ELSEVIER

International Journal of Forecasting 19 (2003) 369–385

international journal of forecasting

www.elsevier.com/locate/ijforecast

The predictability of asset returns: an approach combining technical analysis and time series forecasts

Yue Fang[a,*], Daming Xu[b]

[a]*Lundquist College of Business, 1208 University Of Oregon, Eugene, OR 97403, USA*
[b]*Department of Mathematics, University of Oregon, Eugene, OR 97403, USA*

Abstract

We investigate predictability of asset returns by developing an approach that combines technical analysis and conventional time series forecasts. While exploiting predictable components as functions of past prices or returns, technical trading rules and time series forecasts capture different aspects of market predictability: the former tends to identify periods to be in the market when returns are positive and the latter is capable of identifying periods to be out when returns are negative. Applied to daily Dow Jones Averages over the first 100 years, the combined strategies outperform both technical trading rules and time series forecasts. The predictability can be explained largely by non-trivial low-order serial correlations in returns and is not mainly attributable to measurement errors arising from non-synchronous trading.

Keywords: AR-GARCH models; Combining forecasts; Excess returns; Predictability; Technical trading rules

1. Introduction

Various empirical studies have documented substantial evidence on the predictability of asset returns (Fama & French, 1988; Lo & MacKinlay, 1988; Poterba & Summers, 1988; Brock, Lakonishok, & LeBaron, 1992; Chan, Jegadeesh, & Lakonishok, 1996; Bessembinder & Chan, 1998; Allen & Karjalainen, 1999; Lo, Mamaysky, & Wang, 2000). Their studies suggest that asset returns are correlated, and hence, predictability can be captured, at least to some degree, by technical trading rules or by certain time series models. The primary purpose of this paper is to demonstrate how one can develop trading strategies which combine technical analysis and time series forecasts.

This paper differentiates itself from previous studies in the literature in the following aspects. Most empirical work has studied technical trading rules and time series models—in isolation. This is ultimately not satisfactory because, as shown in this study, technical trading rules and time series models are able to identify different predictable components. We develop an approach combining technical analysis and time series forecasts and apply it to Dow Jones Averages. Unlike most of the previous studies which focused only on the Dow Jones Industrial Average, we study all three Dow Jones Indexes (namely Industrial, Transportation and Utilities Aver-

*Corresponding author. Tel.: +1-541-346-3265; fax: +1-541-346-3341.

E-mail addresses: yfang@darkwing.uoregon.edu (Y. Fang), dxu@math.uoregon.edu (D. Xu).

0169-2070/02/$ – see front matter
doi:10.1016/S0169-2070(02)00013-4

ages) and apply exactly the same trading rules to them to test the robustness of our findings. In addition, a more extended sample period in comparison with those considered in previous studies (e.g. Brock et al., 1992; Bessembinder & Chan, 1998) is covered. The use of an expanded dataset is important since repeated visits of the same dataset could lay to suspicion of data snooping. Furthermore, we use rolling techniques to generate out-of-sample forecasts to guard against overfitting in time series modeling and avoid a potential bias induced by ex post selection.

Our main findings are as follows. Firstly, trading strategies combining technical analysis and time series forecasts are superior to either technical trading rules or time series forecasts. The fact that technical trading rules and time series forecasts are asymmetric in the opposite directions during buy and sell periods: the former tends to identify periods to be in the market when returns are positive and the latter is capable of identifying periods to be out when returns are negative, provides a striking evidence of their complementary properties. The combined trading strategies yield higher returns during both buy and sell periods and require fewer transactions than either technical trading rules or time series models. To examine the possibility of excess returns after accounting for transaction costs, we calculate the break-even costs for all trading strategies considered. For three Dow Averages over the full sample period, the average break-even costs for technical trading rules are between 0.6 and 0.8%. Those for time series models are small (less than 0.3%) due to the large number of transactions required. In all the cases considered, we found that the break-even costs for combined strategies, ranging from about 1.0% to more than 1.9%, are always greater than those from the corresponding technical trading rules.

Secondly, the robustness of the results across various subperiods supports our conclusions drawn from the full sample. Consistent with many earlier studies which documented that the forecasting ability of technical trading rules declined over the past decades, the predictability in returns from the combined trading strategies also deteriorates in recent years. For example, the average break-even costs of combined trading strategies for the Industrial Average in the subperiods from 1921 to 1969 are in excess of 1.2%, higher than the 1.0% level after 1970.

Thirdly, our results suggest that across the trading strategies examined, the Industrial Average is the most difficult to predict, as indicated by low levels in both excess returns over the buy-and-hold (pre-trading cost) and break-even costs. Over the sample period considered there seems no obvious difference in break-even costs between the Transportation and Utilities Averages.

Finally, since there is growing consensus among financial economists that non-synchronous trading induces spurious serial dependence in index returns (Scholes & Williams, 1977; Lo & MacKinlay, 1990), we investigate the sensitivity of returns to implementation of a 1-day lag, in which trading returns are measured beginning 1 day after a trading signal is initiated. Overall, the break-even costs for both technical trading and combined strategies reduce slightly in percentage after the non-synchronous adjustment, especially during subperiods before 1971. Therefore, the forecasting ability is not mainly attributable to return measurement errors arising from non-synchronous trading.

The paper is organized as follows. Section 2 is devoted to some preliminary analysis of the data. Section 3 studies technical trading rules and forecasts based on conventional time series models. Section 4 contains analysis of combined trading strategies, and addresses the robustness of the results. We summarize and conclude in Section 5.

2. Data description and preliminary analysis

As three of the most influential indicators in the US stock market, the Dow Jones Averages are commonly used not only to assess the state of the economy but also to serve as the basis of some investable products.[1] The data used in this study are three daily Dow Jones Averages which are price-

[1]Futures and options on the Industrial Average have been traded on the Chicago Board Options Exchange and the Chicago Board of Trading since October 6, 1997. Also, on January 20, 1998, the American Stock Exchange began trading shares in a fund that holds stocks in the Dow Jones Industrial Average.