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Can idiosyncratic volatility help forecast stock market volatility?

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Abstract

This paper examines the predictive power of idiosyncratic volatility in the context of daily stock market volatility dynamics. Specifically, the relative performance of various models of market volatility is considered with respect to whether idiosyncratic volatility is excluded or included as an explanatory variable in such models. Using high frequency data covering the thirty stocks within the Dow Jones Industrial Average (DJIA) index, the results indicate that the inclusion of idiosyncratic volatility leads to significant in-sample and out-of-sample improvements in the fit of all the volatility models considered. These results are shown to be relatively robust to the loss function adopted by the forecaster, with reasonable forecast accuracy improvements available to such forecasters.

JEL Classification: C53; G14

Keywords: Financial markets; Volatility forecasting; Loss function

1. Introduction

The importance of measuring and forecasting risk in financial markets has motivated a vast body of literature on the dynamics of asset return volatility (see Poon and Granger, 2003, for a comprehensive review). All of the models proposed in this body of literature are, without exception, based on the highly time-dependent nature of volatility in each of the markets considered. However, they differentiate themselves from each other by innovating in terms of model specification, by using alternative definitions of volatility, or by enriching the informational content of the model (see Franses and McAleer, 2002, for an overview of the models used in the context of financial markets). It is to the latter tranche of the literature that this paper contributes. In particular, we introduce and examine volatility models of DJIA index returns that explicitly allow for intraday variation in the overall amount of private information flow in the relevant market. We demonstrate that improved forecasts of market volatility can be obtained by doing this.

The information content of the volatility models proposed in the literature is ultimately based on one of three models, viz., *the mixture of distributions model* (Andersen, 1996; Clark, 1973; Epps & Epps, 1976; Foster & Viswanathan, 1993, 1995; Harris, 1987; Liesenfeld, 2001; and Tauchen & Pitts, 1983), *the sequential information arrival model* (Copeland, 1976; Jennings, Starks, & Fellingham, 1981), or *the*

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no-arbitrage martingale model (Ross, 1989). Despite differences in their underlying motivations, all of these models predict that the return volatility will be proportional to the (unobservable) rate of information arrival (i.e., information flow). Given this motivation, a number of studies have demonstrated that the performance of volatility models can be greatly improved by incorporating proxies for information flow in their specification. Perhaps most notably, the inclusion of contemporaneous trading volume within the specification of such models has been shown to lead to significant improvements in their fit to the data (see Karpoff, 1987, for an early survey, and Bessembinder & Seguin, 1993; Bollerslev & Jubinski, 1999; Lamoureux & Lastrapes, 1990; and Luu & Martens, 2003, for more recent examples). Despite these successes, trading volume may not be the most accurate measure of information flow. This is because trading volume may be driven by factors other than information flow; for example, trading may be liquidity motivated, and/or may be the result of divergent trader opinion. Indeed, many studies have found that lagged trading volume is not helpful in forecasting volatility (see, e.g., Brooks, 1998; Donaldson & Kamstra, 2005; Heimstra & Jones, 1994; Lamoureux & Lastrapes, 1994; and Richardson & Smith, 1994). For these reasons, an alternative measure of information flow is considered in the current paper.

The noisiness of the trading volume measure of information flow has motivated a number of authors to propose alternative measures of information flow. Most notably, in the context of volatility models, a number of studies have used either firm-specific news headlines (see, e.g., Berry & Howe, 1993; Kalev, Liu, Pham, & Jarnecic, 2004; Melvin & Yin, 2000; and Mitchell & Mulherin, 1994) or macroeconomic announcement data (see, e.g., Andersen & Bollerslev, 1998; Flannery & Protopapadakis, 2002; and Jones, Lamont, & Lumsdaine, 1998) as inputs into information flow measures. The disappointing performance of models based on these measures is often explained with reference to the nature of the information flow considered; specifically, these measures attempt to proxy *public*, as opposed to *private*, information flow.[1] Consequently, the large proportion of unexplained volatility is argued to be due to the effects of private information flow; see French and Roll (1986), Barclay, Litzenberger, and Warner (1990), and Jones, Kaul, and Lipson (1994), who find that return volatility is primarily driven by private information; and Darrat, Zhong, and Cheng (2005), who provide evidence in favour of this conjecture in the context of the relationship between return volatility and trading volume. Given this evidence, we consider a measure of private information flow, and examine its importance with regard to the dynamics of market return volatility.

As private information is more common with respect to firms and industries than to the broad market, we use a measure of idiosyncratic volatility as our proxy for private information flow. This particular reasoning is commonly associated with Roll's (1988) conjectures that stocks with high (low) levels of idiosyncratic volatility are associated with either high (low) rates of '*private information* [flow]' or an '*occasional frenzy unrelated to concrete information*'. Despite a large number of papers demonstrating the empirical validity of the former conjecture with ever richer cross-sectional (firm-specific) datasets (Durnev, Morck, Yeung, & Zarowin, 2003; Durnev, Morck, & Yeung, 2004; Ferreira & Laux, 2007; Jin & Myers, 2006; and Morck, Yeung, & Yu, 2000),[2] few (if any) studies have examined the issue using aggregate intraday time series data.[3] This is somewhat surprising, given that if there is indeed a positive cross-sectional association between private information flow and idiosyncratic volatility, then this relationship should hold in aggregate (and over time), and hence we should expect to observe a positive time series relationship between aggregate idiosyncratic volatility and aggregate private information flow. Furthermore, given that return volatility is a positive function of private information

[1] The key distinction between public and private information is that the former affects prices as soon as it becomes known, while the latter is revealed over time through the action of trading (French & Roll, 1986).

[2] Kelly (2007) provides counter-evidence that suggests that idiosyncratic volatility is unrelated to private information.

[3] Campbell, Lettau, Malkiel, and Xu (2001) and Duffee (2001) both find, inter alia, that monthly frequency market volatility is positively associated with (aggregate) idiosyncratic volatility — a result consistent with the arguments that idiosyncratic volatility and private information flow are positively related, and that market volatility is positively associated with private information flow. However, these studies choose to rationalise their results via the argument that both market and idiosyncratic volatilities co-vary with future economic conditions.