DYNAMIC ASSET ALLOCATION USING A COMBINED CRITERIA DECISION SYSTEM

Giuseppe Galloppo, CEIS, University of Rome Tor Vergata

ABSTRACT

In this paper we examine the predictability of asset returns by developing an approach that combines quantitative methods of forecasting, based on technical analysis. As an innovation we introduce a multiple criteria decision system making simultaneous use of trend indicators and other confirming indicators. By combining trend indicators with confirming indicators it is possible to build a superior technical trading strategy that captures a more comprehensive aspect of predictability in past prices. This study also proposes a test for weak form efficiency based on a combining approach. Previous approaches typically make inferences based on the empirical results of testing only one class of technical rules. Applying the combining criteria decision system the evidence suggests that the strategies proposed here have predictive ability on a data sample based on three European stocks Index Markets. Our results rejects the null hypothesis that the returns earned from applying trading rules are equal to those achieved from a naive buy and hold strategy, even after deducting transaction costs. Evidence also suggests that oscillators capture some aspect of predictability in past prices that moving averages do not detect.

JEL: G12: G14

KEYWORDS: Technical Analysis, Market Timing, Efficient Market Hypothesis

INTRODUCTION

Technical analysis involves the prediction of asset price movements from inductive analysis of past movements, using either qualitative methods, qualitative methods or a combination of both. Qualitative methods include recognizing certain visual patterns in the data. Quantitative techniques involve analyzing moving averages and oscillators. Pring (2002), a leading technical analyst, provides a more specific definition: "The technical approach to investment is essentially a reflection of the idea that prices move in trends determined by the changing attitudes of investors toward various economic, monetary, political, and psychological forces". Despite its widespread acceptance and adoption by practitioners, Malkiel (1981) described technical analysis as an ''anathema to the academic world''. This is due to its conflict with market efficiency, one of the central pillars of academic finance. Jensen (1978) developed a detailed definition: 'A market is efficient about information set θt if it is impossible to make economic profits by trading assuming information set θt'. In an efficient market, prices reflect information to the point where the potential risk-adjusted excess returns of acting on information do not exceed the cost of doing so. Jensen's definition implies that market efficiency may be tested by considering the net profits and risk of trading strategies based on information set θt.

The remainder of the paper is organized as follows. In the next section we discuss the relevant literature. Sections that discuss the data and methodology used in the study follow. Next, the empirical results are presented. The paper closes with some concluding comments.

LITERATURE REVIEW

Early academic studies of technical analysis by Alexander (1964) find that transaction costs erode technical analysis profitability. This finding, which is consistent with market efficiency, resulted in few further technical analysis studies over the next twenty years. In the 1990s, with easy accessibility to

financial data banks and greater computer power, came a thorough demonstration of the benefits of technical trading rules, and thus many researchers studied the possibility of forecasting financial asset returns. There has been a growing recognition that the introduction of nonlinearities in the modelling approach could allow one to explain certain price movements that seemed previously random. Our skeletal literature review focuses on papers published since the turn of the century. Although the impact of single technical trading rules over major financial markets worldwide has been studied extensively, combined technical trading systems have rarely received enough attention. Fang and Xu (2003), explore predictability of asset returns by developing an approach that combines technical analysis and conventional time series forecasts. They find technical trading rules and time series forecasts capture different aspects of market predictability. The former identifies periods to be in the market when returns are positive and the latter identifies 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. Nontrivial low-order serial correlations in returns can largely explain the predictability. Chen and Li (2003) use daily stock prices and the trading volume of 39 constituent companies in the Shenzhen Stock Exchange Index to examine the usefulness of technical analysis. It finds weak evidence to support the view that traders or technical analysts can learn more about the future pattern of returns by actively using volume, in conjunction with returns, than those who only watch price movements. In the article of Rogovska-Ischuk (2006), the author offers a new classification of technical methods, which includes a synergic approach as one of the forecasting instruments. In the paper there is a choice of the most effective methods for every pair, and suggests a way of using the synergic approach with classical methods. Marshall and Cahan (2005), examines trading strategies for predicting stock price movements by applying a combination of technical analysis and time series forecasts to the five Asian-Pacific stock markets of Australia, Indonesia, Japan, Malaysia and Singapore. Evidences shows how technical analysis may be improved by incorporating forecasting approaches. Fock, Klein, and Zwergel (2005) put one very popular charting technique, the "candlestick" method, to the test. They start by developing specific criteria for a set of basic candlestick patterns, and then measure predictive performance with intraday data from two major futures, the DAX stock index contract, and the Bund interest rate future.

The authors find no evidence of predictive ability from candlestick patterns alone, or in combination with other common technical indicators, like momentum. However more attention in the literature, also in 2000s, has been paid to single rule approaches. The study of Mitra (2002) employs the Simple Moving Average (SMA) and the Displaced Moving Average (DMA) trading rules to test the weak form efficiency of the Indian equity markets. Results provide sufficient evidence the DMA indicator is a successful trading rule that created profitable signals even after adjusting for transaction and other costs. The purpose of the Park and Irwin (2007) paper is to review the evidence on the profitability of technical analysis. The empirical literature is classified into two groups, 'early' and 'modern' studies, according to the characteristics of testing procedures. Early studies point out that technical trading strategies are profitable in foreign exchange markets and futures markets, but not in stock markets. Modern studies show that technical trading strategies consistently generate economic profits in various speculative markets at least until the early 1990s. Among 95 modern studies, 56 studies find positive results of technical trading strategies, 20 studies earn negative results, and 19 studies suggest mixed results. Atmeh and Dobbs (2006) study how moving average trading rules performing in an emerging market context, namely that of the Jordanian stock market.

The conditional returns of buy or sell signals from actual data are examined for a range of trading rules. These are compared with conditional returns from simulated series generated by a set of models (random walk with a drift, AR(1), and GARCH-(M)). The empirical results show that technical trading rules can help to predict market movements, and there is some evidence that (short) rules may be profitable after allowing for transactions costs. Glezakos and Mylonas (2003) explores the forecast power of technical analysis in the equity markets by applying simple technical trading rules to the Athens General Index and

DAX. The results produce evidence that technical analysis is a valuable investment tool even after deducting transaction costs, especially in Athens Stock Exchange. Reitz (2006) provides a possible explanation for the Technical Analysis puzzle that goes beyond the standard self-fulfilling prophecy argument. If at least some of the asset price fundamentals are not currently observable, the oscillator model is able to infer regime shifts in the stochastic process of these variables through past asset prices. From this view, technical analysis can be interpreted as a cheap proxy for Bayesian learning.

In this paper we research whether by combining some typical technical rules named "oscillators" with moving averages; a superior technical trading strategy can be developed. In this way the use of so called confirming indicators, from oscillators, significantly improves forecast power and should make it possible to more effectively capture the information content in past prices. If the hypothesis is true, technical analysis should enable a trader to earn profits larger then those that come from a naïve buy and hold strategy. The remainder of the paper is organized as follows: data employed in this study and methodology is presented in Section 2 where outlines the technical trading rules. These rules also form the basis of the test for weak form efficiency (*EMH*). Section 3 reports and compares the empirical results of testing the different technical trading strategies for three European Stock Index and Section 4 closes the paper.

METHODOLOGY

This paper mainly distinguishes itself from previous studies, in the literature, in the following aspect. Most empirical work has studied technical approaches in isolation. This is not satisfactory because, as shown in this study, different technical trading rules are able to identify different predictable items. Literature and heuristic evidence shows that market action reflects its behaviour in two ways: trending and trading. A trending market refers to the presence of a strong price trend while in trading range markets; the price is going nowhere. During a period of time when the market is in a strong trend, tools like moving averages give a clue for timing to produce a market order. Another widely used technical tool is the class of indicators, or so called oscillator rules which range from overbought to oversold territory, they do not provide much evidence of a trending market while they are useful for large in trading range markets. These arguments suggest to us that technical trading rules, and particularly moving average and oscillator, are asymmetric in the opposite directions during trending and trading periods providing striking evidence of their complementary properties.

Since this study is based on joint use of different technical analysis approaches, we focus on the most commonly used basic trading strategy employed by technical analysts – a combination of moving averages and oscillators. By combining trend indicators with confirming indicators that are also based on the detection of trends in past prices, it is possible to build a superior technical trading strategy that captures a more comprehensive aspect of predictability in past prices. According to authors of popular practitioner guides to technical analysis such as Patel (2000), Bail (2005) and Nison (2005), most technical analysts use at least one momentum indicator when trading. In this study we have applied a strategy involving the following indicators: RSI, Stochastic, ADX, MACD and Price Oscillator. A simple moving average rule would signal an imminent break in trend, or the emergence of a new trend, when the moving average is crossed by the spot price or by a shorter moving average. Thus, an imminent upward break in trend for the stock price, p_t, might be signalled by a short moving average of length $m>1$, $MA_t(m)$, intersecting from below a longer moving average of length n ($n>m$), $MA_t(n)$, that is:

$$MA_t(j) = \frac{1}{j}\sum_{i=0}^{j-1} p_{t-i}, j = m, n \quad (1)$$

Conversely, a downward break in trend would be signalled by the short moving average crossing the long moving average from above. Indicators of this kind will be profitable in markets showing definite trends and so they are generically known as "trend following" or "momentum" indicators.
The following describes the way in which the MA rules emit buy and sell signals. A buy (sell) signal is emitted when the SMA_t intersects the LMA_t from below (above):

$$b_t : SMA_t > LMA_t \quad and \quad SMA_{t-1} < LMA_{t-1} \tag{2}$$

$$s_t : SMA_t < LMA_t \quad and \quad SMA_{t-1} > LMA_{t-1} \tag{3}$$

For the cross signal, as per previous studies in literature, we use the 1-day moving average (the raw price). The calculation of the *RSI t,p* at time *t* of period *p* uses only closing prices and is the ratio of up-closes, *Ui,* to down-closes, *Di*, over the time period selected. This computation expresses itself as an oscillator that has a range of 0 to 100. The calculation starts by defining an index set $I_{t,p} = \{i : t - p \le i \le t\}$ allowed by defining the up-closes and down-closes:

$$U_i = \begin{Bmatrix} C_i - C_{i-1} & if & C_i > C_{i-1} \\ 0 & otherwise & \end{Bmatrix} \quad \text{and} \quad D_i = \begin{Bmatrix} C_{i-1} - C_i & if & C_{i-1} > C_i \\ 0 & otherwise & \end{Bmatrix} \tag{4}$$

for any $i \in I_{t;p}$ and *Ci* is the closing price for period *i*. The next step is to define:

$$\overline{U}_{t,p} = \text{Average of } U_i \text{ over } I_{t,p} \text{ and} \qquad \overline{D}_{t,p} = \text{Average of } D_i \text{ over } I_{t,p} \tag{5}$$

(7)

and after that the relative strength (*RS*) and the *RSI* at time *t* for period *p* is given as follows:

$$RS_{t,p} = \frac{\overline{U}_{t,p}}{\overline{D}_{t,p}} \qquad \text{and} \qquad RSI_{t,p} = 100 - \frac{100}{1 + RS_{t,p}} \tag{6}$$

The RSI thus attempts to measure the strength of "up movements" relative to the strength of "down movements", and is normalized to lie between 0 and 100; common values at which a particular stock is believed to have been overbought (signalling an imminent downward correction which could be associated with a sell signal) or oversold (signalling an imminent upward correction which could be associated with a buy signal) are 70 and 30, respectively (see, e.g. Henderson, 2002). Developed by Gerald Appel, Moving Average Convergence/Divergence (MACD) is one of the simplest and most reliable indicators available. These lagging indicators are turned into a momentum oscillator by subtracting the longer moving average from the shorter moving average. The resulting plot forms a line that swings above and below zero, without any upper or lower limits. The most popular formula for the "standard" MACD (*differential line*) is the difference between a security's 26-day and 12-day Exponential Moving Averages (EMA):

$$DL_t = EMAf_t - EMAs_t \tag{7}$$

Where:

$EMAf_t$ = exponential moving average with time span of 12 period;
$EMAs_t$ = exponential moving average with time span of 26 period.

Usually, a 9-day EMA of MACD is plotted alongside to act as a trigger line. The most common signal for MACD is the moving average crossover. A Bearish Moving Average Crossover occurs when MACD declines below its 9-day EMA. A Bullish Moving Average Crossover occurs when MACD moves above its 9-day EMA, or trigger line.

The Price Oscillator is an indicator based on the difference between two moving averages, and is expressed as either in absolute terms

$PO_t = MAf_t - MAs_t$ or. as a percentage: $PO_t = [(MAf_t - MAs_t)/ MAf_t] \times 100$ (8)

Where: PO_t = *Price oscillator*, MAf_t = fast moving average, MAs_t = long moving average.

The DMI, Directional Movement Index, is a trend following system. Wilder (1978) defines directional movement as the largest part of the current trading range that is outside the previous trading range. From a mathematical view, it is the largest value of the following differences: $High_t - High_{t-1}$ or $Low_t - Low_{t-1}$, This is only true when the current low is less than the previous low, or the current high exceeds the previous high. Please note that both of these conditions do not have to be met, only one. It is the largest portion of the trading range outside the previous trading range. You must first estimate the directional movement, DM, for the current trading interval. Directional movement can be up, down or zero. When used with the up and down directional indicator values *(dm+)* and *(dm-)*, the DMI is an exact trading system.

State with *t-1* and *t* two sequential temporal units, we have defined before:

Positive Directional Movement *(dm+)* for which $(H_t - H_{t-1}) > 0$ and $(L_t - L_{t-1}) \geq 0$;

in this case we have: $dm_t = (H_t - H_{t-1})$ and $dm_i = 0$

-Negative Directional Movement *(dm-)* for which $(H_t - H_{t-1}) \leq 0$ and $(L_t - L_{t-1}) < 0$;

in this case we have: $dm_i = |L_t - L_{t-1}|$ and $dm_t = 0$

- Zero Directional Movement for which $(H_t - H_{t-1}) \leq 0$ and $(L_t - L_{t-1}) \geq 0$

in this case we have: $dm_t = dm_i = 0$

- Double Directional Movement for which $(H_t - H_{t-1}) > 0$ e $(L_t - L_{t-1}) < 0$ in this case we have:

$(H_t - H_{t-1}) > |L_t - L_{t-1}| \rightarrow dm_t^+ = (H_t - H_{t-1})$ and $dm_i = 0$

$(H_t - H_{t-1}) < |L_t - L_{t-1}| \rightarrow dm_t^- = |L_t - L_{t-1}|$ and $dm_t = 0$

Wilder (1978) the DMI creator states that for an average process, based on a 14 time span, of the previous amounts we get two variables:

$$DM^+_{14+n} = \frac{\sum_{i=1}^{14} dm_i^+}{14} \quad \text{and} \quad DM^-_{14+n} = \frac{\sum_{i=1}^{14} dm_i^-}{14} \tag{9}$$

This is the same span Wilder used on daily data. His logic for using this value is that it represented an average half-cycle period. After epoch for t =14 *DM+* and *DM-* values are calculated by:

$$DM^+_{14+n} = \frac{1}{14}\left[\left(\frac{13}{14}\right)^n \sum_{i=1}^{14} dm_i^+ + \sum_{j=1}^{14}\left(\frac{13}{14}\right)^{n-j} dm^+_{14+j}\right] \text{ and } DM^-_{14+n} = \frac{1}{14}\left[\left(\frac{13}{14}\right)^n \sum_{i=1}^{14} dm_i^- + \sum_{j=1}^{14}\left(\frac{13}{14}\right)^{n-j} dm^-_{14+j}\right] \tag{10}$$

Wilder (1978) prefers to use an accumulation technique rather than computing a pure moving average. The next step in setting the DMI is to calculate the true range. According to the author, the true range is the largest value of the following equations:

$$tr_t = Max\left[(H_t - L_t); \left|C_{t-1} - H_t\right|; \left|C_{t-1} - L_t\right|\right] \tag{11}$$

Following Wilder (1978) a synthetic measure becomes true:

$$TR_{14} = \frac{\sum_{i=1}^{14} tr_i}{14} \quad \text{and} \quad TR_{14+n} = \frac{1}{14}\left[\left(\frac{13}{14}\right)^n \sum_{i=1}^{14} tr_i + \sum_{j=1}^{14}\left(\frac{13}{14}\right)^{n-j} tr_{14+j}\right] \tag{12}$$

Once the average values are determined it is possible to estimate the directional indicator. Again, it can either be up or down, depending on the directional movement:

$$DI_{14}^{+} = \left[\left(DM_{14}^{+}\right)\left(TR_{14}\right)^{-1}\right]100 \text{ and } DI_{14}^{-} = \left[\left(DM_{14}^{-}\right)\left(TR_{14}\right)^{-1}\right]100 \tag{13}$$

And for t>14 we have:

$$DI_{14+n}^{+} = \left[\left(DM_{14+n}^{+}\right)\left(TR_{14+n}\right)^{-1}\right]100 \text{ and } DI_{14+n}^{-} = \left[\left(DM_{14+n}^{-}\right)\left(TR_{14+n}\right)^{-1}\right]100 \tag{14}$$

Once the amounts above have been estimated the DX or directional movement index is calculated. Again the absolute value of this difference is used. This value is always a percentage. The formula is:

$$DX_{14+n} = \left|\left[\left(DI_{14+n}^{+} - DI_{14+n}^{-}\right)\left(DI_{14+n}^{+} + DI_{14+n}^{-}\right)^{-1}\right]100\right| \tag{15}$$

The DX is always a value between 0 and 100. Wilder (1978) was not comfortable using just the directional movement index. It could become volatile during periods of extreme price movement, especially when markets rise and fall quickly. Again, he carries out his accumulated moving average technique to smooth the DX. The result is the ADX or average directional movement index.

The stochastic oscillator compares the closing price to the price range for the price range (high minus low) for the window period. To compose the stochastic oscillator, the following variables are first defined; $CL_t = P_t - \min(P_{t-1}, P_{t-2}, ..., P_{t-m})$ measures the difference between two values, the latest closing price and the lowest observed price over the window period, m, $HL_t = \max(P_{t-1}, P_{t-2}, ..., P_{t-m}) - \min(P_{t-1}, P_{t-2}, ..., P_{t-m})$ computes the difference between the highest closing price and the lowest observed price over the window period and $K_t = \frac{CL_t}{HL_t} \cdot 100$ which is simply the ratio of the latest closing range to the most recent trading range. To determine if an asset price is going down, Kt is compared against a signal line, D_t, which is simply a moving average of K_t: Practitioners view Dt as the signal line that separates 'overbought' and 'oversold' levels. A security is said to be overbought (oversold) when buying (selling) pressure increases its price to a high (low), which is expected to reverse soon. When the oscillator Kt rises above (falls below) Dt, technical traders believe that demand for the asset is increasing (decreasing) as the asset has moved from an oversold (overbought) to an overbought (oversold) position and a buy (sell) signal is then emitted. Therefore, the stochastic

oscillator confirms a buy (sell) signal when Kt is above (below) Dt. Focusing on primary target of this study a trading strategy based on both trend and oscillators then emit buy and sell signals as follows:

$$b_t : SMA_t > LMA_t \quad and \quad O_t = 1 \tag{16}$$

$$s_t : SMA_t < LMA_t \quad and \quad O_t = -1 \tag{17}$$

where:

$$O_t = \begin{cases} 1 \rightarrow oscillator \quad buy \quad signal \\ 0 \rightarrow oscillator \quad neutral \quad signal \\ 1 \rightarrow oscillator \quad sell \quad signal \end{cases}$$

Following the emission of a buy (sell) signal, the buy (sell) position is then maintained until the two indicators emit a sell (buy) signal or inconsistent signals. In system (16)-(17) buy and sell signals for oscillators are producing according to entry method proper of each indicator. Specifically, the following moving averages were tested: 3, 5 and 9-day simple MAs matching to short-term, 21 days for medium-term and 55 days for long-term. Oscillator time span for short strategy are 3, 5 and 9 days, 14and 21 days for both medium and long term. The profitability of technical trading rules depends on the trading strategy and, in particular, on what position the trader should take when the rule emits buy and sell signals. For each strategy (X(bs)), we estimate the daily return and then subtract from it the daily return from the buy-and-hold strategy to get the daily difference return. The null and alternative hypotheses are the following:

$$H_0 : X(bs) - X(bh) = 0 \text{ and } H_A : X(bs) - X(bh) \neq 0 \tag{18}$$

where X (bh) is the mean return for the buy-and-hold strategy. The test statistic for the mean buy returns over the mean buy-and-hold strategy is:

$$t = \frac{X(bs) - X(bh)}{\sqrt{\frac{Var(bs)}{N_{bs}} + \frac{Var(bh)}{N_h}}} \tag{19}$$

where *Var(bs)* and *Var(bh)* are the variance of combined rules system and buy-and-hold returns respectively. We have considered round-trip transaction costs as a measure of 0,0019 for every trading signal. Besides, a strategy return higher than the return of the BH policy suggests market inefficiency in the weak form. All results presented in this paper are based on tests conducted on the assumption that if a particular rule has given a signal and the holding period has not expired, then any following signals are ignored.

DATA

Daily price data for a sample of equity of Mibtel Index, Mib30 Index, Eurostoxx50 Index for the 1/1/2000–23/03/2007 period is used in this study. Open, high, low and close data that has been adjusted for capital structure changes are utilized. All data are sourced from Bloomberg. The reference data sample is identified as follows: (1) 7 stock (Alleanza, Alitalia, Capitalia, Enel, Fiat, Mediobanca, Pirelli) drawn by Mib 30 Index, that is Italian Blue Chips Index; (2) 7 stocks (Aedes, Brioschi, Cam-Fin,

Marzotto, Snai, Unipol, Zucchi) extract from Mibtel Index that is *Borsa Italiana* Stock Market index; (3) 7 stocks (Allied Irish Banks, Bbva, Deutsch Telekom, France Telecom, Iberia, Nokia, Telefonica) are drawn from Eurostoxx 50 Stock Index that is Europe's leading Blue-chip index for the Euro zone. To understand quickly and describe our sets of data some descriptive statistics are presented in Table 1.

Table1: Descriptive Statistics

	EX50	MIBTEL	SPMIB40
Mean	0.0002	0.0006	0.0005
Median	0.0020	0.0033	0.0026
Maximum	0.1456	0.1948	0.2136
Minimum	-0.1057	-0.1283	-0.1367
Std. Dev.	0.0289	0.0251	0.0272
Skewness	0.0386	0.3393	0.4337
Kurtosis	5.1603	14.7510	15.1037
Jarque-Bera	73.5973	2182.1010	2319.2280
Probability	0.0000	0.0000	0.0000
Sum	0.0728	0.2264	0.1941
Sum Sq. Dev.	0.3142	0.2381	0.2794
Observations	378	378	378

Table1 shows Stock Market Index main descriptive statistics for all sample periods.

EMPIRICAL RESULTS

This section reports the results of applying the previous technical trading strategies to European stock market data. To decide if the combined criteria's approach to technical analysis captures the information content in past prices more effectively, we perform two technical trading strategies. We compare: (a) simple trading rules working alone with a Moving average (MA) trading signal method and (b) MA rules with confirming oscillators. Table 2 reports the empirical results, for all sample period, by applying the previous simple trading strategies on the stock markets (Mib30, Mibtel and Eurostoxx50). In Table2 column % profit reports the proportion of returns following both buy and sell signals performing the simple trading rules that are greater than zero. The column % over performance reports the proportion of simple trading rules that lead to over performance relative to a naïve buy and hold investment strategy. The column % t-test reports the proportion of trading rules with returns that are greater than a buy and hold strategy zero and that are statistically significant. The last column reports the best rules label. Results from combining the different strategies, compared by holding period, are reported in Tables 4 and 5.

From Table 2, France Telecom appears as the stock showing more evident sings of inefficiency in weak form. That's because high is excess return with respect to a BH strategy, then we have Deuscth Telecom and Nokia, all of them pertinent to Ex50 Index. This evidence is confirmed also by *t-test* results. Italians stocks: Mediobanca, Aedes, Marzotto and Snai appear on the contrary more efficient, since mean return conditional on trading rules are lower than the unconditional BH mean return. Wanting to make a first summary analysis, we can look at Table 3 which shows that for each of the 21 stocks taken into account, results show at least one profitable trading rule, and at least one is able to produce *overperformances* versus a buy and hold strategy; in the same way at least one t-test is significant. This suggests, based on the empirical test of the generation of excess return, we should reject the hypothesis of weak-form market efficiency. An analysis reveals that for the basket Mib30 basket, on average 50% of the strategies were profitable; 40% of them *over performed*, but in reality only 19% of them assure some signs of market inefficiency. For the equity in the Mibtel basket, around half (52%) of the strategies applied to such titles allow profit making; 27% allow the realization of positive o*verperformances*, but among these, those that make a profit from market inefficiency are just 21%.

Table 2: Simple Trading Rules Average Results

Stock	Return	Return Bh	Excess Return	Average Return	Average Return Bh	Variance	Variance Bh	T Test	N° Trades	Sharpe
Alitalia	-17.15	-27.08	9.93	-0.15	-0.01	0.39	0.05	-0.97	90	-0.81
Alleanza	5.81	25.06	-19.25	0.04	0.05	0.54	0.00	-0.88	77	-0.04
Capitalia	2.75	34.33	-31.58	0.01	0.00	0.14	0.01	0.31	100	-1.70
Enel	-14.02	4.74	-18.76	-0.02	0.00	0.39	0.01	-0.68	82	-0.58
Fiat	8.81	-30.50	39.31	0.15	-0.03	0.68	0.16	1.21	43	0.54
Mediobanca	43.14	119.48	-76.34	0.26	-0.01	0.82	0.04	4.61	89	0.29
Pirelli	1.31	3.93	-2.62	0.00	0.00	0.03	0.00	0.27	104	-5.95
Aedes	12.57	66.93	-54.36	0.11	0.00	0.05	0.01	2.23	101	1.19
Brioschi	3.14	4.25	-1.11	0.02	0.00	0.02	0.00	1.05	104	-3.30
Cam-fin	-0.62	10.93	-11.55	0.01	0.00	0.05	0.00	0.27	99	-0.67
Marzotto	3.93	29.98	-26.05	0.03	0.00	0.06	0.00	1.30	109	-0.10
Snai	33.57	58.84	-25.27	-0.05	-0.02	0.32	0.33	-0.01	89	-0.86
Unipol	-2.29	12.27	-14.56	0.03	0.00	0.14	0.00	-0.05	113	-0.36
Zucchi	-13.66	-7.84	-5.82	-0.02	0.01	0.05	0.01	-1.59	100	-1.66
Allied Irish Banks	3.63	122.59	-88.96	0.54	0.00	0.57	0.07	3.79	44	1.07
Bbva	8.05	42.23	-24.18	0.15	0.01	0.12	0.04	2.42	31	0.26
Deuscth Telekom	7.07	-595.87	612.94	0.35	-0.04	0.37	0.06	3.18	12	2.49
France Telecom	5.40	-952.67	1008.07	1.27	-0.04	1.19	0.32	3.62	19	1.74
Iberia	8.51	25.68	-17.17	0.10	0.00	0.03	0.00	3.04	60	3.17
Nokia	4.39	-297.39	311.78	0.92	-0.03	1.53	0.05	2.45	6	0.29
Telefonica	2.22	-94.19	106.41	0.17	-0.01	0.33	0.08	0.43	27	-0.18

Table 2 shows empirical results on average, for all sample periods, by applying the simple, not considered in conjunction between them, trading strategies to the stock markets (Mib30, Mibtel and Eurostoxx50). First column, after stock name, report trading strategies return, the second the buy and hold return, the third the difference between strategies and buy and hold return, colum from 4 to 7 show average and variance of trading and buy and hold return. Last 3 columns report statistical significance test, number of trades and sharpe ratio considering on average all results.

Table 3: Simple Trading Rules Results – All Sample % Results

Stock	% Profitable Rules	% Excess Return Rules	% Significant Excess Return Rules	Best Rule
Alitalia	0.32	0.68	0.07	RSI5
Alleanza	0.57	0.14	0.04	RSI21
Capitalia	0.46	0.18	0.29	MA21
Enel	0.29	0.18	0.11	ADX21
Fiat	0.50	0.96	0.21	RSI21
Mediobanca	0.75	0.14	0.50	MACD21
Pirelli	0.61	0.50	0.11	MACD21
Average	**0.50**	**0.40**	**0.19**	
Aedes	0.61	0.04	0.46	ADX9
Brioschi	0.86	0.54	0.18	MACD5
Cam-Fin	0.43	0.18	0.11	RSI21
Marzotto	0.50	0.04	0.25	MACD5
Snai	0.57	0.50	0.39	MA21
Unipol	0.46	0.11	0.04	RSI21
Zucchi	0.21	0.50	0.07	MACD9
Average	**0.52**	**0.27**	**0.21**	
Allied Irish Banks	0.79	0.07	0.68	Rsi21
Bbva	0.71	0.21	0.68	ADX5
Deuscth Telekom	0.61	1.00	0.57	Rsi21
France Telecom	0.82	1.00	0.75	Rsi21
Iberia	0.79	0.21	0.57	RSI21
Nokia	0.75	1.00	0.54	RSI9
Telefonica	0.68	1.00	0.54	ADX9
Average	**0.73**	**0.64**	**0.62**	

Table 3 shows the percentage of profitable rules, of rules that earned excess return and those of which t-test reject null hypothesis of equality between rules return and Buy and Hold strategy. Best simple rules for all stocks are also shown. Column % Profitable Rules reports the proportion of returns following both buy and sell signals performing the simple trading rules that are greater than zero. The column % excess returns rules (over performing rules) reports the proportion of simple trading rules that conduct to an over performing respect to a naïve buy and hold investment strategy. The column % Significant Excess Return Rules reports the proportion of trading rules which return performance which are greater than buy and hold strategy zero and that are statistical significance. Last column report the best rules label.

The securities from the European basket allow the creation of profits in 73% of cases, of *overperformances* in 64% of cases, and assure that these possibilities are real in 62% of cases. Observation shows much higher percentages, compared to the Mib30 and Mibtel indices, which suggests the shares from Ex50 show, during the period considered, signs of inefficiency greater than those that are found in the Italian market. This is mainly because of the worse trend of European Stock Market. To summarize, making a comparison between Index Stock Markets it could be noted (Table 3) that, on average, Italian stock's mean returns conditional on simple trading rules signals are positive even though not enough to exceed a BH strategy. Indeed excess returns are not positive and *t-statistic* reveal average out at a not statistically significance. By contrast in the European market, given that BH strategies on average perform poorly, making heavily negative percentage profits, even small profit percentages are enough to produce even high *overperformances*; the *t-test* is significant in confirmation. Weak-form market efficiency hypothesizes that investors cannot drive profits above a buy-and-hold policy using any trading rule that depends only on past market information such as prices. Our results cast doubts on weak-form market efficiency and support the notion of moving average trading rules, exploiting substantial information to predict stock price changes. Following this point Neftci (1991) demonstrated technical trading rules can only be exploited usefully if the underlying process is nonlinear. Indeed, results in Fernandez-Rodrıguez et al. (2003) suggested the data used in this paper display nonlinear dependencies.

So we can say as a first conclusion that, assuming the sample analyzed the Italian market appears, on average, is more efficient than the European. An important point, even if partial and based on sample, is given to the "best rule" (that is the most *over performing*) because it was found that 38% of the best rules is found with an RSI of 21 days. It is of some interest to note temporal span of the best rule, is different for the 3 markets. Evidences show a tendency to the index Mib30 of 21 periods, and lower (where there are more periods 5 and 9 present) than for the other two. To summarize, the weight of the evidence now suggests that excess returns have been available to technical foreign exchange traders over long periods. There is no guarantee, of course, that technical rules will continue to generate excess returns in the future; the excess returns may be bid away by market participants. Indeed, this may already be occurring. Once the significance of the returns produced by the trading rules is verified, we can approach the main purpose of our article that consists in applying joint trading rules moving averages and oscillators to examine whether improvements are earned.

Looking at the results in Table 3, stocks with best positive tracking errors are Fiat and Alitalia. For Fiat the combined rules trading system excess return is lower than simple rules profit, but for Alitalia a drastic increase is reached in the second approach. For Alitalia in fact the average excess return passes from 9.93 gained with the simple strategy to 23.68 undertaken with the combined strategy. Also for Zucchi, the use of strategies involving the joint use of moving averages and oscillators improves the result. In fact performance passes from negative excess return (achieved with strategies that involve use of a single indicator) to positive excess return. As for the shares belonging to the European basket, the most inefficient is France Telecom, as indicated also by the simple test. With the combined test the extra return is much higher, so it is possible to understand that the combined strategy has allowed an improvement performance relative to the simple strategy. Concerning the analysis between baskets: keeping distinct the time horizon where the combined strategies are performed, it can be seen from Table 3 that the shares listed on the Italian market are on average profitable. Indeed we refer to small profits that do not allow one to exceed those recorded with the B & H strategy, so do not make extra profits, which is confirmed by the evidence that significant values of t-test do not appear. Even the shares in the basket Eurostoxx50 present very low profits that, however, compared with those (even lower) made with a BH strategy, allow the production of excess return. This extra performance is confirmed with a significant t-test rejecting the null hypothesis of equality to zero. Looking at Table 5, we can see that on average, for the securities belonging to the Mib30 basket, the trading rule based on the joint moving average and oscillators related to the short term can make profits in 40% of cases, more than in medium (32%) and long term (22%).

These rules are also on average more *over performing* in the short (22%) compared to medium (17%) and the long period (14%). But in the short-term the t-test is, on average, significant only in 10% of cases. We can note the presence of many more significant *t-test* values in relation to medium-term (19%). In the same way we see a similar greater number of improvements of the simple strategy against the combined (14% of cases, compared with an average improvement of 10% in the short-term and 5% in long). From Table 5 concerning securities in the Mibtel basket, there are a larger number of examples of short term profits (43%) compared to the average (29%) and the long term period (25%). Excess returns are achieved more in the medium-term than in the short and long, in confirmation that there are corresponding percentages of significant tests. The greater number of improvements in *performance* by the joint strategy is realized in the medium-term. From Table 5, in relation to European shares it is clear that there are more opportunities to profit in the short term, but unlike in the Italian case, the largest number of *overperformances* reveals themselves in the short-term. Always in short-term we see the greatest number of "improvements" achieved by combined strategies. In summary the most important result shows that on average, without distinction of basket of provenance, the joint rules allow the avoidance of false signals (*whipshaw).* These weak market orders adversely affect the *performance* of a security, and allow an improvement over the *buy* and *hold* strategy. Moreover, the Mib30 shares registering the highest number of improvements by using a combined strategy compared to a single strategy are Capitalia for the short-term, Alliance for the medium and Alitalia for the long. The share in the Mibtel basket that allows for the greatest number of "best performances" is Aedes, across all the time periods. Across the Eurostoxx50 basket the share with the highest number of improvements is BBVA.

Table 4: Combined Trading Rules Results on Average - Mib 30 Sample

Stock	Time Span	Return	Return Bh	Excess Return	Average Return	Average Return Bh	Variance	Variance Bh	T Test	N° Trades	Sharpe
Mib30 Sample											
	Short Term	1.17	-27.08	28.25	-0.02	-0.01	0.65	0.05	0.07	50	-0.10
Alitalia	Medium Term	-6.89	-27.08	20.19	-0.05	-0.01	0.13	0.05	-1.24	8	-1.03
	Long Term	-4.47	-27.08	22.61	-0.08	-0.01	0.15	0.05	-1.76	5	-2.08
	Short Term	11.39	25.06	-13.67	0.07	0.05	0.38	0.00	0.27	31	0.37
Alleanza	Medium Term	6.88	25.06	-18.18	0.14	0.05	0.01	0.00	2.42	3	5.42
	Long Term	1.94	25.06	-23.12	0.02	0.05	0.01	0.00	-0.26	2	-1.07
	Short Term	-8.03	34.33	-42.36	0.00	0.00	0.15	0.04	-0.15	58	-1.14
Capitalia	Medium Term	4.97	34.33	-29.36	0.05	0.00	0.02	0.01	1.23	8	-1.25
	Long Term	-1.22	34.33	-35.55	-0.01	0.00	0.02	0.01	-0.30	4	-3.36
	Short Term	-17.38	4.74	-22.12	-0.04	0.00	0.18	0.01	-1.64	39	-1.67
Enel	Medium Term	-3.90	4.74	-8.64	-0.01	0.00	0.08	0.01	-0.20	6	-0.28
	Long Term	-2.72	4.74	-7.46	-0.03	0.00	0.07	0.01	-0.64	3	-1.42
	Short Term	0.50	-30.50	31.00	0.02	-0.03	0.65	0.16	0.35	22	0.02
Fiat	Medium Term	-0.58	-30.50	29.92	0.00	-0.03	0.12	0.16	0.14	2	-0.38
	Long Term	-0.22	-30.50	30.28	0.00	-0.03	0.11	0.16	0.18	2	-0.82
	Short Term	16.06	119.48	-103.42	0.02	-0.01	0.45	0.04	0.55	38	-0.09
Mediobanca	Medium Term	13.22	119.48	-106.26	0.12	-0.01	0.11	0.04	1.47	2	0.81
	Long Term	0.09	119.48	-119.39	-0.01	-0.01	0.17	0.04	-0.11	2	-1.09
	Short Term	0.76	3.93	-3.17	0.00	0.00	0.01	0.00	0.32	53	-2.08
Pirelli	Medium Term	-0.14	3.93	-4.07	0.00	0.00	0.00	0.00	-0.06	7	-41.00
	Long Term	-0.21	3.93	-4.14	0.00	0.00	0.00	0.00	-0.34	3	-86.08
Mibtel Sample											
	Short Term	-8.26	66.93	-75.19	-0.02	0.00	0.04	0.01	-1.14	56	-1.29
Aedes	Medium Term	0.29	66.93	-66.64	0.05	0.00	0.02	0.01	1.76	7	1.64
	Long Term	7.18	66.93	-59.75	0.13	0.00	0.01	0.01	1.08	4	-42.71
	Short Term	2.19	4.25	-2.06	0.00	0.00	0.00	0.00	1.38	54	-15.98
Brioschi	Medium Term	1.31	4.25	-2.94	0.01	0.00	0.00	0.00	2.16	7	-94.41
	Long Term	0.35	4.25	-3.90	0.00	0.00	0.00	0.00	0.70	4	-299.11
	Short Term	1.25	10.93	-9.68	0.00	0.00	0.04	0.00	-0.07	58	-0.83
Cam-Fin	Medium Term	-0.75	10.93	-11.68	0.00	0.00	0.00	0.00	-0.19	11	-5.96
	Long Term	1.01	10.93	-9.92	0.00	0.00	0.00	0.00	0.01	6	-15.56

Stock	Time Span	Return	Return Bh	Excess Return	Average Return	Average Return Bh	Variance	Variance Bh	T Test	N° Trades	Sharpe
Marzotto	Short Term	0.07	29.98	-29.91	0.00	0.00	0.04	0.00	0.06	52	-1.17
	Medium Term	1.36	29.98	-28.62	0.05	0.00	0.01	0.00	2.56	9	-3.83
	Long Term	-1.07	29.98	-31.05	0.00	0.00	0.01	0.00	-0.48	7	-14.53
Snai	Short Term	0.85	58.84	-57.99	0.00	-0.02	0.43	0.04	0.37	51	0.06
	Medium Term	15.84	58.84	-43.00	0.13	-0.02	0.10	0.04	2.44	12	1.45
	Long Term	10.22	58.84	-48.62	0.03	-0.02	0.07	0.04	1.75	7	0.48
Unipol	Short Term	-5.51	12.27	-17.78	-0.01	0.00	0.10	0.00	-0.40	52	-0.47
	Medium Term	-0.88	12.27	-13.15	-0.02	0.00	0.01	0.00	-1.09	12	-8.28
	Long Term	-1.47	12.27	-13.74	-0.02	0.00	0.01	0.00	-1.03	7	-18.85
Zucchi	Short Term	-2.54	-7.84	5.30	0.00	0.01	0.05	0.01	-0.21	53	0.01
	Medium Term	-2.51	-7.84	5.33	-0.02	0.01	0.01	0.01	-1.05	10	-6.12
	Long Term	-5.41	-7.84	2.43	-0.05	0.01	0.01	0.01	-2.30	6	-9.44
Ex50 Sample											
Allied Irish Banks	Short Term	-0.38	122.59	-122.97	-0.05	0.00	0.05	0.07	-0.10	-4	-3.98
	Medium Term	-1.30	122.59	-123.89	-0.03	0.00	0.01	0.07	-2.11	-21	-20.67
	Long Term	0.00	122.59	-122.59	0.00	0.00	0.00	0.07	0.00	0	0.00
Bbva	Short Term	9.96	42.23	-32.27	0.11	0.01	0.19	0.04	1.92	1	0.57
	Medium Term	1.00	42.23	-41.23	0.07	0.01	0.03	0.04	1.26	0	0.41
	Long Term	4.63	42.23	-37.60	-0.04	0.01	0.02	0.04	-0.77	-5	-4.55
Deuscth Telekom	Short Term	3.19	-595.87	599.06	0.21	-0.04	0.29	0.06	1.80	2	2.39
	Medium Term	4.03	-595.87	599.90	1.27	-0.04	0.04	0.06	17.05	21	21.35
	Long Term	0.00	-595.87	595.87	0.00	-0.04	0.00	0.06	0.00	0	0.00
France Telecom	Short Term	10.56	-952.67	963.23	0.59	-0.04	0.98	0.32	3.64	1	0.61
	Medium Term	0.00	-952.67	952.67	0.00	-0.04	0.00	0.32	0.00	0	0.00
	Long Term	0.00	-952.67	952.67	0.00	-0.04	0.00	0.32	0.00	0	0.00
Iberia	Short Term	-2.18	25.68	-27.86	0.00	0.00	0.03	0.00	0.21	-1	-1.04
	Medium Term	0.94	25.68	-24.74	0.02	0.00	0.00	0.00	1.07	-24	-23.71
	Long Term	1.41	25.68	-24.27	0.08	0.00	0.00	0.00	3.39	-14	-13.80
Nokia	Short Term	0.53	-297.39	297.92	0.05	-0.03	0.10	0.05	0.65	0	0.31
	Medium Term	4.38	-297.39	301.77	0.14	-0.03	0.03	0.05	2.86	7	6.77
	Long Term	0.00	-297.39	297.39	0.00	-0.03	0.00	0.05	0.00	0	0.00
Telefonica	Short Term	0.51	-94.19	94.70	0.01	-0.01	0.06	0.08	-0.12	-2	-1.72
	Medium Term	-1.66	-94.19	92.53	-0.03	-0.01	0.06	0.08	-0.12	0	-0.13
	Long Term	-1.44	-94.19	92.75	-0.06	-0.01	0.06	0.08	-0.91	0	0.05

Table 4 shows the results on average and according holding period (partitioned in short, medium and long term) for the joint strategy for Mib30, Mibtel and Eurostoxx50sample. The first column, after stock name, reports holding period used to form the time span of each strategy, second column exhibits the trading strategies return, the third the buy and hold return, the fourth the difference between strategies and buy and hold return, columns 5 to 8 show average and variance of trading and buy and hold return. The last 3 columns report statistical significance test, number of trades and Sharpe ratio considering on average for all results.

Table 5: MA-Oscillators Trading Rules Results – All Sample & All Holding Period – Synthesis

Equity	Time Span	% Profitable Rules	% Excess Return Rules	% Significantly Excess Return Rules	% Improvement	Best Rule
Aedes	Short Term	0.06	0	0.16	0.16	Stoc5,Ma9
	Medium Term	0.63	0	0.33	0.33	Adx21,Ma21
	Long Term	0.44	0.11	0.44	0.44	Po14-21,Ma55
Brioschi	Short Term	0.88	0.16	0.16	0.16	Adx5,Ma5
	Medium Term	0.63	0.13	0.44	0	Adx14,Ma21
	Long Term	0.67	0	0.11	0	Macd21,Ma55
Cam-Fin	Short Term	0.50	0.19	0.09	0.09	Adx5,Ma9
	Medium Term	0.11	0.11	0.11	0.11	Po14-21,Ma21
	Long Term	0.33	0	0.22	0.22	Po14-21,Ma55
Marzotto	Short Term	0.47	0	0.06	0.06	Stoc5,Ma9
	Medium Term	0.44	0	0.33	0.33	Macd21,Ma21
	Long Term	0.11	0	0.33	0.11	Macd21,Ma55
Snai	Short Term	0.53	0.00	0.16	0.06	Adx9,Ma9
	Medium Term	0.60	0.20	0.33	0.22	Stoc21,Ma21
	Long Term	0.44	0.11	0.22	0.22	Stoc14,Ma55
Unipol	Short Term	0.13	0	0	0	-
	Medium Term	0.11	0	0.33	0.33	Stoc21,Ma21
	Long Term	0.22	0	0.11	0.11	Po14-21,Ma55

Equity	Time Span	% Profitable Rules	% Excess Return Rules	% Significantly Excess Return Rules	% Improvement	Best Rule
Zucchi	Short Term	0.50	0.63	0.44	0.16	Rsi9,Ma9
	Medium Term	0.11	0.89	0.33	0.22	Stoc14,Ma21
	Long Term	0.00	0.67	0.33	0	Stoc14,Ma55
Average	Short Term	0.43	0.14	0.13	0.08	
Average	Medium Term	0.29	0.19	0.27	0.17	
Average	Long Term	0.25	0.11	0.19	0.10	
Alitalia	Short Term	0.31	0.94	0.13	0.13	Rsi9,Ma5
	Medium Term	0.00	1	0.33	0.33	Po14-21,Ma21
	Long Term	0.00	1	0.44	0.44	Po14-21,Ma55
Alleanza	Short Term	0.91	0.19	0.09	0.09	Macd5,Ma9
	Medium Term	0.70	0.10	0.44	0	Macd21,Ma21
	Long Term	0.33	0	0.33	0	Macd21,Ma55
Capitalia	Short Term	0.28	0.09	0.19	0.19	Macd5,Ma9
	Medium Term	0.44	0.11	0.44	0.11	Macd21,Ma21
	Long Term	0.33	0	0.22	0.00	Macd14,Ma55
Enel	Short Term	0.00	0	0.16	0.16	Rsi3,Ma5
	Medium Term	0.22	0	0.11	0.11	Macd21,Ma21
	Long Term	0.00	0	0.00	0.00	-
Fiat	Short Term	0.50	1.00	0.06	0.06	Rsi9,Ma5
	Medium Term	0.22	1.00	0	0	-
	Long Term	0.33	1.00	0.22	0.11	Macd21,Ma55
Mediobanca	Short Term	0.63	0	0.13	0.13	Stoc9,Ma9
	Medium Term	0.38	0	0.33	0.33	Stoc21,Ma21
	Long Term	0.33	0	0	0	-
Pirelli	Short Term	0.50	0.25	0.09	0.09	Rsi5,Ma9
	Medium Term	0.25	0	0	0	-
	Long Term	0.22	0	0	0	-
Average	Short Term	0.40	0.22	0.10	0.10	
Average	Medium Term	0.32	0.17	0.19	0.14	
Average	Long Term	0.22	0.14	0.11	0.05	
Allied Irish Banks	Short Term	0.25	0	0.38	0.34	Po5-9,Ma5
	Medium Term	0	0	0.11	0.11	Adx14,Ma21
	Long Term	0	0	0	0	-
Bbva	Short Term	0.72	0.06	0.63	0.50	Macd5,Ma3
	Medium Term	0.22	0	0.11	0.11	Stoc14,Ma21
	Long Term	0.11	0.11	0	0	-
Deuscth Telekom	Short Term	0.50	1.00	0.09	0.09	Rsi9,Ma9
	Medium Term	0.33	1.00	0.11	0.11	Stoc21,Ma21
	Long Term	0	1.00	0.22	0.22	-
France Telecom	Short Term	0.59	1.00	0.38	0.38	Stoc5,Ma9
	Medium Term	0	1.00	0	0	-
	Long Term	0	1.00	0	0	-
Iberia	Short Term	0.28	0.00	0.06	0.03	Po5-9,Ma9
	Medium Term	0.56	0.00	0.33	0.11	Macd21,Ma21
	Long Term	0	0.00	0.56	0.11	Adx21,Ma55
Nokia	Short Term	0.22	1.00	0.13	0.13	Macd5,Ma3
	Medium Term	0	1.00	0	0	Macd21,Ma21
	Long Term	0	1.00	0	0	-
Telefonica	Short Term	0.47	1.00	0.31	0.28	Po5-9,Ma9
	Medium Term	0.11	1.00	0.22	0.11	Po14-21,Ma21
	Long Term	0	1.00	0.00	0.00	-
Average	Short Term	0.40	0.58	0.23	0.20	
Average	Medium Term	0.21	0.57	0.14	0.10	
Average	Long Term	0.08	0.59	0.11	0.05	

The first column, after stock name, reports the holding period used to form the time span for each strategy . Column % Profitable Rules column % excess returns rules (over performing rules) and column % Significantly Excess Return Rules are the same as for figure 2. The fifth column shows the percentage of improvement with regard to simple strategy achieved performing a combined strategy.

Another result worth noting is that in the Italian market, on average, greater improvements come from combined strategies in the medium-term, whereas in the European market more improvements from joint

strategies come in the short-term. Either way, in the long run there are few improvements. Indeed, an element to note is that for many shares (7 in Europe and 4 in Italy) in the long run you cannot get the improvements with a combined strategy versus a strategy that based on a moving average. This leads us to infer that for the European market in the long-term it is cheaper to use a trading strategy based on a simple moving average. This is easily inferred from the fact the false trading signals are related to volatility, which affects more in the short-term. Indeed it could be sufficient to extend the span of the moving averages to reduce volatility and therefore misleading signals. Considering all samples, the evidence suggests that trend indicators, when applied in isolation, have some predictive ability. When Moving Averages–Oscillators rules are applied jointly, however, the Oscillator component filters out weak signals emitted by the MA rules inducing neutral days where investors are recommended to 'wait-and-see'. These results therefore suggest the simultaneous use of MA and OS indicators leads to improved forecast power because of the ability to catch the information content in past prices more effectively. In general, one can assume that by combining oscillators with moving averages, a superior technical trading strategy is developed. It is thus not surprising that most financial firms do have their own trading team that relies heavily on technical analysis.

CONCLUSION

This paper mainly distinguishes itself from previous studies in the literature in the following aspect. Most empirical work has studied technical approaches in isolation. This is ultimately not satisfactory because, as shown in this, study, different technical trading rules are able to identify different predictable items. Following this thinking, the primary purpose of this paper is to show how one can develop trading strategies which combine different technical analysis approaches. Applied daily to three European Stock Indexes over the 2000–2007 period, we got a set of combined strategies to outperform both simple technical trading rules and the naïve buy and hold strategy even after accounting for transaction cost. In general, one can infer from the results that technical indicators can play a useful role in the timing of stock market entry and exits. It is thus not surprising that most member firms have their own trading teams that rely heavily on technical analysis. The technical analyst's approach, on the other hand, typically involves the simultaneous use of trend indicators and other confirming indicators because trend indicators alone do not capture the information content in past prices. Those arguments suggest to us that technical trading rules, and particularly moving average and oscillators, are asymmetric in the opposite directions during trending and trading periods, providing striking evidence of their complementary properties. This evidence enables us to construct a superior technical trading strategy that captures a more comprehensive aspect of predictability in past prices. To summarize we conclude that the use of confirming indicators in a moving average signal system significantly improves forecast power. As a second goal of our research we found evidence of inefficiency signs in some European Stock Markets.

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BIOGRAPHY

Giuseppe Galloppo – Phd Banking and Finance, is researcher in statistics method for finance at Tor Vergata University of Rome, Faculty of Economics, he is a specialist in applying statistical techniques and methods for analyzing financial instruments and portfolio models. Recently he has dealt with an innovative way of estimate financial parameters, in order to try to contain input errors and obtain best out of sample performances. He can be reached at giuseppe.galloppo@uniroma2.it