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Impact of macroeconomic announcements on implied volatility slope of SPX options and VIX ☆

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ABSTRACT

This paper examines the impact of macroeconomic announcements on the high-frequency behavior of the observed implied volatility skew of S&P 500 index options and VIX. We document that macroeconomic announcements affect VIX significantly and slope at a lesser extent. We also find evidence that good and bad announcements significantly and asymmetrically change implied volatility slope and VIX.

1. Introduction

The Black–Scholes Option Pricing Model presumes that for the same underlying asset, the implied volatilities shall be constant in the same maturity category across different strike prices. However,

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empirical literature documents that options on the same underlying with the same maturity dates have different implied volatilities across different strike prices. This anomaly is known as the volatility skew and takes the shape of a smile or a smirk depending on the instrument. Option traders and financial analysts closely monitor the volatility skew as they believe that it carries important information regarding the market structure and the risk aversion of the participants in the market. This paper examines the impact of macroeconomic announcements on the observed implied volatility skew of S&P 500 index options and VIX in a high-frequency setting.

There have been various studies that investigate the effects of macroeconomic news on financial markets but not in the context of implied volatility skew. Ederington and Lee (1996) are the first to study the impact of macroeconomic announcements on option implied volatility of T-bonds and foreign exchange. Kearney and Lombra (2004) find a significant positive relation between the CBOE volatility index, VIX, and unanticipated changes in employment, but not inflation. Baba and Sakurai (2011) investigate whether macroeconomic variables are leading indicators of regime shifts in the VIX and find that term spreads predict the shift from tranquil to the turmoil regime. Füss et al. (2011) focus only on Gross Domestic Product, Producer Price Index and Consumer Price Index announcements and find that VIX drops on announcement days. This study covers a larger range of macroeconomic announcements and is able to observe the intraday behavior of VIX.

A related strand of literature investigates the effects of monetary policy on stock returns and volatility. Chen and Clements (2007) and Vähämaa and Äijö (2011) investigate the behavior of VIX around US monetary policy announcements and find that implied volatility generally decreases after FOMC meetings. Gospodinov and Jamali (2012) conduct a monthly analysis of the relation between Federal funds rate surprises and implied volatility and volatility risk premium controlling for non-farm payroll employment, consumer price inflation and industrial production announcements. They find that surprises in Fed funds rates and both inflation and industrial growth affect VIX significantly in monthly regressions. Rosa (2011) investigates the effects of Fed's monetary surprises on US stock and volatility indices in a high frequency setting. He finds that the surprise change to the current target federal funds rate significantly affects all indices and the surprise component of Fed's statements affect all but VIX.

This study analyzes the effect of 23 macro announcements, grouped under categories of inflation, investment, employment, real activity and forward-looking, on 2006 high-frequency behavior of VIX and slope of S&P 500 index options. We also analyze the surprises contained in the announcements by computing the difference between the announced and expected figures. We find that macroeconomic announcement impact is statistically significant on VIX for almost every announcement category and at a lesser extent on slope. To study the asymmetric volatility we further categorize information contained in macroeconomic announcements as good or bad. We find evidence that good and bad announcements asymmetrically affect slope of implied volatility smirk of S&P 500 Index options and VIX.

The remainder of the paper is organized as follows. Section 2 describes the data and variable construction. Section 3 presents the results of the analysis of the effects of macro announcements on implied volatility skews and VIX. Section 4 concludes.

2. Data and variable construction

The data consists of tick-by-tick data of S&P 500 Index (SPX) option contracts and is obtained from Berkeley Options Database for a total of 250 trading days in 2006.[3] The dataset is derived from the Market Data Report (MDR file) of the Chicago Board Options Exchange (CBOE) and includes time-stamped (in seconds) option trades and quotes (options of all strikes and maturities) including expiration date, put – call code, exercise price, bid and ask prices and contemporaneous price of the underlying S&P 500 Index. Daily SPX dividend yields and U.S. T-Bill Secondary Market Rates are obtained from the DataStream database. For implied volatility calculations, we use 1-month, 3-month, 6-month, and 1-year

[3] Sample data does not coincide with US financial crisis of 2007–2009.

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