Journal of Economic Dynamics & Control 52 (2015) 340–360

Contents lists available at ScienceDirect

Journal of Economic Dynamics & Control

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

What does financial volatility tell us about macroeconomic fluctuations? ☆

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ARTICLE INFO

Article history:
Received 19 November 2013
Received in revised form
5 January 2015
Accepted 8 January 2015
Available online 14 January 2015

JEL classification:
C32
E32
E44

Keywords:
Financial volatility
Real-time data
Predictive ability tests
Dynamic factor model
Markov switching

ABSTRACT

We provide an extensive analysis of the predictive ability of financial volatility for economic activity. We consider monthly measures of realized and implied volatility from the stock and bond markets. In a dynamic factor framework, we extract the common long-run component of volatility that is likely to be linked to economic fundamentals. Based on powerful in-sample predictive ability tests, we find that the stock volatility measures and the common factor significantly improve macroeconomic forecasts of conventional financial indicators, especially over short horizons. A real-time out of sample assessment yields similar conclusions under the assumption of noisy revisions in macroeconomic data. In a nonlinear extension of the dynamic factor model, we identify two distinct volatility regimes, and show that the high-volatility regime provides early signals of the Great Recession, which was associated with severe financial distress and credit disintermediation.

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1. Introduction

The predictive ability of financial variables such as term spreads, stock returns and credit spreads for economic activity has been extensively studied (see for example, Harvey, 1989; Fama, 1990; Estrella and Mishkin, 1998; Stock and Watson, 2001; Ang et al., 2006; Gilchrist and Zakrajsek, 2012; Faust et al., 2013). Recently, using the information content of second moment of stock returns for predicting economic activity has also attracted attention. For example, Fornari and Mele (2013) study the predictive ability of aggregate stock market volatility combined with other commonly used financial indicators. Bakshi et al. (2011) provide a similar analysis for the forward variances extracted from option portfolios while Allen et al.

☆ We would like to thank William Bassett, John Driscoll, Egon Zakrajsek, participants of the Applied Time Series Workshop at the Federal Reserve Bank of St. Louis, European Central Bank Workshop on the Role of Nonlinear Methods in Empirical Macroeconomics and Forecasting, Annual Symposium of the Society for Nonlinear Dynamics and Econometrics, Conference on Real-Time Data Analysis at the Federal Reserve Bank of Philadelphia/CIRANO, International Symposium on Forecasting, Joint Statistical Meetings, and seminar participants at the Federal Reserve Board, Cornerstone Research, Indiana University, and The University of Queensland for useful comments. We are also grateful to two anonymous referees whose constructive comments have greatly improved this manuscript. The views expressed in this paper are solely the responsibility of the authors and should not be interpreted as reflecting the views of the Board of Governors of the Federal Reserve System, its staff or any other person associated with the Federal Reserve System.

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http://dx.doi.org/10.1016/j.jedc.2015.01.002
0165-1889/Published by Elsevier B.V.

(2012) construct an aggregate systemic risk measure that has predictive value for economic downturns. Ferrara et al. (2014) find that daily volatility of stock prices are useful in forecasting GDP in a mixed-data sampling (MIDAS) regression framework over the Great Recession period. Cesa-Bianchi et al. (2014) analyze the relationship between volatility and output growth in a VAR framework where both are driven by the same set of factors and focus on the direction of causality.

The relationship between financial volatility and economic activity has solid theoretical foundations. Schwert (1989a, 1989b) shows that measures of return volatility proxy for the uncertainty surrounding future cash flows and discount rates based on the standard present value model of stock prices. According to the rational valuation framework of Mele (2007), increases in risk premia are larger in magnitude than declines in good times, leading to counter-cyclical return volatility. This can be caused by habit formation in consumption as in Campbell and Cochrane (1999), or by restricted stock market participation as in Basak and Cuoco (1998). Further theoretical underpinnings of the counter-cyclical characteristics of asset return volatility can be found in the financial accelerator framework of Bernanke et al. (1999) and more recently in Bloom (2009), who investigates the impact of shocks to economic uncertainty under stochastically evolving business conditions. Christiano et al. (2014), Arellano et al. (2012) and Bloom et al. (2014) study uncertainty shocks in the context of dynamic stochastic general equilibrium models and argue that models incorporating uncertainty shocks provide a better fit in matching business cycle dynamics.

The aforementioned theoretical literature suggests that financial volatility is related with anticipated real uncertainty, as well as time-varying risk aversion and credit conditions. Therefore, financial volatility may have predictive power for economic activity and also potentially improve forecasts based on conventional financial indicators. In this paper, we analyze the predictive value of various financial volatility measures and their common component extracted from a dynamic factor model. The individual measures consist of realized and implied volatility series from the stock and bond markets, which incorporate information from higher-frequency data while avoiding estimation uncertainty associated with volatility models.[1] For the stock market, we consider the realized and option implied volatility of broadly defined stock market portfolios and an aggregated realized volatility measure from industry portfolios.[2] For the bond market, we consider the realized and implied volatilities of the Treasury securities and a realized volatility of corporate bonds. We use daily data to construct the financial volatility measures at the monthly frequency from January 1986 to July 2014, which is the longest available sample for the comprehensive set of measures we consider. We use a variety of models and tests to assess the predictive power of these volatility measures as well as their common factor for economic activity using both revised and real-time macroeconomic data. We also estimate a Markov-switching version of the dynamic factor model to characterize cyclical phases of the common volatility factor, and explore its relationship with the economic cycle.

We first show that the aforementioned volatility measures are significantly correlated with growth in industrial production and non-farm employment since early-2000s. Moreover, these volatility measures exhibit strong comovement, which we capture in a dynamic factor framework motivated by the ICAPM model of Adrian and Rosenberg (2008). We filter out the noisy short-run components of volatility measures and extract their common long-run component that is presumably more strongly tied to underlying economic fundamentals. We then implement the in-sample predictive ability tests of Clark and McCracken (2012), which are particularly well-suited to assess the marginal predictive content of volatility. We find that the stock volatility measures and the common factor perform similar to the credit spread and the stock market return in predicting industrial production and employment growth. Among the bond volatility measures, implied Treasury note volatility stands out as the only significant predictor in benchmark autoregressive models. In general, the volatility measures improve forecasts from conventional financial indicators, especially over relatively short forecast horizons. Test results also reveal that financial volatility, similar to other financial indicators, has predictive power mostly in the second half of the sample, which is characterized by several episodes of financial distress.

We also conduct an out-of-sample analysis with real-time data using the framework proposed by Clark and McCracken (2009), which take into account effects of macroeconomic data revisions on the distribution of test statistics. On average, volatility measures perform similar to conventional financial indicators under the assumption of noisy data revisions, especially over short forecast horizons. This result holds using both initial and final data releases to evaluate real-time forecasts. According to the nested model comparisons, the stock volatility measures and the common factor significantly improve short-term forecasts from conventional financial indicators. The additional information content of the volatility measures is slightly stronger with respect to initial data release for industrial production growth, while the same holds for the revised data on employment growth.

In a nonlinear extension of the dynamic factor model, we find evidence of two regimes characterized by asymmetry in the mean, variance and autocorrelation structure of the common volatility factor. The regime classification from this model implies that the expansionary periods characterized by robust economic growth are always associated with low financial volatility. On the other hand, the high volatility regime prevails during recessions and periods of sluggish growth. As a robustness check, we also estimate the model recursively and calculate regime probabilities as one would do in real-time.

[1] An alternative approach is to estimate daily volatility series and use them in MIDAS regressions as in Ferrara et al. (2014). By using realized volatility measures we avoid potential uncertainty resulting from volatility model estimation. Moreover, the particular in-sample and out-of sample tests we conduct are not necessarily applicable in the MIDAS framework.

[2] Realized volatility measures have been extensively used in the empirical finance literature, see for example the early work of Poterba and Summers (1986) and French, et al. (1987). More recently, Andersen et al. (2001a, 2001b, 2003, 2005) showed the empirical success of realized volatility for measuring and modeling underlying return variability.