



The information content of option-implied information for volatility forecasting with investor sentiment



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ABSTRACT

This study explores the effect of investor sentiment on the volatility forecasting power of option-implied information. We find that the risk-neutral skewness has the explanatory power regarding future volatility only during high sentiment periods. Furthermore, the implied volatility has varying volatility forecasting ability depending on the level of investor sentiment. Our findings suggest that the effectiveness of volatility forecasting models based on option-implied information varies over time with the level of investor sentiment. We confirm the important role of investor sentiment in volatility forecasting models exploiting option-implied information with strong evidence from in-sample and out-of-sample analyses. We also present improvements in the accuracy of volatility forecasts from volatility forecasting models derived by incorporating investor sentiment in these models.

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1. Introduction

Volatility forecasting is one of the most important issues in the asset pricing literature. In particular, financial assets are priced based on risk-return tradeoffs;² therefore, estimating the appropriate level of volatility has a large impact on determining the price of financial assets such as stocks and options.³ Volatility forecasting also plays a critical role in financial risk management.⁴ Firms can prepare well for upcoming risk if they can predict increases in future volatility, a common measure of risk. Over the past two decades, several volatility forecasting models based on various factors have been developed. Some of studies point out that option-implied information such as the risk-neutral skewness and the implied volatility, is

effective at predicting future stock return volatility (Latane and Rendleman, 1976; Jiang and Tian, 2005; and Byun and Kim, 2013). In the line of the literature, we examine whether investor sentiment affects the relationship between the future volatility and the option-implied information.

Our study investigates the impact of investor sentiment on the validity of volatility forecasting models based on option-implied information. Fundamental issues such as whether the option market leads the stock market or vice versa are discussed in the financial literature (Bali and Hovakimian, 2009; Cremers and Weinbaum, 2010; Xing et al., 2010; An et al., 2013; Bali and Murray, 2013). Some research papers that support the informativeness of the option market find that option-implied information has the predictive power regarding stock market movements at high frequencies, such as daily or intra-day frequencies (Manaster and Rendleman, 1982; Bhattacharya, 1987; and Anthony, 1988). In contrast, An et al. (2013) find that the predictability of information in an option market regarding stock market movements lasts for more than a month. The factors driving the persistence and magnitude of predictability have not been determined. We suggest that investor sentiment is an important factor that determines the persistence and magnitude of the option market predictability of stock market movements. Byun and Kim (2013) show that the risk-neutral

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² See, e.g., Merton (1980), Ghysels et al. (2005), Bali and Peng (2006), Christensen and Nielsen (2007), Bandi and Perron (2008), and Bollerslev et al. (2009).

³ See, e.g., Heston and Nandi (2000), Christoffersen et al. (2008), Goyal and Saretto (2009), Christoffersen et al. (2012), and Corsi et al. (2013).

⁴ See, e.g., Christoffersen and Diebold (2000), Clements et al. (2008), and Maheu and McCurdy (2011).

skewness has the stock return volatility forecasting power at only daily and weekly frequencies. According to their findings, the risk-neutral skewness does not anticipate future monthly stock return volatility. Along the same lines, we report that the risk-neutral skewness derived from option prices has significantly stronger predictive power regarding future stock return volatility during high sentiment periods than low sentiment periods. In addition, its predictive power lasts for a long horizon (a month) during high sentiment periods. We also find that investor sentiment affects the relationship between the implied volatility and the future stock return volatility.

We expect investor sentiment to strengthen the predictive power of the risk-neutral skewness on monthly stock return volatility for the following two reasons. First, sentiment investors help informed traders disguise their informed tradings during high sentiment periods. According to An et al. (2013), information from an option market can be used to predict stock market movements for a relatively long period (one month) due to the presence of uninformed noise traders in the stock and option markets. These findings imply that it takes a significant amount of time to determine efficient prices in the presence of uninformed traders. Trading by uninformed noise traders conceals informed trading initiated by informed traders. Therefore, the ability of the risk-neutral skewness to forecast future volatility is significantly stronger during periods where noise traders are actively involved in the stock market. During high sentiment periods, a larger number of individual investors participate aggressively in the stock market, and their trading has a strong influence on market prices (Barber and Odean, 2008; Karlsson et al., 2009; and Yuan, 2012). Because most individual investors are uninformed, stock prices do not respond immediately to informed trading during high sentiment periods. Accordingly, the risk-neutral skewness has the stronger predictive power regarding stock return volatility during high sentiment periods than low sentiment periods. In addition, the risk-neutral skewness anticipates future stock return volatility for a long period (one month) during high sentiment periods.

Second, the skewness is a common measure of the risk of future potential negative stock returns, including downward stock return jumps (Dennis and Mayhew, 2002; Doran et al., 2007; Bali and Hovakimian, 2009; and Conrad et al., 2013). We find that the forecasting power of the risk-neutral skewness, a forward-looking measure of the skewness, is stronger during high sentiment periods, suggesting that during high sentiment periods, information in the risk-neutral skewness is not reflected quickly in stock market movements through realizing downward jumps. It also indicates that pessimistic opinions about the stock market are not fully incorporated into stock prices during high sentiment periods. There are three reasons why pessimistic opinions are not reflected instantly in the stock market during high sentiment periods (Yu and Yuan, 2011 and Stambaugh et al., 2012). The first reason is that during high sentiment periods, the stock market is influenced primarily by individual investors who rarely take short positions. Barber and Odean (2008) show that only 0.29% of individual investors utilize short selling, as they are limited by knowledge or behavior biases. The second reason is that to take a short position, investors are required to have supplies of stock loans, which are usually offered by institutional investors. Stocks are more likely to be overpriced during high sentiment periods (Baker and Wurgler, 2007). Thus, informed institutional investors are not willing to loan stocks during high sentiment periods, because many of them are aware of overvaluation during those periods (D'Avolio, 2002). The decreased number of stock loans makes taking short positions costly. The last reason is that pessimistic investors hesitate to sell their stocks or to take short positions due to arbitrage risk during high sentiment periods (Shleifer and Vishny, 1997). Stock prices may keep increasing over the short-term before

eventually decreasing to fair prices during high sentiment periods because irrational and inexperienced investors trade in unpredictable ways. As mentioned before, during high sentiment periods, these irrational and inexperienced sentiment investors are strongly involved in the stock market and make the arbitrage risk higher than usual (Yu and Yuan, 2011). The three reasons listed above provide another explanation of why we expect the risk-neutral skewness to have the stronger forecasting ability regarding future stock return volatility during high sentiment periods than low sentiment periods.

This research also focuses on the effect of investor sentiment on the ability of the implied volatility to forecast future volatility. Latane and Rendleman (1976) report that the weighted average of the Black and Scholes call option-implied volatilities outperforms historical return volatility in future volatility forecasting. Furthermore, the option-implied volatility is affected by the behavioral biases of investors (Stein, 1989 and Potoshman, 2001). We therefore expect and find that overreaction in the stock market during high sentiment periods leads to misestimation of the option-implied volatility and weakens the volatility forecasting power of the option-implied volatility. Our findings provide empirical evidence consistent with Barberis and Huang (2001)'s theoretical expectation that overreaction in current stock returns results in misestimation of future stock return volatility. They investigate irrational investors who are loss averse and trade financial assets based on mental accounting. When past performance is good, loss-averse investors are less concerned about future losses, because past good performance acts as a cushion for future potential losses (Goyal and Saretto, 2009). Therefore, investors underestimate the risk of the stock market in the future. According to Baker and Wurgler (2007), the stock market is likely to be overvalued during high sentiment periods. Our prediction is that this overreaction exacerbates the misestimation of the implied volatility, which contributes to the weaker volatility predicting power of the implied volatility during high sentiment periods than low sentiment periods. Similarly, Goyal and Saretto (2009) report the results based on cross-sectional analysis that the option-implied volatility of individual stocks are misestimated after overreaction to stock returns. The results are consistent with ours. However, our results have different implications, because we investigate time-series volatility forecasting of the stock market.

This study contributes to the financial literature by providing evidence that investor sentiment plays a key role in the relationship between the option-implied information and the future stock return volatility. Investor sentiment can explain irrational phenomena in the stock market. Sometimes, existing rational asset pricing models are not able to perfectly explain anomalies in the stock market. However, numerous studies demonstrate the relationship between the investor sentiment and the stock market movement⁵ and successfully explain irrational phenomena by considering investor sentiment.⁶ Yu and Yuan (2011) suggest that an unstable mean-variance relationship is induced by investor sentiment in the stock market. Stambaugh et al. (2012) suggest that market anomalies are more significant during high sentiment periods than low sentiment periods. Another area of literature focuses on the effect of investor sentiment in the stock market on option prices.⁷ Mahani and

⁵ See, e.g., De Long et al. (1990), Lee et al. (1991), Kamstra et al. (2000), Hirshleifer and Shumway (2003), Brown and Cliff (2004, 2005), Dowling and Lucey (2005), Baker and Wurgler (2006, 2007), Lemmon and Portniaguina (2006), Edmans et al. (2007), Palomino et al. (2009), Kaplanski and Levy (2010), Baker et al. (2012), and Biłkowski et al. (2012).

⁶ See, e.g., Shleifer and Vishny (1997), Baele et al. (2010), Yu and Yuan (2011), Baker and Wurgler (2012), Stambaugh et al. (2012), Shen and Yu (2013), and Kim et al. (2014).

⁷ See, e.g., Cao et al. (2005), Han (2008), Mahani and Potoshman (2008), and Bauer et al. (2009).

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