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Information demand and stock return predictability

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ABSTRACT

Recent theoretical work suggests that signs of asset returns are predictable given that their volatilities are. This paper investigates this conjecture using information demand, approximated by the daily internet search volume index (SVI) from Google. Our results reveal that incorporating the SVI variable in various GARCH family models significantly improves volatility forecasts. Moreover, we demonstrate that the sign of stock returns is predictable contrary to the levels, where predictability has proven elusive in the US context. Finally, we provide novel evidence on the economic value of sign predictability and show that investors can form profitable investment strategies using the SVI.

1. Introduction

The question of whether stock market returns contain a predictable component has attracted much attention from both academics and market participants. As a result, numerous financial and macroeconomic variables have been employed to address the issue (see, *inter alia*, Rozeff, 1984; Campbell and Shiller, 1988; Fama and French, 1988; Hodrick, 1992; Lamont, 1998; Pontiff and Schall, 1998; Lettau and Ludvigson, 2001; Boudoukh et al., 2007; Kellard et al., 2010; Andriosopoulos et al., 2014; Jordan et al., 2014) while a plethora of approaches and testing procedures have emerged in the literature making the overall assessment an extremely difficult task (e.g., Goetzmann and Jorion, 1993; Nelson and Kim, 1993; Ferson et al., 2003; Inoue and Kilian, 2004; Amihud and Hurvich, 2004; Lewellen, 2004).[1]

However, although the empirical evidence on return predictability is mixed when we consider stock returns in the levels, there is a smaller body of literature which suggests that it is more likely to predict the signs of stock returns instead (see Breen et al., 1989; Pesaran and Timmermann, 2000, 1995; Christoffersen et al., 2007; Nyberg, 2011; Chevapatrakul, 2013). An important development in this area is the recent theoretical work by Christoffersen and Diebold (2006) which suggests that the sign of stock returns is predictable given that their volatilities are.[2] The intuition behind this relationship is that

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[1] For a comprehensive and up-to-date overview of stock return predictability, see Rapach and Zhou (2013).

[2] A voluminous literature on volatility predictability exists which is not reviewed here. For the importance of this topic and for detailed evidence, see Schwert and Seguin (1990), Pagan and Schwert (1990), Hsieh (1991), Brooks (1998), and Poon and Granger (2003, 2005).

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any changes in volatility will alter the probability of observing negative or positive returns. More specifically, a rise in volatility increases the probability of a negative return, given that the expected returns are positive. Christoffersen and Diebold (2006) point out that sign predictability may exist even if there is no mean predictability, while it is also independent of the shape of the return distribution. Such sign predictability can be particularly useful for creating profitable investment strategies.

Building on the work of Christoffersen and Diebold (2006), which provides a more concrete framework for sign predictability, we empirically investigate whether improved volatility forecasts, via a measure for information demand, can indeed lead to better sign forecasts of stock returns. Given that stock return predictability in the levels has been proven difficult to detect in the US context (see, Bossaerts and Hillion, 1999; Goyal and Welch, 2003, 2008; Kostakis et al., 2015), it is of particular interest to investigate whether the sign of US stock returns can be predicted instead. Additionally, we investigate whether such sign return predictions can be exploited to form profitable trading strategies from the perspective of investors. This is important for two reasons. First, statistical significance does not necessarily translate into economic gains for investors (Leitch and Tanner, 1991; Andriosopoulos et al., 2014) and second, apart from the theoretical contribution of Christoffersen and Diebold (2006), there is no empirical evidence regarding the economic value of sign predictability based on their model.

To achieve our goal, we turn to the link between return volatility and information flow. As suggested by Ross (1989), the return volatility is directly related to the rate of flow of information to the market. Hence, information about an event occurring (i.e. a signal) will affect the volatility of stock returns and more so if the informational content of this event is low (Gerlach, 2005; Li, 2005). In this case, the demand for information will increase up to the point that the prevailing ambiguity about the state of the world is resolved (Moscarini and Smith, 2002). In other words, the demand for information about an event is directly related to the "quality" of a signal, which is in turn related to return volatility. In a recent study, Vlastakis and Markellos (2012) construct a proxy for demand for information based on the internet "Search Volume Index" (SVI henceforth) from Google. Their analysis reveals a positive and significant contemporaneous relationship between the SVI and historical (and implied) measures of volatility in the US market. Vlastakis and Markellos (2012) also argue that in the networked world information discovery is shared between traditional information providers (such as those employed by sophisticated investors, e.g. Reuters) and alternative channels on the internet. It follows that information arrives on average at roughly the same time for both institutional and retail investors. Therefore, SVI captures the reaction of retail investors to the same signals that institutional investors observe and react to. Consequently, we expect that the use of the SVI as a measure for demand for information can lead to better volatility forecasts. To this end, we augment a number of GARCH family models with the daily SVI to construct better volatility forecasts. Subsequently, we obtain sign forecasts using the model of Christoffersen and Diebold (2006) which we compare against forecasts from various other competing models. Moreover, based on the produced sign forecasts we formulate appropriate trading strategies and examine whether a real-time investor would be able to exploit any sign predictability. Specifically, we adopt the framework of Granger and Pesaran (2000) and consider an investor who, at each period, has the option to invest her wealth either in stocks or in bonds. Therefore, in a dynamic setting, the investor maximizes her utility function using a time-varying optimal predictive rule to translate sign probability forecasts into investment decisions. Our empirical application uses daily data on the Standard & Poor's 500 (S&P 500) index and spans the period from January 2, 2004 through December 31, 2016.

Our contribution to the literature is threefold. First, we show that the most prominent candidate to predict the sign of daily stock returns is the model suggested by Christoffersen and Diebold (2006) when extended with the SVI variable. Specifically, we find that it outperforms all considered types of competing models either in their standard form or extended with a number of variables which have been shown to work well in previous studies on asset pricing and asset return sign forecasts. For instance, based on the Brier score which is a commonly used scoring rule to evaluate probability forecasts, it produces on average 2.6% more accurate return sign forecasts compared to a naive model which only considers the proportion of positive past returns. This finding highlights the usefulness of the demand for information measure (SVI) in predicting the sign of US stock returns. This is a novel finding in the return predictability literature which is robust to different sample periods (both normal and volatile) and further confirmed by the Diebold and Mariano (1995) test statistic of equal predictive accuracy.

Second, our study offers evidence which suggests that the model by Christoffersen and Diebold (2006) exhibits a good performance in terms of economic value. Moreover, we show that the inclusion of the SVI variable can enhance this model and lead to even higher economic gains for investors. This is the first study to confirm the efficacy of the aforementioned model for real-time investors and to also suggest a new variable that further improves its performance. For example, we find that an active trading strategy that utilises the SVI variable within the Christoffersen and Diebold (2006) framework produces a higher return and a lower standard deviation, which results in a higher Sharpe ratio compared to a simple buy and hold strategy. Our results in this context are robust to different utility functions, levels of risk aversion and estimates of transaction costs. Furthermore, our conclusions remain unaffected under different realistic scenarios (with or without short-sales) and measures of economic value. Third, we demonstrate that the inclusion of the SVI variable in all considered GARCH family models leads to superior stock market volatility forecasts. This finding extends an emerging literature which establishes a relationship between measures of demand for information and asset return volatility (e.g., Vlastakis and Markellos, 2012; Andrei and Hasler, 2015; Vozlyublennaia, 2014; Da et al., 2015; Dimpfl and Jank, 2016; Goddard et al., 2015).

Overall, this study answers calls for research on formulating strategies and assessing their profitability based on sign forecasts (Christoffersen and Diebold, 2006) while it complements the literature by providing new empirical evidence on how investors' attention and reaction to new information can enhance the predictability of asset return signs.