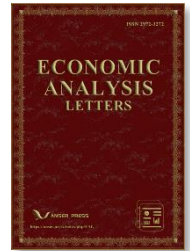




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Aggregate Investor Sentiment and Time-Varying Price Discovery: Evidence from the Options Market

Yaping Zhou ^a, Dayong Lv ^{b, *}

^a Antai College of Economics and Management, Shanghai Jiao Tong University, Shanghai, China

^b School of Financial Technology, Shanghai Lixin University of Accounting and Finance, Shanghai, China

ABSTRACT

Previous literature shows that the price-discovery ability of options market varies substantially over time. Using data of Shanghai Stock Exchange 50 exchange-traded fund options, this paper shows that options prices contribute relatively less to price discovery during low-sentiment periods, but the price-discovery ability of options market remains unchanged during high-sentiment periods. These results suggest that change in aggregate investor sentiment is an important source of the time variation in options' price discovery ability. Moreover, the options market experiences greater bid-ask spreads when investor sentiment is lower, supporting a "transaction costs mechanism." This paper fulfills related literature on the time variation in options' price-discovery ability.

KEYWORDS

Aggregate investor sentiment; price discovery; options market; China

* Corresponding author: Dayong Lv
E-mail address: dylv@lixin.edu.cn

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1. Introduction

Much literature (Muravyev et al., 2013; Patel et al., 2020) studies the price-discovery ability of options market but does not reach a consensus. Holowczak et al. (2006) and Patel et al. (2020) even show that the price-discovery shares of options market vary substantially over time. However, little work has been done to investigate factors related to the time variation in options' price-discovery ability. Being aware that investor sentiment affects traders' behaviors, noise trader risk, and transaction costs (Chordia et al., 2008; Stambaugh et al., 2012), we hypothesize that aggregate investor sentiment may have an important impact on the role of options market in the price-discovery process.

Using data of Shanghai Stock Exchange 50 exchange-traded fund options (SSE 50ETF options), this paper conducts a vector error correction model (VECM) and shows that aggregate investor sentiment significantly affects the price-discovery ability of options market. Specifically, the options market contributes less to price discovery during low-sentiment periods, while the leading role of options market in price discovery is rarely affected during high-sentiment periods. Regression results based on information leadership share also show a similar pattern. Thus, change in aggregate investor sentiment is an important source of the time variation in options' price-discovery ability. Moreover, options' bid-ask spread is much greater during low-sentiment periods and remains unchanged when investor sentiment is high, supporting a "transaction costs mechanism."

This paper extends related literature on the role of options market in the price-discovery process by showing that change in investor sentiment contributes to the time variation in options' price-discovery ability. Moreover, this study also has policy implications regarding price efficiency. According to our main findings, regulatory authorities should take action to boost investor sentiment when aggregate investor sentiment is low, to improve price efficiency.

2. Data and Methodology

We retrieve trade and quote records of SSE 50ETF options and underlying 50ETF from WIND and Tinysoft.NET, with a sample period spanning from September 1, 2015, to June 30, 2019. We compute one-minute returns for both options and ETF. Specifically, options return (r_{OP}) is calculated as the change in the natural logarithm of option-implied prices, estimated based on the put-call parity relation using one-minute closing prices of nearby put- and call-options contracts.¹ In addition, ETF return (r_{ETF}) is computed as the change in the natural logarithm of one-minute prices of SSE 50ETF.

We also calculate the Chinese Sentiment Index (SI) based on Zhu and Niu (2016). Following Lin et al. (2018), we then generate two investor-sentiment dummies, including: (1) low investor-sentiment dummy ($LowSI$), which equals one if SI is below the 25th percentile of its distribution and 0 otherwise; and (2) high investor-sentiment dummy ($HighSI$), which equals one if SI is above the 75th percentile of its distribution and 0 otherwise.

Based on the above variables, we follow Lin et al. (2018) and conduct the following VECM to examine the effect of aggregate investor sentiment on the role of options market in the price-discovery process:

$$R_t = \sum_{i=1}^k (A_{1i} + A_{2i} \times SI) \times R_{t-i} + \gamma \times (z_{t-1} - \mu) + \varepsilon_t \quad (1)$$

where R_t is a 2×1 vector of $r_{OP,t}$ and $r_{ETF,t}$; A_{1i} and A_{2i} are two 2×2 matrices of coefficients on i th-order lagged R ; $(z_{t-1} - \mu)$ is a 2×1 vector of error correction terms; γ is a 2×2 vector of coefficients on the error correction terms. In this specification, a significant coefficient on $SI \times r_{OP}$ for the regression using r_{ETF} as dependent variable would suggest that aggregate investor sentiment affects the price-discovery ability of options.

¹ The nearby options contracts are the most actively traded contracts and are more attractive for informed traders to arbitrage (Lin et al., 2018).

Moreover, we also follow Yan and Zivot (2010) and Putniņš (2013) and compute the information leadership share of the options market (ILS_{OP}) based on daily information share and component share.² Then, we conduct the following daily regression to investigate the effect of aggregate investor sentiment on the information leadership share of options market:

$$ILS_{OP,d} = \beta_0 + \beta_1 \times SI_d + \gamma \times \sum Controls + \varepsilon_d \quad (2)$$

where SI is the investor-sentiment dummy. We incorporate some control variables, including: (1) realized volatility of ETF (RV_{d-1}), computed as the square root of the sum of minutely squared returns within day $d-1$; (2) bid-ask spread of options ($Spread_{d-1}$), defined as the daily average of the differences between quoted ask and bid prices divided by the midpoint of bid-ask quotes, multiplied by 1,000; and (3) first-order lagged ILS_{OP} ($ILS_{OP,d-1}$). A significant β_1 in Model (2) would also suggest that aggregate investor sentiment affects options' price-discovery ability.

Summary statistics for variables of interest are reported in Table 1.

Table 1. Summary statistics.

	Mean	Median	Std. Dev.	Skewness	Kurtosis
SI (monthly)	0.0000	-0.0287	1.0000	-0.3463	2.4737
r_{ETF} (%)	0.0001	0.0000	0.0800	-1.2626	139.8278
r_{OP} (%)	0.0002	0.0000	0.0775	0.1622	201.3882
RV_{ETF} (%)	1.1009	0.9777	0.5285	2.0290	10.0517
$Spread_{OP}$	0.0094	0.0061	0.0138	11.5661	210.7941
ILS_{OP}	0.5929	0.6580	0.3336	-0.4279	1.7926

Note: SI is the standardized monthly aggregate investor sentiment; r_{OP} and r_{ETF} are one-minute options and ETF returns, respectively. RV is ETF' daily realized volatility. $Spread$ is the daily average of options' quoted spread. ILS_{OP} is daily information leadership shares of options.

3. Empirical Results

To address the interference of outliers, we winsorize all continuous variables at the 1st and 99th percentiles. We first run a VECM regression to identify the price-discovery ability of options market and report regression results in Column 1 of Table 2. The coefficient on $r_{OP,t-1}$ is statistically significantly positive, indicating that options return is positively associated with future return of underlying 50ETF. This result suggests a leading role of options market in the price-discovery process, i.e., options' price-discovery ability.

We then perform VECM regressions with the interaction term between investor-sentiment dummy and $r_{OP,t-1}$ to investigate the effect of investor sentiment on options' price-discovery ability. As shown in Columns 2 and 3 of Table 2, the coefficient on $r_{OP,t-1} \times LowIS_t$ is significantly negative at the 5% significance level, suggesting that the leading role of options market in the price-discovery process is attenuated when aggregate investor sentiment is low. In addition, the coefficient on $r_{OP,t-1} \times HighIS_t$ is insignificant, implying that the price-discovery ability of options market remains unchanged during high-sentiment periods. Thus, aggregate investor sentiment serves as an important source of the time variation in options' price-discovery ability.

We further compute information leadership share of options market (ILS_{OP}) and estimate Model (2). As shown in Table 3, the coefficient on $LowIS$ is significantly negative, while that on $HighIS$ is insignificant, indicating that the information leadership share of options market is smaller when investor sentiment is low but remains unchanged when investor sentiment is high. These results strongly support our main findings.

² See Hasbrouck (1995), Gonzalo and Granger (1995), Yan and Zivot (2010) and Putniņš (2013).

Table 2. Results of VECM estimation.

	(1) $r_{ETF,t}$	(2) $r_{ETF,t}$	(3) $r_{ETF,t}$
$r_{OP,t-1}$	0.589*** (131.99)	0.634*** (38.57)	0.593*** (27.30)
$r_{OP,t-1} \times LowIS_t$		-0.095** (-2.23)	
$r_{OP,t-1} \times HighIS_t$			0.008 (0.23)
Adj. R ²	0.080	0.081	0.080
N	212,551	212,551	212,551

Note: *LowSI* (*HighSI*) is the low (high) investor-sentiment dummy. VECMs are estimated in a VAR (15) framework. To save space, we suppress estimation results of VECMs, presenting only the coefficients on the first-order lagged options returns for regressions using r_{ETF} as dependent variable. t statistic is reported in parentheses. “*”, “**”, and “***” represent significance at the 10%, 5%, and 1% levels, respectively.

Table 3. Regression results of information leadership shares on investor sentiment.

	(1) ILS_d	(2) ILS_d
$LowIS_d$	-0.0716** (-2.32)	
$HighIS_d$		-0.0196 (-0.63)
$Spread_{d-1}$	1.1259** (2.07)	1.0555* (1.94)
RV_{d-1}	5.5816** (2.12)	2.7467 (1.06)
ILS_{d-1}	0.0029 (0.08)	0.0131 (0.34)
Intercept	0.5385*** (14.63)	0.5522*** (13.77)
Adj. R ²	0.0069	0.0002
N	707	707

Note: *LowIS* (*HighIS*) is the low (high) investor-sentiment dummy. RV is the realized volatility of ETF. $Spread$ is the daily average of quoted spread of options. t statistics are reported in parentheses. “*”, “**”, and “***” represent significance at the 10%, 5%, and 1% levels, respectively.

4. Additional analysis

According to Chordia et al. (2008), lower investor sentiment may make investors unwilling to trade and lead to increased transaction costs, which would deter informed arbitrageurs from betting against mispricing and thus hinder the price-discovery process of options market (“transaction costs mechanism”).

To test this hypothesis, we regress options’ bid-ask spread on investor-sentiment dummy and present estimation results in Table 4. The coefficient on *LowIS* is significantly positive, suggesting that lower investor sentiment leads to higher transaction costs. In addition, the coefficient on *HighIS* is insignificant, indicating that the transaction cost does not change significantly during high investor-sentiment periods. Thus, the “transaction costs mechanism” can help explain our main findings, as informed traders would be less willing to arbitrage when transaction cost is high.

Table 4. Investor sentiment and transaction costs.

	(1) <i>Spread_d</i>	(2) <i>Spread_d</i>
<i>LowIS_d</i>	2.9670*** (3.85)	
<i>HighIS_d</i>		0.1439 (0.23)
<i>RV_{d-1}</i>	-67.6773 (-1.11)	27.6556 (0.42)
<i>Spread_{d-1}</i>	85.5755 (1.63)	89.4202 (1.57)
Intercept	7.7633*** (8.93)	7.3505*** (6.89)
Adj. <i>R</i> ²	0.0481	0.0256
N	707	707

Note: *Spread* is the daily average of quoted spread, multiplied by 1,000. *LowIS* (*HighIS*) is the low (high) investor-sentiment dummy. *RV* is the realized volatility. *t* statistics in parentheses. “*”, “**”, and “***” represent significance at the 10%, 5%, and 1% levels, respectively.

5. Conclusion

Based on the SSE 50ETF options in China, this paper investigates the effect of aggregate investor sentiment on the price-discovery ability of the options market. Baseline results show that options returns are positively associated with future returns of underlying 50ETF, suggesting a leading role of options market in the price-discovery process. Moreover, options market contributes less to price discovery during low-sentiment periods, while the leading role of options returns is unaffected during high-sentiment periods. Thus, change in aggregate investor sentiment is an important source of the time variation in options’ price-discovery ability. Furthermore, we find that lower aggregate investor sentiment is associated with higher transaction costs, suggesting that the “transaction costs mechanism” can help explain our main findings.

Our studies show that increased trading costs during low investment sentiment periods discourage informed traders from leveraging their information advantages on the options market, which may lead to greater pricing errors in the underlying assets. Therefore, investors should pay more attention to market sentiment and adjust their trading decisions dynamically. Our findings also have important policy implications. To improve the options market, the regulatory authorities could incorporate investor sentiment into the regulatory indicators and take more actions to guide individual investors to build up correct investment ideas and rationally participate in investment transactions.

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Conflict of interest

All the authors claim that the manuscript is completely original. The authors also declare no conflict of interest.

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