

Determinants of Put-call Disparity: A Review

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Abstract

The Korean Stock Exchange (KRX) is among the most rapidly growing markets in the world, and the Korean KOSPI 200 stock index option is among the most traded options contract. Not surprisingly, the KRX and related derivatives products have been attracting significant interest from investors and researchers alike. The KRX offers an excellent opportunity to examine the effects of individual investors. Most of the trading on the KRX is done by individuals as opposed to institutions. This paper examines behavioral tendencies of traders of the KOSPI 200 option contract. Findings show the KOSPI 200 index options contract is often mispriced and that the mispricing occurs most often after extreme downturns in the KRX. Traders exhibit cognitive recency biases, strong preferences for skewness, and often overreact to changes in the KRX spot market.

Keywords: Cognitive bias • Options • Arbitrage

Introduction

Derivatives trading have soared in recent years. According to the World Federation of Exchanges Derivatives Report, record volumes of equity derivatives were traded in 2019 – rising 17 percent year over year. Most notably, stock index options rocketed 42 percent. Most of the increase was driven by Asia and Pacific exchanges, including India, South Korea, Taiwan, and Hong Kong in the top ten. For stock index option trading, the Korea Exchange ranks second by notional value in the world, after the CBOE.1 Trading volume in the Korean KOSPI 200 stock index option market totalled 638 million contracts, making KOSPI 200 stock index options among the most actively traded option contracts in the world. For comparison, 319 million S&P500 stock index option contracts traded in 2019, with a total U.S. dollar notional value 74 percent as large as the KOSPI 200 stock index option contract.

World Federation of Exchanges IOMA Derivatives Report 2020

The Korean Stock Exchange (KRX) has been one of the fastest growing markets in the world, was recently ranked as the 15th largest in the world with a market capitalization of about USD 2.5 trillion and has been identified as a major growth market for the future. The unprecedented growth has attracted the attention of investors and researchers alike. Researchers have been particularly interested in the behavior of investors in the KRX, with keen interest in derivatives trading behavior. For example, Chen and Tang find that investors in Korean stocks generally use derivatives to speculate, but turn to hedging during periods of high market volatility such as during political elections. In a similar study, Lee and Ryu find the KOSPI 200 stock index leads the implied volatility index during normal market periods, but the relationship reverses during periods when implied market volatility is extreme. The authors also find evidence of investor overreaction within their implied [1-3].

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Volatility results Kim SH and Kang HG [4] use implied volatility and the ratio of put-call volumes among other variables to create an index of Korean investors' sentiment index. Their sentiment index does well in predicting future returns, and leads to significant profits earned by simple investment style tactical asset allocation strategies. The Korean economy is considered a leading emerging market, offering rich data for studies of the theory of efficient markets and of practical implications of departures from market efficiency. The KRX offers a fertile testing ground for the trading behaviour of domestic individual investors because a significant percentage of trading is done by individuals rather than institutions [4-6]. Information shocks are rapidly reflected in KOSPI 200 option prices and offer a glimpse into the opinions and preferences of option traders. As pointed out by Ryu corporate treasurers and regulators question the quality of information offered by KOSPI 200 options prices and volume, asserting individual investors is often uninformed and swayed by sentiment and behavioural biases [7].

In the paper under review here, Kim S, et al. [8] identifies unique trading preferences implied by KOSPI 200 data measured over the 14 year period spanning 2004 – 2017. This paper offers an interesting take on options trading. Most research on derivatives is conducted on developed markets, particularly U.S. markets. By examining the KOSPI contracts, this paper is able to identify differences against earlier research findings and offers especially relevant insight into the behavioural tendencies of individual investors.

Behavioral Tendencies of Investors and Violations of Option Pricing Model Assumptions

Emotions that characterize everyday lives of humans often cross over into decisions made by investors and corporate managers. These behavioural biases can have significant effects on asset prices. In the absence of behavioural biases, prices - on average - equal intrinsic values, expected returns are driven solely by risk, and investors should focus mainly on portfolio diversification [9]. investors are "normal" not "rational" in a modern portfolio theory mean-variance efficient sense, and investors create and manage portfolios according to behavioural finance theory rather according to modern portfolio theory. Three behavioural biases are especially relevant for the paper recency bias, overreaction, and skewness preference. Recency bias plagues investors who overweight recent events at the expense of less recent events. Recency bias causes investors to ignore contrasting information during bull and bear markets, driving prices too high during bull markets and too low during bear markets. Overreaction refers to the tendency of investors to overreact to news, driving prices of winners too high and losers too low. Investors also exhibit preference for positive skewness. Skewness preference is more consistent

with Kahneman and Tversky's prospect theory in which investors place greater value on avoiding losses than on realizing gains ("loss aversion" bias). In their behavioral model, Barberis and Huang cumulative prospect theory to show how positively skewed assets become overpriced and earn inferior subsequent returns [10-13].

Discussion

The Kim et al. paper holds special relevance, particularly in light of the importance of information revealed in option prices. Traditional option pricing models rely on a restrictive set of efficient market assumptions. In practice, many traditional assumptions are violated. Therefore, it should be little surprise that option prices often deviate from theoretical model predictions. For example, in theory, option pricing model implied volatility should be identical across option exercise prices. However, in practice, implied volatility rises as options move deeper in-the-money or deeper out-of-the-money. Explanations for the violations of the predictions of option pricing models are voluminous, and often are driven by behavioral biases such as "crash-o-phobia", overestimation of probabilities of downside risk and the violation of the law of one price [14-16].

In perfect capital markets, option prices should offer no information about stock returns. However, in imperfect capital markets, the options market likely attracts informed traders [17,18]. Option trading is not redundant under the assumption that information is asymmetric. If the options market is found to be more attractive (perhaps due to higher leverage possibilities, lower trading costs, or short sale constraints on the underlying asset), informed traders would buy and sell options rather than the underlying stocks themselves. Therefore, option prices should reveal information relevant to the pricing of the underlying equities, especially in markets dominated by informed traders. Further, by providing a mechanism to circumvent short-selling constraints, options can contribute to the transactional and informational efficiency of the stock market.

The price discovery implications of option trades are significant. Price discovery offers insight into the roles of various investment instruments competing for order flow, and of how information is captured and revealed in the prices of each instrument. In theory, informed investors should trade in both stocks and options, implying both instruments contribute to the price formation process [19]. Break the logjam, finding actively traded options on large U.S. stocks reflect new information before stock prices about 25 percent of the time. They also find that the role of options in price discovery increases during periods of corporate announcements and in work closely related to the current paper [20]. Examine options on the Shanghai Stock Exchange (SSE) 50 ETF options. Using methodology (information leadership shares developed by Yan and Zivot [21,22], the authors find the options market dominates the price discovery process, contributing 67% to price discovery on the SSE. Also find that the contribution of options to the price discovery process increases over time after investors gain more confidence in the option market and after key events in the Chinese stock market.

Against this backdrop, Kim S, et al. [8] study the behavior of KOSPI 200 stock index option prices with special focus on behavioral tendencies of Korean option traders. The authors examine data spanning 14 years from 2004 – 2017. KOSPI 200 options are European options on the KOSPI 200 stock index – the benchmark stock market index for Korean equities – an index of 200 of the largest stocks trading on the KRX, making up over 90% of the total market value of the KRX. KOSPI 200 stock index options offer a great opportunity to examine inefficiencies and mispricing in the options market. Tests of option mispricing rely heavily on liquidity of the options being tested, and, KOSPI 200 stock index options are among the most heavily traded in the world.

The article offers rare insights into option prices when trading is not dominated by institutions. The authors begin by examining predictions of traditional option pricing models that spot prices should equal prices implied by the put-call parity model (implied spot price equals the call option price minus the put option price plus the present values of the exercise price and dividends). The implied spot index price increases (decreases) with the price of the call (put) option. Several studies have found put options are overvalued. Bondarenko (2014) attributes the put overvaluation to the overestimation by investors of probabilities of negative returns [15].

Kim et al. find deviations of prices from put-call parity prices are statistically significant and economically meaningful. On average, put-call parity implied prices for the KOSPI 200 index are significantly less than KOSPI 200 spot index prices, regardless of moneyness category. Their findings show KOSPI 200 index put options are often overpriced relative to calls. They investigate further by testing relations of the put-call disparity rate (e.g., implied spot price minus realized spot price, divided by realized spot price) with recent return, volatility, and skewness on the stock index, as well as the ratio of option-to-spot market trading volume. In their generalized method of moments regressions, the authors show KOSPI 200 index put-call disparity is significantly and positively related to recent KOSPI 200 spot index returns. These findings support a momentum strategy in which investors increase demand for calls (puts) versus puts (calls) after the stock market rises (falls). They also find statistically significant relationships between the KOSPI 200 index put-call disparity and past volatility on the KOSPI 200 spot index. When confined to negative put-call disparity days, the authors find a negative relation between put-call disparity and recent stock market volatility. This is a key result, showing, when investors prefer put options (negative disparity), investor risk aversion increases after recent market volatility. The increase in risk aversion drives up the prices of put options versus call options, causing put-call disparity to become more negative. Alternatively, when investors prefer call options (positive disparity), investor risk aversion falls after recent market volatility, driving up prices of calls versus puts and causing put-call disparity to become more positive. These results show the sign of the disparity rate is a breakpoint between risk preferences versus risk avoidance.

Some of the most interesting results centre on the tests of importance of spot market skewness. The authors find a positive relation between put-call disparity and recent spot market skewness. They find recent market skewness contributes nearly 20% to the KOSPI 200 stock index put-call disparity rate. Their results indicate investor demand for call options rises relative to put options after periods of positive outliers in spot index returns. Alternatively, investor demand for put options rises relative to call options after periods of negative outliers in spot index returns. In a related test, the authors find a negative relation between put-call disparity and the ratio of option-to-spot market trading volume. This result is relevant because individual investors in Korea are not allowed to short stocks comprising the KOSPI 200 index. Therefore, investors likely turn to put options to act upon their pessimistic expectations. Findings reported in this article support the short-selling argument.

Demand for put options rises relative to call options after periods of negative outliers in spot index returns. In a related test, the authors find a negative relation between put-call disparity and the ratio of option-to-spot market trading volume. This result is relevant because individual investors in Korea are not allowed to short stocks comprising the KOSPI 200 index. Therefore, investors likely turn to put options to act upon their pessimistic expectations. Findings reported in this article support the short-selling argument.

The authors also examine the predictive ability of KOSPI 200 stock index put-call disparity for future KOSPI 200 index returns. They find an increase of one standard deviation in the put-call disparity rate corresponds to a 45 basis point drop in the cumulative returns on the KOSPI 200 stock index over the next 10 days. Their findings indicate KOSPI 200 index option traders overreact to recent stock market performance driving prices of calls too high relative to puts after the spot index rises and driving prices of puts too high relative to calls after the spot index falls. As shown in the article, KOSPI 200 option disparity rates are often negative. Therefore, their overreaction results likely are dominated by downside market observations. Interestingly, also find non-informed option traders overreact to market movements, and Pan (2002) show investors prefer put options when attempting to protect against downside risk [24-26].

Conclusion

The Kim SH, et al. article makes many insightful contributions to our understanding of the behaviour of option traders, especially for implications of trading of individuals rather than of institutions. Their tests show departures of KOSPI 200 index spot prices from prices implied by the put-call parity model are statistically significant and economically meaningful. Traders of KOSPI 200 index options are characterized by cognitive biases such as recency bias and strong preference for skewness. Traders overreact to recent spot market performance especially after downward market movements, driving prices of put options too high relative to call options. By studying a market dominated

by individuals, their work offers clear evidence confirming conjectures often made about possible behavioural biases exhibited by individual option traders.

Conflicts of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be constructed as a potential conflict of interest.

References

1. Wilson, Dominic and Anna Stupniska. "Beyond the BRICS: A look at the 'Next 11'". *Goldman Sachs Global Econ* 153 (2007):160-164.
2. Chen, Chun-Da and Wan-Wei Tang. "Are they Hedgers Or Speculators? Evidence From South Korea's political elections". *Emerg Mark Fin Trade* 45 (2009):19-30.
3. Lee, Jaeram and Doojin Ryu. "Regime-dependent relationships between the implied volatility index and stock market index". *Emerg Mark Fin Trade* 50 (2014): 5-17.
4. Kim, Soo-Hyun and Hyoung-Goo Kang. "Tactical asset allocation using investors' sentiment". *Hitotsubashi J Econ* 56 (2015):177-195.
5. Choe, Hyuk, Bong-Chan Kho and Rene M. Stulz. "Do domestic investors have an edge? The trading experience of foreign investors in Korea". *Rev Fin Stud* 18 (2005):795-829.
6. Ahn, Hee-Joon, Jangkoo Kang and Doojin Ryu. "Informed trading in the index option market: The case of the KOSPI 200 options". *J Fut Mark* 28 (2008):1118-1146.
7. Ryu, Doojin. "Implied volatility of KOSPI200: Information contents and properties". *Emerg Mark Fin Trade* 48 (2012):24-39.
8. Kim, Sam, Jimmy Lockwood, Larry Lockwood and Hong Miao. "Determinants of put-call disparity: KOSPI 200 index options". *J Behav Fin* (2021).
9. Statman, Meir. "What is behavioral finance?" *Handbook of Finance* 9 (2008):79-84.
10. Bondt, De, Werner FM and Richard Thaler. "Does the Stock Market Overreact?". *J Finance* 40(1985): 793-805.
11. Kahneman, Daniel and Amos Tversky. "Prospect theory: An analysis of decision under risk". *Econometrica* 47 (1979):263-292.
12. Barberis, Nicholas and Ming Huang. "Stocks as lotteries: the implications of probability weighting for security prices". *American Eco Rev* 98 (2008):2066-2100.
13. Tversky, Amos and Daniel Kahneman. "Advances in prospect theory: Cumulative representation of uncertainty". *J Risk Uncertainty* 5 (1992):297-323.
14. Rubinstein, Mark. "Implied binomial trees". *J Finance* 49 (1994):771-818.
15. Bondarenko, Oleg. "Why are put options so expensive?". *Quar J Fin* 4 (2014):1-50.
16. Lamont, Owen A., and Richard H Thaler. "Anomalies: The law of one price in financial markets". *J Econ Persp* 17 (2003):191-202.
17. Manaster, Steven and Richard J. Rendleman. "Option prices as predictors of equilibrium stock prices". *J Finance* 37 (1982):1043-1057.
18. Easley, David, Maureen O'hara, and Pulle Subrahmanya Srinivas. "Option volume and stock prices on where informed traders trade". *J Finance* 53 (1998):1269-1300.
19. Patel, Vinay, Talis J. Putnins, David Michayluk and Sean Foley. "Price discovery in stock and options markets". *J Fin Markets* 47 (2020):1-28.
20. Lockwood, Jimmy, Hong Miao, Sanjay Ramchander, and Dongxiao Yang. "The informational role of option prices in China". Working Paper, University of North Georgia. (2022).
21. Yan, Bingcheng and Eric Zivot. "A structural analysis of price discovery measures". *J Fin Markets* 13 (2010):1-19.
22. Putnins, Talis. "What do price discovery metrics really measure?". *J Emp Finance* 23 (2013):68-83.
23. Harvey, Campbell R., and Akhtar Siddique. "Conditional skewness in asset pricing tests". *J Finance* 55 (2000):1263-1295.
24. Kent, Daniel, David Hirshleifer and Avanidhar Subrahmanyam. "Investor psychology and security under- and overreactions". *J Finance* 53 (1988):1839-1186.
25. Hong, Harrison and Jeremy C. Stein. "A unified theory of under-reaction, momentum trading, and overreaction in asset markets". *J Finance* 54 (1999):2143-2184.
26. Bakshi, Gurdip and Nikunj Kapadia. "Delta-hedged gains and the negative volatility risk premium". *Rev Financial Studies* 16 (2003):527-566.

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