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Histogram-based prediction of directional price relatives

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ABSTRACT

A model of directional prediction of price relatives is proposed following the histogram-based scheme developed in Györfi et al. (2006). This methodology allows us to exploit potential information contained in multivariate series of price relatives. The impact of the model is studied from the perspective of an economic agent through the use of double linear loss functions. A numerical example with real data is presented to illustrate the model.

1. Introduction

Since the seminal work by Henriksson and Merton (1981), the directional forecast of financial variables has become one of the most challenging and fundamental problems in the financial modeling. Because of the academic relevance of the topic and the immediate benefits that the study of return signs produce from a practitioner's point of view, it comes as no surprise the growing literature that this topic has generated along the past years. Also, since the same techniques can be applied to the predictability of economics variables such as aggregate demand or industrial production, directional prediction has expanded to more general economic settings (e.g. Ash et al., 1998).

From a theoretical point of view, one of the main reasons that explains the importance of directional predictability lies in the implications that its potential success has in contesting the efficiency of capital markets. Economic theory suggests that returns and therefore direction of change of returns

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should not be easily forecast: if markets are efficient then all the relevant information is embodied in the prices of the traded assets. Substantial evidence supporting return sign predictability would thus incur a violation of the Efficient Market Hypothesis. However, there is a mixed literature supporting (Fama, 1991) and rejecting the theory. Linton and Whang (2007), Hong and Lee (2003), Cheung et al. (2005), White (2000) or Pesaran and Timmermann (2002), just to mention a few, find strong evidence on directional predictability of financial variables. Therefore, as seen in Hong and Chung (2003), the study of sign predictability is a practical tool to test the efficiency of markets.

From a practical point of view, an accurate directional forecast is also important since many portfolio techniques are founded on a correct prediction of the direction of time series. For example, some technical trading rules are based on the detection of turning points in the market. Naturally, an investor goes long in the asset if the price of the asset is expected to go up and goes short in the asset if it is expected to go down, so market timing is a key component of active asset allocation strategies. In real investment, direction-of-change prediction may provide relevant information about changes in business cycles to market participants. Also policymakers, regulators and agencies benefit of the directional predictability of economic magnitudes such as inflation rates, GDP or foreign exchange rates. These forecasts help to monitor economic policies and might reflect the need of intervention if the forecasts exceed certain thresholds.

All this wide variety of reasons explain why there is still a strong body of ongoing research in the topic. Different methodologies have been proposed and tested in the literature to study the predictability of the direction of financial variables. For example, Chung and Hong (2007) examine the directional predictability of foreign markets using a model-free approach. Christoffersen and Diebold (2006) study the dependence between volatility dynamics and directional market movements. Bekiros and Georgoutsos (2008) explore the profitability of trading rules based on the prediction of return signs and, more recently, Anatolyev and Kryzhanovskaya (2009) compare the predictability of return signs for different statistical models.

In this point we want to empathize that the vast majority of works in the topic only consider the predictability of univariate time-series. Very few studies take into account the information contained in historical data of join returns or price relatives. So, the potential information available in the dependence structure of returns is not used and exploited to yield directional forecasts. Moreover, join predictions of sign returns are not considered and as a result the relevant variables are treated as if they were independent when generating directional forecasts.

With the aim to utilize the information provided by multivariate series price relatives, in this paper we expand the literature on direction-of-change prediction through a methodology based on the discretization scheme proposed in Györfi et al. (2006). This approach allows us to construct nonparametric estimates of the direction of price relatives exploiting nonlinearities and hidden dependencies in multivariate series that would be otherwise difficult to reveal. Trough the use of different prediction strategies, we analyze the impact of directional forecasts from the perspective of economic agents. A strength of this approach is that it makes possible the study of directional predictability of price relatives without having to identify the factors that might determine its success.

This article is organized as follows. Section 2 introduces the mathematical setup. Section 3 introduces the model and methodology. Section 4 discusses the empirical results and finally, Section 5 concludes.

2. Setup

2.1. Discretization scheme

The core of the method is to consider different prediction strategies. We can think of each strategy as a different forecaster (k, l) who tries to forecast the direction of returns (defined as price relatives) of the assets contained in the portfolio. In order to generate a forecast, each forecaster examines the series of past returns and collects those with a history of join returns similar to the current performance of the assets. Next, she uses that information to yield a directional forecast. Note that each forecaster is characterized by the combination of two parameters, k and l. As we will see later, the parameter l de-