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The role of trading volume in volatility forecasting☆

Van Le*, Ralf Zurbruegg

Business School, University of Adelaide, Adelaide, SA 5005, Australia

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ABSTRACT

Current models of volatility generally either use historical returns or option implied volatility to generate forecasts. Motivated by recent findings in the strand of literature focusing on volume–return (price) volatility relationships, this paper proposes the introduction of trading volume into various ARCH frameworks to improve forecasts. In particular, ex-ante evidence indicates that the incorporation of option implied volatility and trading volume into an EGARCH model leads to outperformance over other alternate forecast approaches. Noticeably, abnormal returns obtained from trading simulation underscores the improvement in forecast accuracy to be economically significant. These results remain robust to different measures of volatility and volume and offers scope for investors to more accurately predict volatility in the future.

1. Introduction

Forecasting volatility has been the subject of much investigation by academics and practitioners in recent years, due to the increasing recognition of its great practical importance in derivatives pricing, risk analysis, and portfolio management. Given that volatility serves as a critical input in most financial asset pricing models, the question of whether its dynamics can be forecasted falls within the vast literature on the predictability of asset prices and market efficiency.

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* Corresponding author. Tel.: +61 8 8303 7100; fax: +61 8 8303 4368.
E-mail address: thi.t.le@adelaide.edu.au (V. Le).

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Despite the extensive literature in developing sophisticated models to forecast volatility dynamics [refer to Poon and Granger, 2003 for a review], little investigation exists on whether a synthesis between the research that focuses on option implied volatility and that of price–volume relationships can lead to an improved time series model for volatility forecasting. Our line of inquiry emerges from recent developments in two strands of studies independently existing in the literature which may give potential to improving forecasts. One investigates the dynamics of volatility driven by the market trading process to incorporate new information reflected in trading volume, while another seeks to capture the market expectation subsumed by option implied volatility. While independent forecasts can be estimated from single-factor models which are structured to extract the information content of each factor, anecdotal evidence gives higher merit to combining forecasts (Clemen, 1989; Becker, 2008). Besides, the appropriate incorporation of multiple factors may potentially offer an advanced forecasting model. It is documented in Poon and Granger's (2003) review that singular-factor time series models have some limitations which few empirical studies have attempted to overcome.

In this paper, the information content of option implied volatility and trading volume in forecasting the return volatility of individual stocks and the S&P 500 index in the US market will be tested for the period from 2 January 2003 to 30 June 2008. This study is necessary due to conflicting evidence surrounding whether additional information can be gleaned from option implied volatility. Work by authors such as Lamoureux and Lastrapes (1993), Mayhew and Stivers (2003) and Donaldson and Kamstra (2005) have shown mixed, if no improvement at all, in using option implied volatility over historical volatility in forecasting volatility.

In addition, the investigation into the information content of trading volume will provide further insight into three competing hypotheses currently upheld in the literature regarding the nature of the volume–volatility relation. The mixture of distribution hypothesis (MDH), proposed by Clark (1973), implies that the volume–volatility relation is simultaneous since they inherit a joint dependence on an underlying latent event and information flow variable. Hence, past volume does not contain any additional useful information on the future dynamics of volatility. Though the empirical confirmation of the hypothesis shows inconsistent results, its stance in the literature has firmly been established through the development of many influential theoretical models (Tauchen and Pitts, 1983; Andersen, 1996). In contrast, the sequential information arrival hypothesis (SIH) [see Copeland, 1976] and the noise trading hypothesis (Brock and LeBaron, 1996; Iori, 2002; Milton and Raviv, 1993) both suggest a lead-lag (causal) relation exists, and can be exploited for forecasting purposes. Given that we intend on incorporating volume into the forecasting model, results from our study can further elucidate the efficacy of the above models. Our particular approach not only can be intuitively appealing to determine the importance of any lag relationship that exists but also may prove to yield a beneficial improvement in the volatility forecast itself.

Our special interest in the information content of trading volume in volatility forecast rests on the scarcity of studies which link the volume–volatility relation with forecasting applications. This line of research has not yet been pursued vigorously in the past, either because of the conflicting evidence surrounding the nature of the volume–volatility relation (Lamoureux and Lastrapes, 1990a; Wagner and Marsh, 2005; Abu Hassan Shaari Mohd and Chin Wen, 2007) or due to discouraging results found in the earliest examinations of the role of volume in forecasting volatility (Brooks, 1998). Furthermore, it is important to note that the forecast performance of trading volume in those studies usually focused on statistical evaluations of the model, with little emphasis on examining trading strategies that may have led to a possible different conclusion. Some recent work by Donaldson and Kamstra (2005) did examine the role of trading volume in volatility forecasting by using it as a switching mechanism between the relative informativeness of ARCH and option implied volatility estimates. Although their results suggested forecasts did improve, volume only appeared as a dummy parameter switch and the results did not focus on possible economic viability of using the forecasts in trading strategies. In this paper we extend our investigation to evaluate whether the inclusion of trading volume does lead to tangible benefits from trading strategies, whilst modeling trading volume directly into our formulations.

Our study therefore intends to fill the gap in the literature by addressing the relative importance of stock and option trading volumes, combined with option implied volatility, in volatility forecasts to highlight the potential information captured from trading activities taken from both the stock and