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International Journal of Forecasting 24 (2008) 122–133
www.elsevier.com/locate/ijforecast

Are combination forecasts of S&P 500 volatility statistically superior?

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Abstract

Forecasting volatility has received a great deal of research attention, with the relative performances of econometric model based and option implied volatility forecasts often being considered. While many studies find that implied volatility is the preferred approach, a number of issues remain unresolved, including the relative merit of combining forecasts and whether the relative performances of various forecasts are statistically different. By utilising recent econometric advances, this paper considers whether combination forecasts of S&P 500 volatility are statistically superior to a wide range of model based forecasts and implied volatility. It is found that a combination of model based forecasts is the dominant approach, indicating that the implied volatility cannot simply be viewed as a combination of various model based forecasts. Therefore, while often viewed as a superior volatility forecast, the implied volatility is in fact an inferior forecast of S&P 500 volatility relative to model-based forecasts.

PACS: C12; C22; G00
Keywords: Implied volatility; Volatility; Forecasts; Volatility models; Combination forecasts; Model confidence sets

1. Introduction

Estimates of the future volatility of asset returns are of great interest to many financial market participants. Generally, there are two approaches which can be employed to obtain such estimates. First, predictions of future volatility can be generated from econometric models of volatility given historical information (model based forecasts, MBF). For surveys of common modeling techniques see Campbell, Lo, and MacKinlay (1997) and Gourieroux and Jasiak (2001). Second, estimates of future volatility can be derived from option prices using the implied volatility (IV). IV should represent a market's best prediction of an asset's future volatility; see, among others, Jorion (1995) and Poon and Granger (2003, 2005).

Given the importance of volatility forecasting, a large number of studies have examined the forecast performance of various approaches. While the results of individual studies are mixed, Poon and Granger

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doi:10.1016/j.ijforecast.2007.09.001

(2003, 2005) report in their survey of 93 articles that overall, IV estimates generally provide more accurate volatility forecasts than the competing MBF. Specifically relating to equity market volatility, Lameroux and Lastrapes (1993) and Vasilellis and Meade (1996) find that individual stock option implied volatilities provide better forecasts of volatility than MBFs. Day and Lewis (1992), Canina and Figlewski (1993) and Ederington and Guan (2002) report that MBFs of equity index volatility provide more information relative to IV. Koopman, Jungbacker, and Hol (2005) show that volatility models that utilise the realized volatility (RV) produce the most accurate forecasts of equity index volatility. On the other hand, Fleming, Ostdiek, and Whaley (1995), Christensen and Prabhala (1998), Fleming (1998) and Blair, Poon, and Taylor (2001) (henceforth BPT) all find that the equity index IV dominates MBF. While there is a degree of inconsistency in previous results, the general result that IV estimates often provide more accurate volatility forecasts than competing MBFs is rationalised on the basis that IV should be based on a larger and timelier information set. In a related yet different context, Becker, Clements, and White (2007) examine whether a particular implied volatility index derived from S&P 500 option prices, the VIX, contains any information relevant to future volatility beyond that reflected in model based forecasts. As they conclude that the VIX does not contain any such information, this result appears at first sight to contradict the previous findings summarised in Poon and Granger (2003). However, no forecast comparison is undertaken in Becker et al. (2007), and they merely conjecture that the VIX may be viewed as a combination of MBFs.

This paper seeks to examine this contention in more detail, specifically examining the forecast performance of S&P 500 IV, relative to a range of MBFs and combination forecasts based on both classes (IV and MBF). In doing so, this paper addresses two outstanding issues raised by Poon and Granger (2003). Poon and Granger (2003) highlight the fact that little attention has been paid to the performance of combination forecasts, which are potentially useful, since different forecasting approaches capture different volatility dynamics. They also point out that little has been done to consider whether forecasting approaches are significantly different in terms of performance. By applying the model confidence set approach proposed by Hansen, Lunde, and Nason (2003a,b), this paper will determine whether combination volatility forecasts are statistically superior to individual model based and implied volatility forecasts. In doing so, this paper also readdresses the relative performance of IV forecasts.

The paper proceeds as follows. Section 2 outlines the data relevant to this study. Section 3 discusses the econometric models used to generate the various forecasts, along with the methods used to discriminate between the different forecast performances. Sections 4 and 5 present the empirical results and concluding remarks respectively.

2. Data

This study is based upon data from the S&P 500 Composite Index between 2 January 1990 and 17 October 2003 (3481 observations). To relate to the results of Becker et al. (2007), the same sample period is considered here. To address the research question at hand, estimates of both IV and future actual volatility are required.

The VIX index constructed by the Chicago Board of Options Exchange from S&P 500 index options constitutes the estimate of IV utilised in this paper. It is derived from out-of-the-money put and call options that have maturities close to the target of 22 trading days. For technical details relating to the construction of the VIX index, see Chicago Board Options Exchange (CBOE) (2003). While the true process underlying option pricing is unknown, the VIX is constructed to be a general measure of the market's estimate of average S&P 500 volatility over the subsequent 22 trading days (see BPT, Christensen and Prabhala (1998), and CBOE). Having a fixed forecast horizon is advantageous and avoids various econometric issues. This index has only been available since September 2003, when the CBOE replaced a previous implied volatility index based on S&P 100 options.[1] Its advantages in comparison to the previous implied volatility index are that it no longer relies on option implied volatilities derived from Black-Scholes option pricing models, that it is based on more liquid

[1] The new version of the VIX has been calculated retrospectively back to January 1990, the beginning of the sample considered here.