SOME EMPIRICAL EVIDENCE ON THE
REAL EFFECTS OF NOMINAL VOLATILITY

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Abstract

It has been argued that volatility in nominal macroeconomic aggregates has had a negative effect on real output, in particular that such volatility contributed to slow output growth in the early 1980s. This paper reexamines the effects of volatility in nominal macroeconomic aggregates in the context of a modern simultaneous equation framework where the volatility of nominal macroeconomic variables is modeled as the conditional variance of two variables of interest: the federal funds rate and inflation. The empirical framework is the recently developed multivariate GARCH-in-mean vector autoregressive model. We confirm evidence that inflation volatility and tight monetary policy have directly affected output growth, but find that volatility in the federal funds rate has not. (JEL: E42, E43, E44)

Introduction

This article explores the real effects of volatility in nominal macroeconomic variables—the federal funds rate and inflation—in the context of a modern multivariate empirical framework. It is motivated by three observations drawn from the theoretical and empirical literatures on monetary uncertainty. First, the theoretical literature on monetary uncertainty does not usually differentiate between uncertainty regarding those nominal variables that are directly under the control of the monetary authority, such as the federal funds rate, and uncertainty regarding the price level, over which the monetary authority has much less direct control. From a policymaking perspective, however, distinguishing between the effects of volatility in aggregate inflation and short-term interest rates is significant.

Second, as argued by Elder (2004), there exists a large theoretical literature on the real effects of monetary and inflation volatility that exhibits little agreement. For example, Friedman (1977) argues that monetary uncertainty decreases the allocative efficiency of the price system as economic agents transition between institutional arrangements, while Lucas (1973) shows how monetary uncertainty can obfuscate the distinction between real and nominal shocks. In contrast, Dotsey and Sarte (2000) show how monetary uncertainty can lower nominal interest rates through increased precautionary savings and therefore increase real economic activity. Similarly, Eijffinger, Hoeberichts, and Schaling (2000) show that monetary uncertainty may increase social welfare.

Finally, previous empirical research has investigated the effects of inflation volatility and interest-rate volatility but not in consistent empirical frameworks. For example, Huizinga (1993), Evans and Wachtel (1993), Cunningham, Tang, and Vilasuso (1997) and Grier and Perry (2000) estimate low-order dynamic models to examine the effects of inflation volatility. An earlier strand of literature, such as Mascaro and Meltzer (1983) and Barro (1976), estimated the real effects of volatility in other nominal macroeconomic variables, including short-term interest rates. The empirical framework in these latter studies was typically a single-equation, reduced form that is subject to considerable omitted-variable and simultaneous-equations bias.

In contrast, this paper specifies and estimates a trivariate simultaneous equations model that can, in turn, incorporate volatility in short-term interest rates and inflation. The framework, developed in Elder (2004 and 2003), can be viewed as an integration of the vector autoregression (VAR)
methodology of Sims (1980) with the multivariate-generalized-autoregressive-conditional-heteroskedastic (MGARCH) model of Engle and Kroner (1995), but with some modifications. I adopt a trivariate VAR based on the seminal paper of Bernanke and Blinder (1992) to this framework. The resulting trivariate MGARCH-in-Mean (MGARCH-M) VAR model mitigates the effects of simultaneous equations bias and problems associated with generated regressors that are prevalent in alternative approaches. This specification can also be viewed as a generalization of the bivariate system estimated by Grier and Perry (2000).

I confirm that both inflation volatility and positive innovations in the federal funds rate have tended to adversely affect real economic activity, but I also find that volatility in the funds rate has not adversely affected real economic activity. Predictably, funds rate volatility was unusually high during the 1979:10 to 1982:10 episode, but any real effects of such volatility were apparently overwhelmed by the effects of shocks to the policy variable. These results suggest that, for example, the recessions of 1980 and 1982 were more likely the result of tight monetary policy than of volatility in the federal funds rate. More generally, the results suggest that monetary authorities have sufficiently smoothed short-term interest rates to avoid adversely affecting real economic activity. These results also suggest that there may be real benefits to further reducing volatility in the inflation process. Our results are particularly persuasive because they control for a variety of factors that affect real economic activity, such as lagged output, interest rates, and inflation. Finally, our results are robust to a variety of specifications, including different measures of output, assumptions about identification, the number of lags, and various sample periods.

The organization of the paper is as follows: in the second section the MGARCH-M model is presented within the VAR framework; in the third section the data and identifying assumptions are specified; and in the fourth section the results are presented. The fifth section provides concluding remarks. The estimation technique and methods are included in Appendix A.

Methodology

The empirical model presented here is similar to Elder (2004) and is based on the common VAR methodology of Sims (1980), modified with MGARCH. The operational assumption is that the dynamics of the structural system can be summarized by a linear function of the variables of interest so that the structural system can be represented by (1), where \( \dim(B) = \dim(I) = (N \times N) \), \( \psi_{t-1} \sim \text{iid} \ N(0, H_t) \), \( H_t \) is diagonal, \( \Lambda(L) \) is a matrix polynomial in the lag operator, and \( \psi_{t-1} \) denotes the information set at time \( t-1 \), which includes variables dated \( t-1 \) and earlier.

\[
By_t = C + \Gamma_1 y_{t-1} + \Gamma_2 y_{t-2} + \cdots + \Gamma_p y_{t-p} + \Lambda(L)H_t + \epsilon_t, \tag{1}
\]

The system is identified by imposing a sufficient number of exclusion restrictions on the matrix \( B \), which governs the contemporaneous interaction of the variables within the system, and by assuming that the structural disturbances \( \epsilon_t \) are uncorrelated. Note that this specification allows the matrix of conditional variances, denoted \( H_t \), to affect the conditional mean. A test of whether volatility of the relevant nominal macroeconomic variables affects real economic activity is therefore a test of restrictions on the elements \( \Lambda(L) \), which relate the conditional covariance matrix \( H_t \) to the conditional mean of \( y_t \). That is, if interest rate volatility has adversely affected output growth, then we would expect to find a negative and significant coefficient on the conditional variance of interest rates in the output equation.

In our application, the vector \( y_t \) includes measures of nominal macroeconomic variables and real economic activity. In particular, we use as a guide the extensive literature on monetary shocks to specify the variables in the system. Our benchmark model is a trivariate VAR comparable to that of

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1 Note that we do not address inflation targeting directly since inflation volatility could be low whether or not the central bank targets the level of inflation. However, it might be reasonable to expect that inflation volatility would be lower under a regime of inflation targeting, ceteris paribus.