International Review of Economics and Finance 37 (2015) 42–54

Contents lists available at ScienceDirect

International Review of Economics and Finance

journal homepage: www.elsevier.com/locate/iref

The response of stock market volatility to futures-based measures of monetary policy shocks

Nikolay Gospodinov [a,1], Ibrahim Jamali [b,*]

[a] Research Department, Federal Reserve Bank of Atlanta, 1000 Peachtree Street NE, Atlanta, GA 30309-4470, USA
[b] Department of Finance, Accounting and Managerial Economics, Olayan School of Business, American University of Beirut, P.O. Box 11-0236, Riad El-Solh Street, Beirut 1107 2020, Lebanon

ARTICLE INFO

Article history:
Received 11 October 2012
Received in revised form 3 November 2014
Accepted 3 November 2014
Available online 11 November 2014

JEL classification:
C32
C58
E52
E58
G10
G12

Keywords:
Stock market volatility
Federal funds futures
Monetary policy
Volatility risk premium

ABSTRACT

In this paper, we investigate the dynamic response of stock market volatility to changes in monetary policy. Using a vector autoregressive model, our findings reveal a significant response of stock returns and volatility to monetary policy shocks. While the increase in the volatility risk premium, futures-trading volume and leverage appear to contribute to a short-term increase in volatility, the longer-term dynamics of volatility are dominated by monetary policy's effect on fundamentals. The estimation results from a bivariate VAR-GARCH model suggest that the Fed does not respond to the stock market at a high frequency but that market participants' uncertainty regarding the monetary stance affects stock market volatility.

1. Introduction

The effect of Federal Reserve (Fed) actions on the stock market has garnered substantial policy-making, practical and research interest. A change in the federal funds rate, the Fed's policy instrument, is closely associated with changes in various short-term interest rates. This, in turn, influences the discount rate used to value the cash flows from equities (i.e. dividends). Monetary policy also affects the stock market through its effect on financial leverage: each rate change by the Fed changes the cost for firms to finance their activities through issuing debt.[2] While the extant literature (Bernanke & Kuttner, 2005; Goto & Valkanov, 2002; Patelis, 1997; Thorbecke, 1997; Tsai, 2014) widely documents a decrease in stock market returns following a monetary policy tightening, the effect

* Corresponding author. Tel.: +961 1 340 460x3770; fax: +961 1 750 214.
E-mail addresses: Nikolay.Gospodinov@atl.frb.org (N. Gospodinov), ij08@aub.edu.lb (I. Jamali).
[1] Tel: +1 404 498 7892.
[2] Researchers refer to the first channel as the "wealth channel" while the second channel is labeled the "balance sheet" channel. For a survey of the empirical and theoretical research on the relationship between the stock market and monetary policy, see Sellin (2001).

http://dx.doi.org/10.1016/j.iref.2014.11.001
1059-0560/

of Fed actions on stock market volatility are less documented and understood. Nevertheless, the response of the stock market to Fed actions need not be limited to returns and can extend to stock price volatility through a number of channels.

On the one hand, as first documented in Black (1976) and Christie's (1982) seminal contributions, an asymmetric relationship exists between stock returns and volatility. Black (1976) and Christie (1982) attribute the increase in volatility to a higher leverage (debt-to-equity) ratio and researchers since refer to the asymmetric return-volatility relationship as the leverage effect. In view of the established decrease in stock prices following a monetary policy tightening, an increase in volatility can thus result from the leverage channel.

On the other hand, monetary policy can exert a direct influence on risk premiums and volatility. In fact, an alternative view of the asymmetric return-volatility relationship proposed by Campbell and Hentschel (1992) and subsequently referred to as the volatility feedback hypothesis, postulates that negative news spur an increase in future volatility. According to the volatility feedback hypothesis, time-varying risk premiums relate the increase in future volatility to a decrease in contemporaneous returns. More specifically, the negative news leads to an increase in the expected stock returns (i.e. risk premiums) as investors require additional compensation to account for the increased riskiness of holding stocks. If volatility is a priced risk factor, and given a positive correlation between future volatility and expected returns, the increase in future volatility feeds back into and lowers contemporaneous returns. In sum, negative news decreases returns contemporaneously and increases both future volatility and expected stock returns. An unexpected monetary policy tightening constitutes negative news to stocks whose future cash flows (dividends) are valued at a higher than expected discount rate. This implies that a monetary policy shock is expected to decrease returns contemporaneously and to increase future stock market volatility. Evidently, both the leverage and volatility feedback channels can operate simultaneously as argued in Wu (2001).

An unexpected monetary policy tightening, which represents new information to investors, can also increase volatility through its effect on trading activity. In light of the new information available in the market, investors may rebalance their portfolios more intensively between equities and bonds thus spurring an increase in trading volume. The increase in trading volume could, in turn, translate into higher volatility due to the well-known positive relation between volatility and trading volume (Andersen, 1996; Karpoff, 1987, among others). Such an increase in volatility would also be in line with Ross's (1989) analysis suggesting that information flow into the market positively correlates with volatility.

While previous research (Bomfim, 2003; Lee, 2006) uses Generalized Autoregressive Conditional Heteroskdasticity (GARCH) models to investigate the link between monetary policy surprises and the volatility of some assets, the existing literature did not assess the *dynamic* effect of monetary policy shocks on stock market volatility (volatility risk premium) nor investigate the channels through which monetary policy affects volatility. In an influential contribution, Schwert (1989) studies the relationship between macroeconomic and stock market volatility but does not explicitly tackle the effect of monetary policy on stock market volatility.

In this paper, we undertake an in-depth analysis, at the monthly level, of the effect of futures-based monetary policy shocks on stock market volatility and the volatility risk premium. We examine the dynamic effects of monetary policy shocks, identified from Federal funds futures data, by employing a vector autoregressive model with exogenous regressors (VARX). The use of market-based measures of monetary policy shocks allows us to avoid the need to resort to identifying assumptions and circumvents dimensionality (degrees of freedom) problems in the estimated VARX. Our goal from this analysis is threefold. First, we assess the dynamic response of stock market volatility and the volatility risk premium to monetary policy shocks. Second, our analysis allows us to characterize asymmetries in the return-volatility relationship. Third, we study the channels through which monetary policy shocks affect stock market volatility by analyzing the joint response of several financial variables to market-based measures of monetary policy shocks. By inspecting the channels of monetary policy transmission to volatility, we also identify the importance of changes in the risk premium or leverage on stock market volatility and, therefore investigate in further detail the importance of the volatility feedback and leverage effect hypotheses.

Our baseline results show a contemporaneous decrease in monthly excess returns of 1% and an increase in annualized stock market volatility which peaks one month following a 10 basis point monetary policy shock at 0.4%. The results illustrate the asymmetric return-volatility relationship. We further explore the high-frequency effect of monetary policy expectations on stock market volatility by estimating a bivariate VAR-GARCH model relating federal funds futures to stock market volatility. Our results lend empirical support to the hypothesis that market participants' uncertainty about the future course of monetary policy is an important determinant of stock market volatility.

The dynamic response of stock market volatility (volatility risk premium) to monetary policy shocks and the transmission of monetary policy to volatility, that are examined in this study, would be of both theoretical and practical importance. Theoretically, volatility is a key component of many derivative pricing models and an understanding of the dynamic response of volatility to monetary policy shocks would allow for better derivative pricing. From a practical perspective, the advent of derivatives on market volatility and their increasing popularity with investors shows that volatility, while itself not being a tradable asset, can be profitably traded as underlying asset for a number of derivatives contracts.[3] In addition, a more complete understanding of the role of monetary policy in affecting the volatility risk premium would contribute to a better understanding of risk taking behavior in financial markets.

The plan of the paper is as follows: Section 2 discusses the data and variables we employ, Section 3 presents the econometric methodology and results while Section 4 offers some concluding remarks.

[3] Such as the Chicago Board of Options Exchange (CBOE)'s futures and options on the VIX index which began trading in 2004 and 2006, respectively. In addition, variance swaps currently have a liquid market. Carr and Wu (2006) discuss variance swap contracts and the return that accrues to investors from holding such contracts around FOMC announcement days.