10	-17.0196	-17.0078	-16.9887
2	8049.59	37.72	4	0	1.30E-10	-17.0511	-17.0315	-16.9997*
3	8062.86	26.54	4	0	1.30E-10	-17.0708	-17.0433*	-16.9988
4	8066.63	7.53	4	0.11	1.30E-10	-17.0703	-17.035	-16.9777
5	8070.8	8.34	4	0.08	1.30E-10	-17.0706	-17.0275	-16.9575
6	8077.57	13.55	4	0.009	1.30E-10	-17.0765	-17.0255	-16.9428
7	8078.96	2.77	4	0.597	1.30E-10	-17.071	-17.0122	-16.9167
8	8083.79	9.67	4	0.046	1.30E-10	-17.0727	-17.0061	-16.8979
9	8088.34	9.11	4	0.058	1.30E-10	-17.0739	-16.9994	-16.8785
10	8091.66	6.62	4	0.157	1.30E-10	-17.0724	-16.9901	-16.8565
11	8097.54	11.77	4	0.019	1.30E-10	-17.0764	-16.9863	-16.8399
12	8106.1	17.12	4	0.002	1.30E-10	-17.0861*	-16.9881*	-16.829

During event window 2 (September 24 to October 24, 2024), lag orders were selected using Akaike Information Criteria (AIC), Hannan-Quinn Information Criteria (HQIC), and Schwarz Bayesian Information Criteria (SBIC) to determine the optimal lag order after fiscal policy issuance. The results of lag order selection show that AIC and HQIC reach the minimum value when the lag is 12 orders, which are -17.0861 and -16.9881 respectively. In addition, the SBIC reaches a minimum value of -16.9997 with a lag of 2 orders. Although SBIC tends to choose order 2 lag, AIC and HQIC recommend order 12 lag as the optimal lag. Considering the common use and sensitivity of AIC and HQIC in VAR models, and the model needs to capture the complexity of market volatility spillover after the release of fiscal policies, this paper finally selected the 12-order lag as the optimal lag order of event window 2.

3.2.3. Granger causality

Because choose different lag order the results of the model may be different, so, in this paper, with reference to establish the VAR model to determine the optimal lag of csi 300 stock index futures market and the index of yield for ranger causality test. The results of bivariate Granger causality test are shown in the table:

Table 5. Results of bivariate information estimation after policy release

Equation	Excluded Variable(s)	Chi-squared	df	Prob	Time Period
HS300 Change	Future Change	19.474	2	0	Period1
HS300 Change	ALL	19.474	2	0	Period1
Future Change	HS300 Change	3.5859	2	0.166	Period1
Future Change	ALL	3.5859	2	0.166	Period1
HS300 Change	Future Change	29.54	12	0.003	Period2
HS300 Change	ALL	29.54	12	0.003	Period2
Future Change	HS300 Change	8.4183	12	0.752	Period2
Future Change	ALL	8.4183	12	0.752	Period2

In event window 1 (August 27 to September 23, 2024, before the release of fiscal policy), when the change of HS300 index (HS300Change) is set as the explained variable, the Chi-square statistic of the change of stock index futures (the change of stock index futures) as the explanatory variable is 19.474, the degree of freedom is 2, and the P-value is 0. The significant passing of the test indicates that there is a significant Granger causality between the futures market and the spot market before the release of fiscal policy. In addition, when the overall model including ALL variables is tested (ALL), the results remain significant, indicating that changes in the futures market have a guiding effect on price discovery in the spot market before the release of fiscal policy. However, when the change of stock index futures is tested as the explained variable and HS300Change as the explanatory variable, the chi-square statistic is 3.5859, the degree of freedom is 2, and the P-value is 0.166, which fails the significance test, indicating that the guiding relationship between the spot market and the futures market before the release of fiscal policy is not significant.

In event window 2 (September 24 to October 24, 2024, after the release of the fiscal policy), when the change of HS300 index is the explained variable, the chi-square statistic of the change of stock index futures is 29.54, the degree of

freedom is 12, and the P-value is 0.003, which significantly passes the test, indicating that during the market period after the release of the policy, The futures market plays a more significant role in guiding the price of the spot market. At the same time, the overall model (ALL) test results also show that the Granger causality between futures and spot exists significantly. Comparatively speaking, when the change of stock index futures is the explained variable, the Chi-square statistic of the change of HS300 index is 8.4183, the degree of freedom is 12, and the P-value is 0.752, which fails the significance test.

3.2.4. Construct the VAR-VECM model

During event window 1 (August 27 to September 23, 2024), we construct a vector error correction model (VECM) to explore the price discovery and interaction between the CSI 300 Index (HS300Change) and CSI 300 stock index futures (FutureChange) before the fiscal policy announcement. The model results are as follows:

Table 6. Main results of vector error correction model before policy release

	(1)	(2)	(3)	(4)
VARIABLES	HS300Change	Future Change	HS300Change	Future Change
L.HS300 Change	-0.248***	0.233***	-0.253***	0.246***
	(0.034)	(0.036)	(0.034)	(0.037)
L2.HS300 Change	-0.061*	0.017	-0.065*	0.046
	(0.034)	(0.011)	(0.034)	(0.037)
Future Change	0.882***		0.881***	
	(0.009)		(0.010)	
L.Future Change	0.229***	-0.213***	0.234***	-0.225***
	(0.032)	(0.033)	(0.032)	(0.035)
L2.Future Change	0.051		0.055*	-0.030
	(0.032)		(0.032)	(0.034)
L.ecm	-0.001***	0.001***		
	(0.000)	(0.000)		
HS300 Change		1.031***		1.032***
		(0.011)		(0.011)
L.send_ecm			-0.017***	0.019***
			(0.005)	(0.005)
Constant	-0.000	0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Observations	862	862	862	862
R-squared	0.912	0.911	0.912	0.911

Note: *, **, *** means significant at 10%, 5%, 1% level, the same below

During event window 1, fiscal policy has not yet been released and market sentiment remains low. The analysis of VECM model shows that the CSI 300 index has a significant negative impact on its own lag term, and the coefficient of the first lag term is -0.248, indicating that the spot market has a certain self-inhibition effect in the short term. At the same time, the lag term of stock index futures has a significantly positive impact on the change of the spot market, with a lag coefficient of 0.229, which indicates that the futures market has a strong guiding role in the price discovery of the spot market before the release of fiscal policy. The error correction term (send_ecm) of the sentiment variable has a significant negative effect on the spot market with a coefficient of -0.017. This shows that even if the level of sentiment is low before the policy is released, the fluctuation of sentiment has had a certain adjustment effect on the correlation of the current market. When sentiment rises, price transmission between markets may be more sensitive, further strengthening the short-term guiding role of the futures market on the spot market.

In event window 1, the price discovery function of the futures market is significant, and investor sentiment amplifies the short-term influence of the futures market to a certain extent by adjusting the linkage between markets. This provides an important clue for understanding the potential role of sentiment index in price discovery during market stability.

During event window 2 (September 24 to October 24, 2024), a vector error correction model (VECM) is constructed to explore the interaction and price discovery relationship between the CSI 300 index (HS300Change) and CSI 300 stock index futures (Futurre Change) after the fiscal policy announcement. The model results are as follows:

After the release of the fiscal policy, market sentiment increased significantly, and investors' expected response to the policy led to significant changes in the dynamic relationship of the current market. The results of VECM model show that the negative impact of CSI 300 index on its own lag term is still significant, and the coefficient is slightly reduced to -0.212, indicating that the self-inhibition effect of spot market is weakened. At the same time, the positive influence of the lag term of stock index futures on the change of the spot market was further enhanced, and the lag coefficient of one period rose to 0.244, reflecting that the guiding role of the futures market on the price discovery of the spot market was significantly improved after the policy was issued.

Table 7. Main results of vector error correction model before policy release

	(1)	(2)	(3)	(4)
VARIABLES	HS300Change	Future Change	HS300Change	Future Change
L.HS300 Change	-0.212***	0.168***	-0.226***	0.194***
	(0.032)	(0.032)	(0.034)	(0.035)
L2.HS300 Change	-0.150***	0.062***	-0.165***	0.128***
	(0.032)	(0.015)	(0.033)	(0.034)
Future Change	0.865***		0.869***	
	(0.015)		(0.015)	
L.Future Change	0.220***	-0.187***	0.244***	-0.217***
	(0.032)	(0.032)	(0.034)	(0.035)
L2.Future Change	0.080**		0.098***	-0.075**
	(0.032)		(0.034)	(0.034)
L.ecm	-0.001***	0.001***		
	(0.000)	(0.000)		
HS300 Change		0.910***		0.905***
		(0.015)		(0.016)
L.send_ecm			-0.003**	0.002
			(0.001)	(0.001)
Constant	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Observations	942	942	864	864
R-squared	0.801	0.790	0.795	0.788

In addition, the error correction term of the sentiment variable (send_ecm) has a more significant negative effect in the spot market, with a coefficient of -0.003. This indicates that with the increase of emotion level, the adjustment effect of emotion fluctuation on the linkage of future market price is more prominent. The upsurge in sentiment not only intensified the short-term linkage of the futures market, but also further consolidated the dominant position of the futures market in price discovery by enhancing the price transmission effect. From the perspective of dynamic changes, the rise in market sentiment caused by the release of fiscal policy has promoted the short-term price discovery function of the futures market. The significant regulating effect of sentiment index strengthens the volatility transmission of futures market to spot market, making the contribution of futures market to price discovery more prominent under high sentiment level.

4. Robustness Test

Robustness test is an important step to verify the reliability and consistency of the results in empirical research. Robustness tests can test whether the model results are sensitive to changes in a particular method, variable selection, or hypothesis, thus ensuring the robustness of the research conclusions. In this study, the robustness test was conducted by constructing a differential (DiD) model and taking policy release as a quasi-natural experiment to analyze the dynamic relationship between the CSI 300 index and the stock index futures market before and after the policy implementation, as well as the moderating effect of sentiment variables. By reestimating the model and analyzing the significance and direction of error correction, policy release variables, and sentiment variables, this study further verified the validity of the conclusions of the original model. The results of robustness test not only improve the scientificity and credibility of the research, but also provide a more comprehensive perspective for the understanding of market mechanism in the context of policy implementation.

The robustness test results show that the error correction term (L.CM) has significant effects on both the CSI 300 Index (HS300Change) and CSI 300 stock index futures (Futurre Change), where the adjustment coefficient of the spot market is -0.001, while that of the futures market is 0.001. All of them were significant at 1% significance level. This shows that in both the spot and futures markets, when the price deviates from the long-run equilibrium, there is a significant adjustment mechanism to bring it back to equilibrium.

In addition, the dynamic impact of post-policy error correction (ECM_Post) on the market is also significant. The coefficient of the spot market is -0.001, and the coefficient of the futures market is -0.001, which further indicates that the implementation of the policy has changed the short-term adjustment mode of the market price to a certain extent. At the same time, the moderating effect of sentiment variable (Sent_Post) after policy release has no significant negative effect on the futures market but combined with the analysis of error correction term and sentiment interaction term (Sent_ECM_Post), the moderating effect of interaction term is significant in the spot market and futures market, with coefficients of -0.002 and 0.002, respectively. All were significant at 1% level. This indicates that the sentiment fluctuations after the implementation of the policy significantly enhanced the linkage between the spot and futures markets, and further amplified the leading role of the futures market in short-term price discovery by strengthening the price transmission mechanism.

Table 8. DCC-GARCH estimated result table

	(1)	(2)	(3)	(4)
VARIABLES	HS300Change	Future Change	HS300Change	Future Change
L.ecm	-0.001***	0.001***	-0.001****	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
ECM_Post	-0.001***	-0.000***	0.002***	-0.002***
	(0.000)	(0.000)	(0.000)	(0.000)
Sent_Post			0.001	-0.001
			(0.000)	(0.000)
Sent_ECM_Post			-0.002***	0.002***
			(0.000)	(0.000)
L.HS300 Change	-0.213***	0.187***	-0.219***	0.192***
	(0.023)	(0.024)	(0.023)	(0.024)
L2.HS300 Change	-0.148***	0.118***	-0.152***	0.121***
	(0.023)	(0.024)	(0.023)	(0.024)
Future Change	0.867***		0.867***	
	(0.010)		(0.010)	
L.Future Change	0.221***	-0.202***	0.226***	-0.206***
	(0.023)	(0.024)	(0.023)	(0.024)
L2.Future Change	0.081***	-0.063***	0.084***	-0.066***
	(0.023)	(0.024)	(0.023)	(0.024)
HS300 Change		0.917***		0.919***
		(0.011)		(0.011)
Constant	0.000	0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Observations	1,805	1,805	1,805	1,805
R-squared	0.806	0.797	0.808	0.799

5. Conclusion

This study takes the CSI 300 stock index spot market as the research object, focuses on the key event of fiscal policy release, and especially emphasizes the moderating role of investor sentiment. By constructing a VAR-VECM model and combining descriptive statistics, ADF stationarity test, cointegration test, lag order selection and Granger causality test, this paper systematically analyzes the dynamic relationship between the current market before and after the release of fiscal policies. The main conclusions are as follows:

Fiscal policy has significantly strengthened the price discovery function of the futures market. The results show that after the release of fiscal policy, the core role of futures market in price discovery has been significantly improved. The results of the VAR-VECM model show that the price guidance effect of the futures market on the spot market increases significantly after the policy, indicating that fiscal policy events have a strengthening effect on the price discovery function of the futures market. In contrast, price discovery in the spot market is less effective. This result confirms that high mood may not be a single result. Under certain market conditions (such as favorable policies or bull markets), high sentiment may stimulate more speculative trading and arbitrage activities, making the futures market more effective in guiding the spot and improving the price discovery ability. The sensitivity of futures market to absorbing and reflecting new information under policy impact provides empirical support for it to become the core platform of price discovery.

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