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Do investor sentiment, weather and catastrophe effects improve hedging performance? Evidence from the Taiwan options market

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ABSTRACT

This study examines the usefulness of incorporating investor sentiment, weather, and catastrophe effects into the benchmark volatility model for an effective hedging strategy in the Taiwan options market. The empirical results indicate that investor sentiment, as measured by the option volatility index (*VIX*) and put-call open interest ratio (*PCO*), and the catastrophic factors of earthquakes (*EQ*) can help explain realized volatility and that the *PCO* has the best predictive ability. Incorporating investor sentiment and weather effects improves the hedging performance of options. *VIX* and changes in cloud cover (ΔCC) have significant improvement level for hedging performance, the highest of which are 0.44% and 5.36%, respectively.

1. Introduction

Traditional finance theory holds that the stock market is fundamentally rational and, thus, it reflects only economic information relevant to asset pricing (Chang et al., 2008). However, recently, many researchers have found that psychological factors appear to exert significant influence on the trading decisions of investors in financial markets (e.g., Baker and Wurgler, 2007). Moreover, some of the literature demonstrates weather effects on stock returns (e.g., Saunders, 1993; Hirshleifer and Shumway, 2003; among many others). Volatility estimation and forecasting are very essential factors of hedging, which is currently considered to be one of the most important investment strategies. In this study, we aim to bridge the gap between options hedging and the information content of investor behavior, weather changes, and catastrophic events. By proposing a volatility model and recruiting the factors of investor sentiment, weather, and catastrophes, we measure the performance of the options hedging strategies of a first-order moving average (MA(1)-type) process in an options model.

In addition to the issue of the optimal combination of multivariate volatility measures[1], other topics examining possible indicators could improve the predictive power of forecasting and its applications. A growing body of literature presents evidence of irrational behavior in stock and options markets. For example, De Long et al. (1990) attempt to substantiate the proposition that noise traders' risks indexed by sentiment influence either the mean or the variance of asset returns. Investor sentiment measurements, such as the option volatility index (*VIX*), market turnover (*TO*), and the put-call open interest ratio (*PCO*), are therefore

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[1] Blair et al. (2001) classify volatility models into the following four categories: historical volatility models (e.g., Bossaerts and Hillion, 1997), the GARCH family (e.g., Yung and Zhang, 2003), the options implied standard deviation model (e.g., Yung and Zhang, 2003) and the stochastic volatility model (e.g., Bakshi et al., 1997).

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proposed to be indicators that could enhance the incremental explanation of asset returns and realized volatility (e.g., Bollen and Whaley, 2004; Sheu and Wei, 2011).

Psychological evidence indicates that numerous factors affect human mood, including the weather, which exerts an inescapable and constant influence (e.g., Huibers et al., 2010). Many finance studies argue that when people feel good as a result of good weather, they hold optimistic opinions of their future prospects (Hirshleifer, 2001). Weather not only affects our daily lives and moods but also decisively influences the trading decisions of investors within the financial markets and four-fifths of global economic activity (Yuan et al., 2006). Some of the literature has noted that market volatility is affected by weather factors, such as cloud cover (*CC*), temperature (*TEMP*) and humidity (*RH*) (e.g., Chang et al., 2008; Symeonidis et al., 2010). Hence, the relationships between weather, mood, and the decision-making processes of investors have been the subject of extensive study.

Additionally, catastrophic events, such as earthquakes, may create huge losses for exposed firms, affecting not only returns but also volatility. Most studies investigate the impact of catastrophes on stock returns (e.g., Shelor et al., 1990; Yamori and Kobayashi, 1999; Carter and Simkins, 2004) and on the volatility (e.g., Thomann, 2013) of the real estate and insurance industries in the US or Japan. Thomann (2013) investigates the impact of natural catastrophes and the September 11th attacks (hereafter, "9-11") on the volatility of US insurance stocks and finds that natural catastrophes increase their volatility.

The motivation to study options hedging performance by employing Taiwan Stock Exchange Capitalization Weighted Stock Index (hereafter, TAIEX) options is enhanced by several characteristics of Taiwan's financial market. First, Taiwan's stock market exhibits a high turnover rate and a high participation rate by individual investors, and several limitations exist on trading activity, including a 7% daily limit on price movement and constraints on short selling.[2] These characteristics are markedly different from those of the major financial markets in the US and Europe. Second, most options and warrants in Taiwan are sold to and traded by individual investors (Chung et al., 2014); individual investors are also more easily affected by market performance than institutional investors and, therefore, are more likely to show investor sentiment (Hsu et al., 2005). These two characteristics imply that investor sentiment and psychological bias may substantially affect trading behavior on the Taiwan stock market (Hsiao et al., 2011). Although Chang et al. (2008) find that the trading activities of individual investors in the Taiwan options market convey no information content, investor sentiment and psychological bias might substantially affect the option volatility and the hedging performance of the Taiwan options market. Last, but not least, due to constraints on short selling in Taiwan, the Taiwan options market provides investors with an important channel for transferring and hedging stock market risk. Thus, observations from the Taiwan options market can provide clear evidence of investor sentiment, weather and catastrophe effects on hedging performance.

Most existing studies examine the relationship between investor sentiment (weather and catastrophe) and stock markets; however, few studies investigate the relationships between investor sentiment, weather, catastrophe and realized volatility and their application to options hedging decisions. The motivation for our study and the questions we set out to answer are as follows: (i) several studies find that investor sentiment, weather, or catastrophes affect volatility (e.g., Saunders, 1993; Bollen and Whaley, 2004; Sheu and Wei, 2011), but which psychological factors more significantly impact the forecasting ability of volatility? (ii) Many studies (e.g., Chang et al., 2008; Symeonidis et al., 2010) use *TEMP*, *RH* and *CC* as weather indicators, but could catastrophic factors such as typhoons and earthquakes, the major natural hazards in Taiwan, also affect the trading activities of investors? In this study, to analyze the effects of a broader range of weather variables on the stock market, we construct multivariate regressions in which realized volatility is linked to the lagged daily historical volatility. This setting implies capturing the autocorrelation of volatility, i.e., the GARCH effect; (iii) Prior studies examine primarily the impact of investor sentiment (weather conditions) on stock returns, and few simultaneously investigate the relationship between investor sentiment, weather, catastrophe, and realized volatility and options hedging decisions. In the present study, we examine the impact of investor sentiment, weather indicators, and catastrophe on the volatility of TAIEX returns and assess the influence of these factors on the performance of TAIEX options hedging strategies, including the delta hedge, delta-gamma hedge and delta-vega hedge methods.

We consider a general option-pricing framework where asset returns are not independent. To capture the autocorrelation of financial asset returns, many classical studies such as Bollerslev (1987) suggest extracting the autocorrelation from the asset returns' first moment in the form of a first-order moving average process (MA(1) process). Liao and Chen (2006) derive the closed-form formula for an MA(Ahn et al., 2007) option on an asset and show that the first-order MA parameter is significant for option values, even when the autocorrelation between asset returns is weak. Hence, we measure the performance of options hedging strategies based on Liao and Chen (2006)'s model.

Our empirical and analytic results support our inclusion of the investor sentiment effect (*VIX* and *PCO*), the weather effect (ΔCC and *RH*), and the catastrophe effect (*EQ*) in the volatility model and options hedging strategies. The best improvement level of the hedging performance in the volatility model was shown during the 2008 financial crisis.

The remainder of this paper is organized as follows. Section 2 reviews the literature and develops our hypothesis. Section 3 presents the research methodology adopted in this study. Section 4 provides a description of the data and the empirical results of the investor sentiment, weather and catastrophe effects on the different volatility models. This section further discusses options hedging performance and investigates the impact of investor sentiment variables and weather on performance. Section 5 provides conclusions to the study.

[2] The Taiwan Stock Exchange has relaxed limits on daily price fluctuations from 7 to 10% since June 1, 2015.