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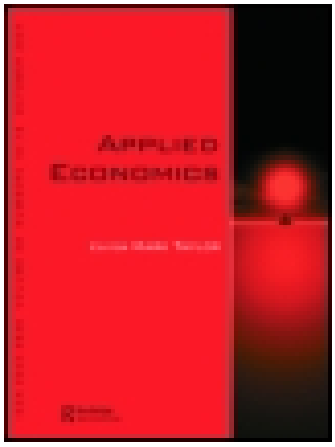

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Can technical oscillators outperform the buy and hold strategy?

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This study compares returns from the traditional buy and hold (B&H) strategy to well-known technical oscillators applied to diverse indices leading the global market (DJI, FTSE, NK225 and TA100) during the period 2007–2012. Our aim was to establish whether technical tools can consistently achieve returns exceeding those of the B&H strategy across various financial markets. We found the relative strength index (RSI) to be the best oscillator, outperforming the DJIA, the FTSE100 and the NK225 for five of the six years examined. The only index that did better than the RSI was TA100, which outperformed all the examined oscillators. In second place was the moving average convergence/divergence (MACD) oscillator, which outperformed the NK225 B&H strategy and came in second for TA100. The results show that during bear markets the RSI and MACD generally produce better gains than the indices, while the opposite occurs during bull markets.

Keywords: oscillators; technical; buy and hold; international

JEL Classification: F37; G15

I. Introduction

The efficient market theory in the financial literature suggests that an investor cannot outperform the markets using any investment tool such as fundamental or technical.[1] If this is the case, he or she should adopt the 'buy and hold' (hereinafter, B&H) investment strategy which is simple to adopt and cheaper in terms of transaction cost in comparison to other investment strategies (see, for example, Shilling, 1992). B&H means buy the financial asset at the beginning of the year and realize returns at the end of that year. The practitioners and academics that praise the B&H strategy argue that in accordance with the efficient market theory, an investor should divide the investment amount to market exposure through the major stocks indices and to risk-free rate. Moreover, they argue, that such an investment strategy should be repeated year after year regardless of market conditions such as price multipliers, dividend to price or short ratios because, according to their view, market movements are unpredictable and prices are efficient in the long run.

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[1] See, for example, Malkiel (2003).

Many academic and practitioners have tried over the year to construct investment strategies that would consistently outperform the financial market with a limited success. In terms of technical analysis, most past researches have concentrated on simple tools such as support and resistance lines and moving averages. However, as far as we know, no past research has tested the performance of various complex technical oscillators in four financial markets (the United States, Great Britain, Japan and Israel) over six consecutive years and compared the result to the simple B&H strategy. In the examined years (2007–2012), the global financial markets have experienced a dramatic financial crises followed by an astonishing markets rally fuelled by an economic recovery mainly in the United States. In our view, it is interesting to compare the performance of the various investment strategies in a bear and bull markets to the B&H strategy in the examined financial markets. Moreover, each technical oscillator formula was computerized, hence enabling us to carry out objective simulations and obtain reliable results without depending on visual observations of graphs. We also included in our analysis trade commissions in order to obtain net returns that reflect reality as closely as possible enabling us to compare real returns generated by various investment strategies. The technical tools that were chosen are moving average convergence/divergence (MACD), stochastic, parabolic stop and reverse (PSAR) and relative strength index (RSI)[2] and the indices that represent the financial markets are: DJI-US, FTSE-GB, N225-Japan and TA100-Israel.

Our results indicate that the RSI was the best oscillator, outperforming the DJIA, FTSE100 and NK225 four five of the six years examined. The only index that performed better than the RSI-based strategy was TA100. In second place was the MACD oscillator, which outperformed the NK225 B&H strategy and came in second for TA100. The results show that during bear markets the RSI and MACD generally produced better gains than the indices, while the opposite occurred during bull markets. These results emphasize the importance of self-market condition evaluation before using any investment strategy.

II. Literature Review

Prentis (2011) examined the rational expectations theory and the efficient market theory. Until then the results of studies that examined market efficiency in the United States using trading rules were not unequivocal. The study by Prentis is the first to provide unequivocal evidence of obtaining excess returns over 81 years using new technical tools known as maxima and minima. In examining the S&P 500, these tools were able to obtain excess returns over the B&H strategy. The explanation proposed for the success of the new tools is that the participants in the trading do not have emotions. An investor who feels fear will immediately sell his/her shares, causing the price to drop to the bottom, beneath its actual value. Similarly, a greedy investor will cause the price to rise to record levels, beyond its actual value. Hence, when investors exhibit herd mentality behaviour by acting according to emotions and not according to basic market rules, bubbles are created in which it is possible to obtain excess index returns. Others researches, as mentioned before, have examining the performance of basic technical investment strategies. Papathanasiou and Samitas (2010) compared the technical analysis method of moving averages to the CSE index B&H strategy during the period 1998–2005. Their results provided clear evidence supporting the predictability and profitability of technical analysis on the Cyprus stock market. Fifield *et al.* (2005) examined 11 European markets during the period 1991–2000 and found that moving average oscillators were very unstable and varied significantly from one market to another. For emerging markets, technical analysis exhibited some degree of predictability in their share returns, though not for developed markets. These different findings indicate that previous academic attempts to analyse various investment strategies in European countries as a group (due to their geographic location) were erroneous. The study by Cheung *et al.* (2011) surveys the period 1972 through 2006 on the Hong Kong stock exchange according to two technical analysis methods: simple moving average (SMA) and trading range break (TRB). The findings contradict previous findings indicating that the returns in Hong Kong can be predicted after 1986, i.e., that the market exhibits weak form efficiency. As a result, no investor can

[2] These technical tools formulations will be described later in this article.

gain excess returns by using technical trading tools that rely upon historical prices. The use of technical analysis over the abovementioned period led to obtaining excess returns on the Hong Kong market despite the sales commissions during the years prior to 1986. After that year the excess returns disappeared, apparently due to the integration the market underwent, which led to greater efficiency as a result of increased information dissemination.

The only study of the Israeli capital market was carried out by Ben-Zion *et al.* (2003). These researchers compared the Tel Aviv 25 to the S&P 500, using moving average to examine the timing of each index's buying and selling compared to its buying and holding. The researchers examined 1500 observations of daily returns that supported the theory of weak form efficiency for the S&P index but not for the Tel Aviv 25. Park and Irwin (2007) surveyed the profitability of technical analysis. Based on previous studies, they show that technical analysis strategies yielded consistent profits, at least up until the early 1990s. Nevertheless, many empirical studies encountered problems in the examination process due to the difficulty of assessing the risks and costs of purchase and sales as well as problems in finding data. Marshall *et al.* (2009) found that technical analysis on the American stock exchange is liable to result in profitability for shares not included in any index, particularly for the period 1990–2004. No profitability was found for a wide range of large shares. Smaller and less liquid shares may have greater profitability. No relation was found between the industrial branch of a share and its profitability. When technical analysis did indicate profitability, the profits were quite large, and this may be the reason that technical analysis continues to be used. Hsu *et al.* (2010) showed that compared to the B&H strategy, for the NASDAQ the buy-and-sell strategy according to technical analysis can yield higher returns, even when (purchase and sales) commissions are taken into account. The DJIA and the S&P 500 indices did not show this profitability. Kwon and Kish (2002) also examined the excess returns for the NYSE for the period 1962–1996. The examination used *t*-tests and found that technical analysis does indeed contribute to obtaining excess returns according to the B&H strategy. Fama and French (1988) examined autocorrelation of daily and weekly stock returns for the period 1926–1985. They found statistically significant autocorrelation of small and large shares on the NYSE at different time horizons. They claimed that share returns can be predicted.

III. The Tested Oscillators

All technical oscillators collect historical data that is formulated and graphed in order to present different aspects of trading, such as price movement and volumes. In the following sections, we elaborate on each tested oscillator.

Moving average convergence/divergence

The purpose of the MACD[3] oscillator is to identify changing trends. The MACD, one of the simplest and most common oscillators, shows the difference between the 'fast' and the 'slow' exponential moving average (EMA) of closing prices. The oscillator includes calculation of two EMAs, one for 12 days (EMA[12]) and the other for 26 days (EMA[26]). The MACD is composed of two lines: the MACD line, which represents the difference between the two EMAs (subtracting the long average from the short), and the signal line, which represents the EMA for nine days (EMA[9]), which is dependent upon the MA curve. The difference (MACD) is represented as a red line above zero with no upper or lower boundary, while the signal line is represented as a green line. When the MACD (red) line crosses the green EMA[9] signal line in an upward direction, this is a signal to buy. When it crosses the green line in a downward direction, this is a signal to sell. The standard periods recommended by Gerald Appel in the 1960s were 12 and 26 days. These values can be adjusted to other values, for example, 17 and 8 days.

The MACD is calculated as follows:

$$\mathrm{MACD} = \mathrm{EMA}[12]\mathrm{of\ price} - \mathrm{EMA}[26]\mathrm{of\ price} \tag{1}$$

Auxiliary equation for calculating EMA:

[3] This oscillator was developed by Gerald Appel in the 1960s. In 1973, Appel found a giant corporation to manage investments of clients' funds. He developed the MACD oscillator and wrote more than 15 books and dozens of articles on the topic of investment strategies, systems for trading on the capital market and others.

$$\mathrm{EMA} = \mathrm{Price}(t) * k + \mathrm{EMA}(y) * (1-k) \quad (2)$$

where t = today, y = yesterday, $k = 2/(N+1)$, $N = 12$, $N = 26$, with N representing the number of days for which the moving average is calculated.

$$\mathrm{EMA}[9] = \mathrm{MACD} * k9 + \mathrm{EMA9}(y) * (1-k9) \quad (3)$$

Stochastic oscillator

The stochastic oscillator[4] monitors market trends. Many studies have pointed to a trend towards rising prices, with daily closing prices tending to be closer to the upper limit, the highest price during that period, while when prices fall, closing prices tend to be closer to the lower limit. The oscillator examines the position of the closing rate of a security relative to the highest and lowest prices.

$$\mathrm{Stochastic} = \left(\frac{\text{Lowest share price during period} - \text{Last closing price}}{\text{Lowest share price during period} - \text{Highest closing price for the period}}\right) \times 100 \quad (4)$$

As is usual on the market, a high oscillator score (over 80) leads to over-purchasing and consolidation, which ultimately results in a small number of buyers, in turn leading to a drop in prices. A low oscillator score (under 20) leads to overselling and to consolidation of the meeting point between buyers and sellers, because the price becomes attractive, thus predicting an increase.

When the oscillator upwardly crosses over the trend line (line 20) from bottom to top, this is a signal to buy. When the oscillator downwardly intersects the trend line (line 80) from top to bottom, this is a signal to sell.

Relative strength index

The RSI[5] examines the magnitude of market acceleration. That is, it compares upward movements in closing price to downward movements over a selected period. The term 'relative magnitude' can also refer to the magnitude of a security relative to the market in general or to the branch to which the security belongs, for example, a share that increases by 2% when the rest of the market increases by 1%.

The RSI is calculated as follows: For each day, the upward change, U,[6] or the downward change, D, is calculated.

In the case of increases:

$$U = \mathrm{Close}_{\mathrm{today}} - \mathrm{Close}_{\mathrm{yesterday}}\{D = 0\} \quad (5)$$

In the case of decreases:

$$D = \mathrm{Close}_{\mathrm{today}} - \mathrm{Close}_{\mathrm{yesterday}}\{U = 0\} \quad (6)$$

The ratio between the two averages is called the relative strength (RS):

$$\mathrm{RS} = \left|\frac{\mathrm{EMA}[N] \text{ of } U}{\mathrm{EMA}[N] \text{ of } D}\right| \quad (7)$$

N is the number of days on which price increases/decreases were examined. The default is 14 days. The range can be increased in order to reduce the sensitivity, and vice versa.

$$\mathrm{RSI} = \left|100 - \left(\frac{1}{1+\mathrm{RS}} \times 100\right)\right| \quad (8)$$

According to accepted market practice, an RSI score above 70 indicates over-buying, meaning that the trader must consider selling the security. An RSI score below 30 indicates over-selling, meaning that the trader should consider buying the security. It should be noted that other boundaries can be set,

[4] The stochastic oscillator was developed by George Lane in the 1960s.
[5] The RSI was developed by J. Welles Wilder in 1978.
[6] For each day that the change was upward, that is, that the closing rate was higher than on the previous day.

for example, 80 and 20, respectively, according to which the number of signals to buy and sell will be reduced. In summary, a high rate of daily oscillations in the same direction signals an extreme event and the trend is likely to reverse itself.

Parabolic stop and reverse (PSAR)

The PSAR[7] was so named because its shape resembles a parabola. The PSAR is a price and time indicator mainly used to signal exit (sales) points. The PSAR oscillator is not a continuous line but rather a collection of dots, with one dot adjacent to each price candlestick.[8] For a decreasing trend, the dots of the indicator are above the price index. When the trend changes and the price crosses the parabolic curve from bottom to top, the dots flip over and appear below the price index. The parabolic dot flips when the price crosses it. At first, when the dot flips over, it is the same distance from the price candlestick. But as the movement gains momentum or as time passes, the dots of the parabola distance themselves from one another and approach the candlesticks, and the parabolic curve becomes steeper. The assumption is that as a trend grows stronger or lasts longer, the chances are greater that it will come to an end. Therefore, when the PSAR dots get closer together and approach the price, an investor can expect a sharp countermove signalling that it is time to adopt a new position. The dots appear in red when their value is higher than or lower than the price per share.

When the price crosses the PSAR oscillator from above, this is a signal to buy. When the price crosses the PSAR oscillator from below, this is a signal to sell.

The PSAR is calculated as follows:

$$Sar_{n+1} = Sar_n + \alpha(EP - Sar_n) \tag{9}$$

Sar_{n+1}, and Sar_n denote the values of the oscillator tomorrow and today, respectively.

EP: The upper extremity (maximum) of a rising trend, or the lower extremity (minimum) of a falling trend.

A: The acceleration coefficient which begins at 2% (market standard) and increases by 2% each time a new high/low is reached. The maximum value of the acceleration coefficient is 20%, and if this value is reached it remains fixed without any additional changes.

IV. Results

The results are presented in this section in the following order: (1) the American DJIA index; (2) the British FTSE100; (3) the Japanese NK225; and (4) the Israeli TA100.

Table 1 shows that for the six examined years, the oscillator that performed best on average was the RSI, yielding an annual average return of 5.45% and a total of 37% for the entire period, while the B&H strategy gained an average annual return of −0.05% and a total of −0.30%. Moreover, the RSI outperformed the B&H strategy for five out of the six years. Only in 2009 was the B&H strategy superior to the RSI. This result is consistent with Asness *et al.* (2013) who found value and momentum return premia across diverse markets and assets classes.

When we compare return versus risk, measured by dividing returns by their SDs, the RSI scored 0.47 versus −0.05 for the B&H strategy. The only year in which B&H performed better than the RSI was 2009. On average, the RSI strategy was in position 189 days a year compared to an average of 252 days for the B&H, resulting in an average daily return of 0.029% for the RSI oscillator compared to a close to zero return for the B&H strategy. The stochastic, the MACD and the PSAR oscillators consistently failed to outperform the B&H on the DJIA. Table 2 summarizes our results for the British FTSE100.

Table 2 demonstrates that, as with the DJIA, the RSI on average also outperformed the B&H strategy for the FTSE100. The RSI yielded an average of 10.12%, totalling 78% for the entire examined period, while the FTSE100 yielded a negative annual average return of −2.11 (total of −12%). The risk/

[7] The PSAR was developed by J. Welles Wilder in the late 1970s.

[8] Japanese candlesticks are thought to have been developed in the seventeenth century by Japanese traders for trading on the rice market. The Japanese candlestick chart is a type of bar and line graph that reflects price oscillations during a certain period. Each unit of time is assigned a candlestick comprising a body and a wick. This type of graph includes four important variables: opening rate, closing rate, highest traded price and lowest traded price. Japanese candlesticks usually include the body of the candle, which is red for a lower closing and green for a higher closing.

Table 1. Technical oscillators versus buy and hold strategy for DJIA

	2007	2008	2009	2010	2011	2012	Average
1. MACD	2.75	2.31	1.72	−6.52	−10.19	−11.77	−3.61
2. SD	12.11	30.18	11.92	15.29	17.55	13.61	16.77
3. 1/2	0.23	0.08	0.14	−0.43	−0.58	−0.86	−0.23
Days	174	215	216	175	189	196	194
1. Stochastic	0.36	−36.49	−11.83	−22.18	10.36	6.67	−8.85
2. SD	13.40	18.36	17.59	16.67	14.60	9.84	15.07
3. 1/2	0.03	−1.99	−0.67	−1.33	0.71	0.68	−0.42
Days	152	193	142	214	188	203	182
1. RSI	10.28	2.18	−8.43	9.89	10.19	8.62	5.45
2. SD	13.18	21.34	25.88	8.40	18.77	14.61	17.03
3. 1/2	0.78	0.10	−0.33	1.18	0.54	0.59	0.47
Days	199	164	165	95	331	181	189
1. PSAR	−36.96	−54.54	−27.96	−23.60	−44.50	−15.76	−33.88
2. SD	13.27	21.02	27.28	5.44	12.60	6.27	14.31
3. 1/2	−2.79	−2.59	−1.02	−4.34	−3.53	−2.51	−2.80
Days	218	211	248	216	179	234	218
1. B&H	5.00	−32.13	12.74	7.61	3.65	4.49	0.23
2. SD	9.52	12.86	24.55	17.53	12.56	10.61	14.60
3. 1/2	0.53	−2.50	0.52	0.43	0.29	0.42	−0.05
Days	251	253	252	252	252	250	252

Notes: (1) Line 1 of every row displays the annual return minus trading commissions for every technical oscillator, line 2 is the SD of the annual return and line 3 is the annual return divided by its SD. (2) The days represent the number of trading days according to well-known levels for each oscillator.

Table 2. Technical oscillators versus buy and hold strategy for FTSE100

	2007	2008	2009	2010	2011	2012	Average
1. MACD	−7.58	8.09	4.57	9.25	−16.90	−23.16	−4.29
2. SD	10.41	26.13	19.78	15.77	22.73	12.89	17.95
3. 1/2	−0.73	0.31	0.23	0.59	−0.74	−1.80	−0.36
Days	170	193	183	187	202	193	188
1. Stochastic	−2.22	−32.05	−6.16	−9.09	−3.72	0.74	−8.75
2. SD	9.78	14.83	19.85	11.89	10.61	9.86	12.80
3. 1/2	−0.23	−2.16	−0.31	−0.76	−0.35	0.08	−0.62
Days	177	177	217	145	197	172	181
1. Stochastic	13.89	−1.59	8.24	7.61	26.84	5.73	10.12
2. SD	9.88	18.59	18.81	16.54	21.01	16.47	16.88
3. 1/2	1.41	−0.09	0.44	0.46	1.28	0.35	0.64
Days	137	154	132	199	186	164	162
1. PSAR	−33.11	−20.66	−32.57	−13.66	−31.55	−20.48	−25.34
2. SD	8.46	18.46	16.07	16.70	17.82	12.24	14.96
3. 1/2	−3.91	−1.12	−2.03	−0.82	−1.77	−1.67	−1.89
Days	163	204	133	164	214	209	181
1. B&H	1.56	−30.83	14.91	5.61	−6.40	2.51	−2.11
2. SD	8.46	18.76	20.44	16.38	14.32	9.78	14.69
3. 1/2	0.18	−1.64	0.73	0.34	−0.45	0.26	−0.10
Days	251	253	252	252	252	250	252

Notes: (1) Line 1 of every row displays the annual return minus trading commissions for every technical oscillator, line 2 is the SD of the annual return and line 3 is the annual return divided by its SD. (2) The days represent the number of trading days according to well-known levels for each oscillator.

return ratio of the RSI is positive 0.64 on average against the negative −0.10 of the B&H strategy. Moreover, the RSI-based returns were achieved in an average of 162 trading days a year, as opposed to 252 trading days for the B&H strategy. Again, as with the DJIA, 2009 is the only year in which the B&H strategy was superior to the RSI. All the other technical oscillators were on average inferior to the B&H strategy.

Table 3 shows the results for the Japanese NK225.

Table 3 shows that as with DJIA and FTSE100, the RSI outperformed the B&H strategy by a huge difference. On average, the RSI yielded an annual return of 14.67%, compared to −5.91% for the B&H, with a total return of 127% for the six examined years compared to −31% for the B&H. The RSI accomplished this with an average of only 188 days of trading, yielding an average daily return of 0.08%. Return divided by risk measurement results in 0.72 compared to −0.45 for the B&H. The only year in which the B&H was superior to the RSI was 2012. For NK225, the MACD also yielded a higher annual return, although it was negative (−1.97%), compared to −5.91% for the B&H. The MACD also exhibited a better risk return score of −0.13, while the B&H scored −0.45. The MACD outperformed the B&H for four of the six examined years of trading, for an average of 191 days a year. The stochastic and PSAR oscillators failed to outperform the B&H strategy.

Finally, we analyse the performance of the oscillators for a leading index of the Israeli financial market, TA100 (Table 4).

Table 4 demonstrates that on average no technical oscillator outperformed the B&H strategy for TA100 index. The highest average annual return, achieved by the MACD, was 2.36%, while the B&H strategy gained an annual average of 5.79%. Moreover, the MACD scored a return/risk average of 0.14, while B&H scored 0.34. The RSI oscillator, which performed very well for the DJIA, FTSE100 and the NK225, failed to do the same for TA100, yielding an average annual return of −0.28 and outperforming the index for only three years out of six. Although on average the MACD performed better than the RSI in the Israeli market, it only outperformed the index twice during the examined years.

Table 3. Technical oscillators versus buy and hold strategy for NK225

	2007	2008	2009	2010	2011	2012	Average
1. MACD	−11.02	10.65	−6.33	4.94	−6.26	−3.81	−1.97
2. SD	19.08	29.18	19.67	20.37	20.87	22.82	22.00
3. 1/2	−0.58	0.36	−0.32	0.24	−0.30	−0.17	−0.13
Days	179	210	210	164	207	177	191
1. Stochastic	−9.52	−37.14	5.35	−19.13	−15.82	11.03	−10.87
2. SD	12.92	28.29	22.59	17.56	16.33	20.89	19.76
3. 1/2	−0.74	−1.31	0.24	−1.09	−0.97	0.53	−0.56
Days	203	253	171	228	192	163	202
1. RSI	2.84	8.12	18.39	30.51	15.48	12.67	14.67
2. SD	12.23	29.98	21.63	20.85	15.38	24.77	20.81
3. 1/2	0.23	0.27	0.85	1.46	1.01	0.51	0.72
Days	149	202	181	140	225	229	188
1. PSAR	−17.66	−29.59	−25.89	−30.42	−4.44	15.06	−15.49
2. SD	12.39	25.48	18.27	15.60	17.08	11.18	16.67
3. 1/2	−1.34	−1.16	−1.42	−1.95	−0.26	1.35	−0.81
Days	151	224	168	175	237	221	196
1. B&H	−13.01	−39.04	15.17	−1.54	−18.11	21.05	−5.91
2. SD	9.16	25.50	24.04	23.14	14.34	21.96	19.69
3. 1/2	−1.42	−1.53	0.63	−0.07	−1.26	0.96	−0.45
Days	251	253	252	252	252	250	252

Notes: (1) Line 1 of every row displays the annual return minus trading commissions for every technical oscillator, line 2 is the SD of the annual return and line 3 is the annual return divided by its SD. (2) The days represent the number of trading days according to well-known levels for each oscillator.

Table 4. Technical oscillators versus buy and hold strategy for TA100

	2007	2008	2009	2010	2011	2012	Average
1. MACD	12.36	18.38	−21.40	3.97	5.37	−4.55	2.36
2. SD	13.43	24.80	22.20	12.60	23.04	12.08	18.03
3. 1/2	0.92	0.74	−0.96	0.32	0.23	−0.38	0.14
Days	207	169	194	223	183	205	197
1. Stochastic	16.11	−44.15	15.06	−13.90	−10.49	7.96	−4.90
2. SD	10.13	36.20	27.62	16.06	18.53	12.83	20.23
3. 1/2	1.59	−1.22	0.55	−0.87	−0.57	0.62	0.02
Days	146	192	158	139	229	213	180
1. RSI	−8.10	−5.10	−3.44	2.95	4.62	7.40	−0.28
2. SD	14.98	25.86	20.44	20.84	17.36	11.75	18.54
3. 1/2	−0.54	−0.20	−0.17	0.14	0.27	0.63	0.02
Days	179	251	112	144	230	136	175
1. PSAR	−45.51	−24.96	12.30	−5.34	−2.66	−14.92	−13.52
2. SD	11.62	32.64	19.26	6.65	17.78	8.91	16.14
3. 1/2	−3.92	−0.76	0.64	−0.80	−0.15	−1.67	−1.11
Days	176	231	164	114	256	176	186
1. B&H	17.73	−47.03	65.09	10.32	−17.51	5.89	5.79
2. SD	13.42	23.98	19.90	17.40	11.16	14.93	16.80
3. 1/2	1.32	−1.96	3.27	0.59	−1.57	0.39	0.34
Days	251	253	252	252	252	250	252

Notes: (1) Line 1 of every row displays the annual return minus trading commissions for every technical oscillator, line 2 is the SD of the annual return and line 3 is the annual return divided by its SD. (2) The days represent the number of trading days according to well-known levels for each oscillator.

Here again, the stochastic and the PSAR were inferior to the MACD and RSI.

V. Summary and Conclusions

In the current study, we computerized four major technical oscillator formulas, producing clear simulations according to known buy-and-sell levels of these oscillators. We ran the simulations on four major stock indices (DJIA, FTSE100, NK225 and TA100), deducting trading commissions in order to imitate the real financial world and comparing the results to the B&H strategy. Our results indicate that the RSI was the best oscillator, outperforming the DJIA, FTSE100 and NK225 four five of the six years examined. The only index that did better than the RSI was TA100, which outperformed all examined oscillators. In second place was the MACD oscillator, which outperformed the NK225 B&H strategy and came in second for TA100. The results show that during bear markets the RSI and MACD generally produced better gains than the indices, while the opposite occurred during bull markets.

Disclosure Statement

No potential conflict of interest was reported by the authors.

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