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Analyzing Momentum-Based and Moving Average-Based Portfolio Strategies: A Case Study of the Egyptian Stock Market

تحليل استراتيجيات المحفظة القائمة على الزخم والمتوسط المتحرك:
دراسة حالة لسوق الأوراق المالية المصرية

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المستخلص:

تقدم هذه الدراسة استراتيجيتين متنافستين للتداول/الاستثمار على شكل محفظتين ("A" و "B")، استنادًا إلى مزيج من تقنيات وأساليب التحليل الفني المعتمدة والمدرسة جيدًا، وهي الأداء النسبي (RP)، والزخم (معدل التغيير) و المتوسطات المتحركة (MA). يهدف هذا البحث إلى قياس أداء نتائج اختيار الأوراق المالية في المحفظة في سوق الأوراق المالية المصري، من أجل تقييم استراتيجيات التداول/الاستثمار المقترحة على قدرتها في تحقيق نتائج متفوقة على استراتيجية الشراء والاحتفاظ (B&H) في سوق الأوراق المالية المصرية. ويقدم البحث تحليلاً وتقييمات متعمقة لأداء ونتائج الاستراتيجيتين باستخدام القياسات ذات الصلة والمصادق عليها في تقييم أداء المحفظة. في نهاية المطاف، يهدف البحث إلى إنتاج بحث أكاديمي معتمد حول الاستراتيجيات المقترحة القائمة على التحليل الفني والتي تم تصميمها لمساعدة

المستثمرين الأفراد والمؤسسات في قراراتهم الاستثمارية قصيرة الأجل، مع تقليل تعرضهم للمخاطر المحددة من خلال التنويع واختيار السليم للأوراق المالية في المحفظة. تمكنت نتائج هذا البحث من تقديم دليل قاطع لصالح استراتيجيات التداول/الاستثمار، مع تفضيل الإستراتيجية "A" على "B"، على إستراتيجية (B&H) التي يمثلها المؤشر القياسي لسوق الأوراق المالية المصرية EGX30.

الكلمات المفتاحية:

المحفظة، الإستراتيجية، الأوراق المالية، التحليل الفني، تحليل الأداء النسبي، تحليل الزخم، المتوسطات المتحركة، مؤشر EGX30، إستراتيجية الشراء والاحتفاظ.

Abstract:

This study introduces two competing portfolio-styled trading/investment strategies ("A" & "B"), based on a combination of well-accredited & researched Technical Analysis (TA) techniques and approaches, namely Relative Performance (RP), Momentum (Rate of Change) and Moving Averages (MA). This research aims at measuring the outcome performance of the on-portfolio security selection in the Egyptian stock market, to assess the likelihood of TA portfolio-styled trading/investment strategies to achieve superior results to the Buy & Hold (B&H) strategy in the Egyptian stock market. The research offers in-depth analysis & assessments of the performance and results of the two strategies using both, relevant and validated measurements of portfolio performance. Ultimately, the research aims at producing validated and academic research on TA-based strategies that are designed to aid individual and institutional investors in their short-term investment decisions, while reducing their exposure to specific or unsystematic risk through diversification and portfolio security selection. The findings were able to render conclusive evidence to the advantage of the portfolio-styled trading/investing strategies, favoring strategy

“A” over “B”, over the passive “Buy & Hold” strategy as represented by the EGX30 market benchmark Index.

Keywords: Portfolio, Strategy, Technical Analysis, Stockmarket, Relative Performance Analysis, Momentum Analysis, Moving Averages, EGX30 Index, Buy & Hold strategy.

1. Introduction

Previous academic research has primarily focused on evaluating the standalone performance of Technical Analysis (TA) tools and techniques, rather than their effectiveness within a portfolio framework. This study aims to fill this gap by proposing two competing portfolio-based trading/investment strategies, labeled "A" and "B," that incorporate well-established TA techniques such as Relative Performance (RP), Momentum, and Moving Averages (MA). Strategy "A" is based on a modified adaptation of the momentum model (RPA) suggested by Jegadeesh and Titman (1993), while strategy "B" utilizes MA Cross-over (MACO) techniques proposed by Masry (2017).

It is important to note that these portfolio strategies integrate multiple TA tools and techniques that have been extensively researched in the academic literature. By combining these approaches, the researcher aims to explore the performance of TA-based strategies within a portfolio context, specifically in the Egyptian stock market. To test the hypotheses, the following statements are proposed:

Hypothesis one: There is a significant difference in returns between strategy "A" and strategy "B."

Hypothesis two: There is a significant difference in returns between strategy "A" and the Equal Weighted Portfolio (EWP) - Buy & Hold (B&H) strategy benchmark.

Hypothesis three: There is a significant difference in returns between strategy "B" and the EWP-B&H strategy benchmark.

Hypothesis four: There is a significant difference in risk-adjusted returns between strategy "A" and the EWP-B&H strategy benchmark.

Hypothesis five: There is a significant difference in risk-adjusted returns between strategy "B" and the EWP-B&H strategy benchmark.

The findings of this study have important implications for investment managers, traders, and individual investors seeking to enhance portfolio returns. Demonstrating the efficacy of technical analysis could encourage the adoption of rule-based systematic strategies for investing. However, it is crucial to recognize that the results are specific to the Egyptian stock market and may not apply to other asset classes or global markets.

Further research can build upon this study by examining different periods, technical indicators, portfolio weighting schemes, and risk-adjustment methods. Additionally, assessing performance across various market regimes and employing more advanced statistical techniques and larger datasets could enhance the modelling and predictive accuracy of TA-based strategies.

2. Literature Review

Most academic studies conducted which tackled TA, were primarily concerned with assessing or measuring the profitability of TA-related tools and strategies as well as their capacity and capability of generating abnormal returns in the financial markets against the backdrop of a B&H strategy implemented on a stock market benchmark, such as a stock market Index. The literature presented below is categorized into two types. Each type represents the foundation based on which the two competing TA strategies are elected in this study.

Relative Performance RP or Momentum Based Strategies (Basis of Strat. “A”)

Sabir (2021) investigated the impact of portfolio security selection criteria based on historical relative momentum performance. The study used closing prices for an average of 131 securities in the NASDAQ OMX Helsinki between Jan 2009 and Jan 2019. The primary strategy was based on buying past winners and selling past losers with several, but separate portfolios of equal weights, while holding them for a specified duration. Both, ranking and holding periods were six months. The results from this strategy, which has been specified as an imitation to a prior study by Jegadeesh, N., & Titman, S (1993), have yielded significant abnormal returns, thus confirming the originally reported anomaly. Moreover, **Chen (2020)** conducted a study to investigate styled momentum strategies in investing in the Chinese stock market (size and BM). The testing period was between 1994 and 2017, and was divided into sub-periods from 1994 to 2006 and from 2007 to 2017. The sample used ranged from 195 to 2417 securities in the A-share firms listed on SHSE or SZSE over the testing period.

The results rendered were profitable over the second sub-period, rather than the first sub-period. Additionally, the results indicated that momentum-styled strategies are reliant of various market states. Additionally, **Asness, et al. (2013)** tested for the efficacy of implementing both value and momentum (also known as relative performance) factors in an investment strategy. They assembled eight asset classes in three equally weighted portfolios (a total 48 portfolios) based on both values, as per indicated by book-to-market ratio, and momentum (relative performance), as per indicated by the past 12-month cumulative return. The study tested monthly returns for the eight asset classes: US & UK stock exchanges between 1972 and 2011, and Japan & Europe between 1974 and 2011, in addition to four equity indices which present eighteen developed equity markets, ten currencies, ten Int'l gov't bonds, and twenty-seven commodities between 1978 and 2011.

The results indicated a strong correlation among value and momentum strategies across various asset classes, and both, value and momentum returns measured in different asset classes were affected by the same global factors. Furthermore, **Rosillo et al. (2013)** tested specific TA indicators & strategies on securities closing prices in the Spanish stock exchange between 1986 and 2009, and were divided into eight periods to cover different economic crises in Spain. The TA-based indicators were the Relative Strength Index (RS), the Moving Average Convergence Divergence (MACD), the Momentum, and the Stochastic Oscillator (%K). The results indicated that generating excessive capital gains is dependent on (i) the security and (ii) the utilized indicator. Moreover, the study managed to reduce or eliminate cases of ambiguity about the indicators under study.

Finally, in their study, **Jegadeesh & Titman (2001)** evaluated possible explanations for the profitability of momentum (relative performance) strategies. The study measured the returns from the closing prices of securities in the US stock exchange (NYSE, AMEX & NASDAQ stocks excluding small caps) between 1990 and 1998. The primary strategy was based on buying past winners and selling past losers. The portfolio formation period was set at five months before initiation. Meanwhile, the holding period was set from one to six or twelve months from initiation. Moreover, post-holding period was set from thirteen to sixty months from initiation. The results have validated their previous study in 1993 once more and have yielded significant abnormal returns during holding period. Moreover, the study confirmed that the original study results and test was not a product of data mining or snooping.

Moving Average (MA) and Indicators-Based Strategies (Basis of Strat. "B")

Sahid & Zulkarnain (2022) conducted a study on the FX market in the form of an automated expert advisor. The study was performed during the period from January 2019 to December 2020. Through this automated expert advisor, the study tested a

triple MACO method variation of 20, 80, and 160-period MAs. The results generated a win rate of 87.21% during the period under test. In another study, **Daniswara et al. (2022)** tested the accuracy of specific TA indicators in predicting security price action listed LQ45 market Index of the Indonesian stock exchange during the period between February 2021 to July 2021.

The TA Indicators tested included Dual MACO method, Bollinger Bands (B-Bands) techniques and Relative Strength Index (RSI) Indicator tactics. For statistical inference, the researchers applied the Mann-Whitney/Wilcoxon test. The results revealed no difference between predictions generated by the three indicators and the actual price action of the tested securities with respect to direction. In addition, RSI offered the best results in terms of accuracy among the three tested indicators. Moreover, a study conducted in India by **Kantaria & Tanna (2022)** presented an empirical test of trading session based on MACO technique using EMAs. The study was performed pre and post COVID-19 period, and was applied on thirteen selected securities in the Indian stock exchange as well as the Nifty50 market Index representing the benchmark B&H strategy during the period from 2016 to 2021. The result indicated that MACO strategy generated higher CAGR for most securities in both pre and post COVID-19 period. Additionally, a study applied in India by **Ambashtha & Singh (2020)** to examine the impact of TA in predicting the Indian stock market index NIFTY-50 Index. The study applied the 5, 50 and 200 day MAs during the period from 2007 to 2018. The findings concluded that the tested MA durations are significant for short-term predictions of the NIFTY-50 Index.

In addition, **Okereke et al. (2019)** performed a comparative study on simple and exponential MA types against the B&H strategy. The study was conducted on the weekly and monthly values of the British Pound (GBP) currency during the period from 2011 to 2018. MA durations were optimized during the testing phase to identify durations that yielded the highest risk adjusted returns. The results confirmed that MACO strategies rendered higher risk

adjusted returns than the B&H strategy. **De Souza et al. (2018)** conducted studies on the BRICS stock exchanges in order to examine the profitability of TA through the use of the MACO technique as a TA tool, employing both simple and exponential moving averages. The study was applied on the closing prices for over 1,450 securities during the period between 2007 and 2016 and included over 2,569 observations. The study employed a double MACO system with optimization. Finally, the results indicated that some combinations of the MACO strategy were able to outperform the B&H strategy.

Ansary & Atuea (2017) investigated the Effect of TA strategies on achieving abnormal returns. The study used daily closing prices for 27 securities traded on the Egyptian stock exchange and represented as constituents of the EGX30 Index between 1998 and 2016. They tested three strategies on their respective three TA Indicators against the B&H strategy: the Relative Strength Index (RSI), the Stochastic Oscillator (%K) and the Money Flow Index (MFI). Using the bootstrap method for statistical significance, the researchers tested the data for short, long terms as well as bull/bear trends. The results indicated that the three TA strategies generated higher and more profitable results to the B&H strategy.

In addition, the results favoured long term (LT) strategies over short term (ST) ones with respect to less risk and higher returns during both bull and bear markets. **Masry M. (2017)** implemented a study on the Egyptian stock exchange to measure the impact of TA on security returns. The study was applied on the daily closing prices of 46 traded securities between 2008 and 2015. The traded securities represented constituents of the EGX70 Index. Employing a double MACO system with the aid of a variable price filter, the study tested various MA durations (5, 50 and 150 day SMAs). Finally, the study offered evidence of higher returns attained by the tested SMACO systems compared to a B&H strategy. **C.-H. Chen et al. (2016)** examined the effectiveness of the MACO system on two groups (portfolios) of

stocks in the Taiwan stock market. They compared the two portfolios with and without option hedging. The study looked at the outcomes of different SMAs with 10, 20, 50, 100, and 200-day periods.

The results demonstrated that, for the grouped securities without option hedging only, the system produced higher returns than the B&H strategy, indicating that securities that do not issue options experience greater information uncertainty and are therefore better suited to TA tools like SMA CO systems.

3. Data and Methodology

The researcher presents in detail all aspects related to the design and methodology of the research experiment, offering rationale and justification for each parameter, tool and factor utilized in this methodology. In addition, the researcher will offer a detailed presentation of the two competing strategies (“A” & “B”) proposed in this study.

Data and Sample

The data utilized in this research constituted the daily closing prices and returns of the EGX30 Index as well as its constituents as the variables. This primarily accounts for thirty individual securities during any given semi-annual rebalance of the EGX30 Index. The period under study selected aimed at capturing several bull/bear market cycles to provide further validation to the study. The period under study covered a period of 21 years; from 2000 until 2020, with over 136 individual securities, which had been included and excluded over time as a result of the semi-annual rebalancing of the Index and over the course of the period under study.

In order to test hypotheses 1 to 5, the researcher performed the testing within the duration from 1H-2000 to 2H-2020 (21 years). The data represented the testing phase was segmented by 6-month intervals. This 6-month interval constituted the duration in which

the EGX30 Index covered while bearing a specific and un-altered group of securities until the subsequent semi-annual rebalance. The performance of the B&H strategy was tested and compared to the performance of the two competing strategies on the EGX30 Index and the underlying Index constituents during this period.

Method

Components of Strategies “A” & “B”:

Strategies “A” and “B” are applied on the Absolute Price (AP) data of the underlying securities, and their calculated Relative Performance (RP) values.

RP compares the performance between two or more securities. The same TA techniques and analysis approaches, that are used on a security’s price chart to suggest its tendency to move in one direction or the other, are also applied on a RP data (El Saiid, M., 2012). RP calculation:

$$RP_i = \frac{C_i}{I_i}$$

Where C_i is the closing value of the underlying security today, I_i is closing value of the EGX30 Index benchmark today.

When comparing a security to a benchmark using RP, we arrive at three main outcome-structures as follows.

Portfolio Security Selection Method “Strategy A”:

Strategy “A” is composed of two primary TA techniques, namely Absolute Price Performance (APP) and Relative Price Performance (RPP).

Techniques of Strategy “A”:

Absolute Price Performance (APP): APP calculation:

$$APP_n = \frac{C_i}{C_n}$$

Where C_i is the closing value of the underlying security today, C_n is the ending value of the underlying security in the preceding 6-month interval representing a semi-annual rebalance duration of the EGX30 Index. Relative Price Performance (RPP): RPP calculation:

$$RPP_i = \frac{RP_i}{RP_n}$$

Where RP_i is the Relative Performance value of the underlying security today, RP_n is the ending RP value of the underlying security in the preceding 6-month interval representing a semi-annual rebalance duration of the EGX30 Index.

For each 6-month interval representing a semi-annual rebalance duration of the EGX30 Index, securities which registered positive APP and RPP values were selected and included (purchased) in the portfolio (strategy “A”) on the following trading day. Meanwhile, securities which registered negative APP and RPP values were excluded (sold) from the portfolio on the following trading day.

Going forward, this process was reapplied each day throughout each 6-month interval. After a 6-month interval ends, the cumulative returns of both strategy “A” and an equal-weighted version of the EGX30 Index representing the benchmark B&H strategy were calculated. This was then repeated in the exact same procedure once more on the new list of 30 Index security constituents, which were announced by the EGX Stock-market exchange on the next semi-annual rebalancing announcement.

Portfolio Security Selection Method “Strategy B”:

Strategy “B” is composed of AP-Moving-Average-Cross-Over (AP-MACO) and RP-MACO.

Techniques of Strategy “B”:

AP-Moving-Average-Cross-Over (AP-MACO)

The researcher used a single MACO between the absolute security price and a single SMA of Medium-term MT duration.

Long positions (buy) signals were generated when a security closing price exceeded its MA, while sold positions (sell) signals were generated when a security closing price fell below or crossed below its MA. SMA calculation: The AP-SMA is expressed as follows:

$$AP - SMA_N = \sum_{i=1}^N \frac{C_i}{N}$$

Where N is the number of values in the data series, and C denotes the closing prices

RP-MACO

The RP-SMA is expressed as follows:

$$RP SMA_N = \sum_{i=1}^N \frac{RP_i}{N}$$

Where N is the number of values in the data series, and RP denotes the calculated RP values of the underlying security.

RP-MACO buying and selling rules have been applied in the same manner as AP-MACO rules.

For each 6-month interval representing a semi-annual rebalance duration of the EGX30 Index, securities which registered positive AP-MACO and RP-MACO values were selected and included (purchased) in the portfolio (strategy “B”) on the following trading day. Meanwhile, securities which registered negative AP-

MACO and RP-MACO values, were excluded (sold) from the portfolio (strategy B) on the following trading day.

Going forward, this process was reapplied each day throughout the duration of each 6-month interval. After a 6-month interval ends, the cumulative returns of strategy B was calculated. This was then repeated in the exact same procedure once more on the new list of 30 Index security constituents, which were announced by the EGX Stock-market exchange on the next semi-annual rebalancing announcement

Figure 1: Portfolio Security Selection Strategy “A”

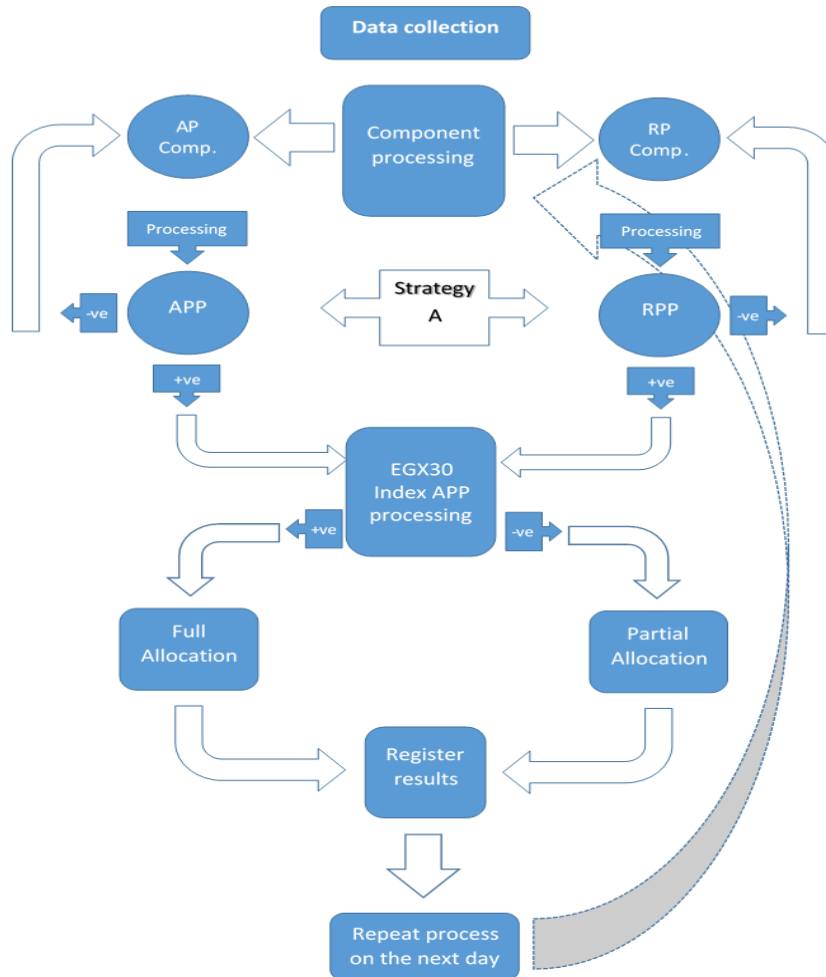


Figure.1: Highlights in detail the processing aspect of portfolio security strategy "A".

Figure 2: Portfolio Security Selection Strategy "B"

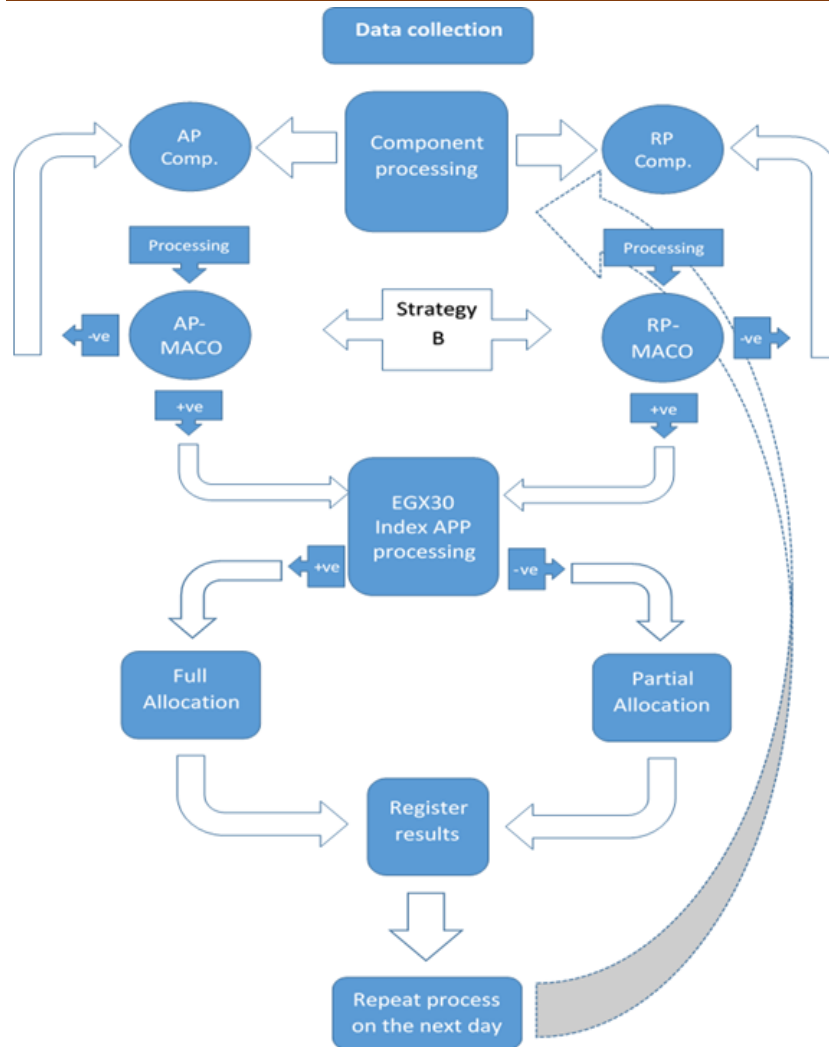


Figure.2: Highlights in detail the processing aspect of portfolio security strategy “B”.

Calculation of Returns for Strategies “A” and “B”

The daily returns for strategies “A” and “B”, as well as the EGX30 Index EWP returns are calculated as the log of daily change in closing prices respectively (El-Khodary, 2009).

$$\text{Daily Return } (R_d) = \ln \left(\frac{P_d}{P_{d-1}} \right)$$

Where R_d is the closing price of today, and P_{d-1} is the closing price of yesterday.

4. Results

This section presents the statistical analysis performed on the outcomes of strategies “A” and “B” against the EGX30 Benchmark Index, which represents the B&H strategy. The objective is to test the hypothesis presented in this research.

Statistical Analysis and Techniques

The researcher provided descriptive statistics that offer information about the sample, including the mean, standard deviation, and sample size (Dong, 2023). In addition to the paired samples, correlation, which is a statistical measure used to determine the relationship between two variables, is measured on the same individuals or objects. The correlation coefficient measures the strength and direction of the association between the paired data (Kafle, 2019).

The researcher then applied the t-test and presented its results. T-test indicates whether there is a statistically significant difference between the means of the two groups. The output includes the t-value, degrees of freedom, and p-value (Rouder et al., 2009). The t-value represents the difference between the means of the two groups relative to the variability of the data. The degrees of freedom represent the number of independent pieces of information available to estimate the population parameters. The p-value represents the probability of obtaining the observed difference (or an extreme difference) between the means should the null hypothesis be true. If the p-value is less than the chosen

significance level (usually 0.05), then the results are statistically significant, and we reject the null hypothesis in favor of the alternative hypothesis. If the p-value is greater than the significance level, then the results are not statistically significant, and we fail to reject the null hypothesis (Jones et al., 2003).

To compare between three groups or more, the researcher conducted the ANOVA (Analysis of Variance) test. ANOVA is a statistical technique used to analyze differences between the means of two or more groups. ANOVA is an extension of t-tests, which compare the means of two groups. In contrast, ANOVA can be used to compare the means of more than two groups. The "ANOVA" table provides the F-statistic and p-value for the overall comparison of the three groups. The null hypothesis for ANOVA implies that the means of all groups are equal, and a significant p-value (typically less than 0.05) suggests that this null hypothesis should be rejected in favor of the alternative hypothesis that at least one of the group means is different (Ali and Bhaskar, 2016). If the ANOVA test is significant, post-hoc tests are performed to identify which group means differ significantly from one another. The most commonly used post-hoc test is Scheffe test, which the researcher applies (Cabral, 2008).

**Descriptive Statistics and t-tests
Comparison of System, “A” with System “B”**

Table 1: Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Returns of system A	12.0975%	42	28.69452%	4.42766%
	Returns of system B	11.2386%	42	29.76998%	4.59361%
Pair 2	Cum. returns of system A	1989.6708%	42	1478.61600%	228.15540%
	Cum. returns of system B	1328.2873%	42	953.17867%	147.07866%
Pair 3	STDEV of semi-annual returns of system A	.01	42	.006	.001
	STDEV of semi-annual returns of system B	.01	42	.006	.001

Table 1: presents the descriptive statistics of the paired samples (systems “A” and “B”), showing that system “A” outperformed system “B” concerning the mean of returns as well as the cumulative mean of returns. As for the standard deviations of the semi-annual returns, the outcome was identical for both systems.

Table 2: Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Returns of system A & Returns of system B	42	.961	.000
Pair 2	Cum returns of system A & Cum returns of system B	42	.990	.000
Pair 3	STDEV of semi-annual returns of system A & STDEV of semi-annual returns of system B	42	.888	.000

Table 2: presents the correlations between the paired samples, and reveals the coefficient of correlations, which clearly indicates a strong positive correlation (with a p-value less than 0.05) between system “A” and system “B” for all variables, including returns,

cumulative returns, mean number of shares, as well as the standard deviation of semi-annual returns.

Table 3: Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Dev.	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Returns of system A - Returns of system B	0.858%	8.274%	1.2767%	-1.7195%	3.437%	.673	41	.505
Pair 2	Cum returns of system A - Cum returns of system B	661.38%	552.42%	85.240%	489.23%	833.53%	7.759	41	.000
Pair 3	STDEV of semi-annual returns of system A - STDEV of semi-annual returns of system B	.000	.003	.000	-.001	.001	.699	41	.489

Table 3: presents the t-test results of the paired samples (systems “A” and “B”). The results reveal a significant difference in the cumulative return between system “A” and system “B” in favor of System “A”. The t-values for cumulative return is 7.759, with a corresponding p-value of 0.00, which is below the typical significance level of 0.05. Accordingly, we can reject the null hypothesis, which suggests that there is no difference between the two groups, and accept the alternative hypothesis that there is a difference between system “A” and system “B”. Moreover, based on the average results, the same conclusion that system “A” performs better than system “B” can be reached.

Comparison of System, “A” with EGX30

Table 4: Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Returns of system A	12.0975%	42	28.69452%	4.42766%
	Returns of EGX30	7.9895%	42	30.02546%	4.63303%
Pair 2	Cum returns of system A	1989.6708%	42	1478.61600%	228.15540%
	Cum returns of EGX30	403.7017%	42	213.61648%	32.96174%
Pair 3	STDEV of semi-annual returns of system A	.01	42	.006	.001
	STDEV of semi-annual returns of EGX30	.02	42	.006	.001

Table 4: presents the descriptive statistics of the paired samples (system “A” and EGX30 Index). It reveals that system “A” outperformed system EGX30 Index with regards to the mean of returns (12.09% vs. 7.98% respectively), and the cumulative mean of returns (1989% vs. 403% respectively). Additionally, the standard deviations of the semi-annual returns, system “A” registered a lower variability in returns than the EGX30 Benchmark Index, implying an advantage in system “A” compared to the Benchmark Index.

Table 5: Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Returns of system A & Returns of EGX30	42	.916	.000
Pair 2	Cum returns of system A & Cum returns of EGX30	42	.824	.000
Pair 3	STDEV of semi-annual returns of system A & STDEV of semi-annual returns of EGX30	42	.063	.692

Table 5 displays the correlations between the paired samples of system "A" and the EGX30 Index. The coefficients of correlations provide insights into the relationships between the variables. The findings indicate the following:

Strong Positive Correlation: There is a strong positive correlation between system "A" and the EGX30 Index in terms of both returns and cumulative returns. The correlation coefficients show a significant relationship, as indicated by the p-value being less than 0.05. This implies that the performance of system "A" is closely tied to the performance of the EGX30 Index. **No Correlation in Standard Deviations:** However, there is no correlation between the standard deviations of semi-annual returns of system "A" and the EGX30 Index. The correlation coefficient suggests no relationship, and the p-value is greater than 0.05. This indicates that there is no significant correlation in the variability of returns between system "A" and the benchmark Index.

In summary, the correlations analysis reveals a strong positive relationship between system "A" and the EGX30 Index in terms of returns and cumulative returns. However, there is no significant correlation in the variability of returns between system "A" and the benchmark Index. These findings provide valuable insights into the associations between system "A" and the EGX30 Index, highlighting the importance of considering both the performance and variability of returns when evaluating their relationship.

Table 6: Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Returns of system A - Returns of EGX30	4.108%	12.105%	1.8678%	0.3358%	7.8802%	2.199	41	.034
Pair 2	Cum returns of system A - Cum returns of EGX30	1585.9%	1308.08%	201.842%	1178.3%	1993.5%	7.857	41	.000
Pair 3	STDEV of semi-annual returns of system A -STDEV of semi-annual returns of EGX30	-.003	.008	.001	-.006	-.001	-2.473	41	.018

Table 6: presents the t-test results of the paired samples (systems “A” and the EGX30 Index). The results reveal a significant difference in the returns, cumulative returns, and standard deviation of semi-annual returns between system “A” and EGX30. Specifically, the t-values for the returns and cumulative return are 2.199 and 7.857, respectively, while the t-value for the standard deviation of semi-annual returns is -2.473. Furthermore, the corresponding p-values for these statistics are 0.034, 0, and 0.018, all of which are below the typical significance level of 0.05. Therefore, the null hypothesis, which suggests that there is no difference between the two systems, can be rejected in favor of the alternative hypothesis, which indicates that there is indeed a significant difference between system “A” and EGX30 benchmark index. Additionally, based on the average results, it can be concluded that system “A” outperforms the benchmark Index.

Comparison of system B with EGX30

Table 7: Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
Pair 1 Returns of system B	11.2386%	42	29.76998%	4.59361%
Returns of EGX30	7.9895%	42	30.02546%	4.63303%
Pair 2 Cum returns of system B	1328.2873%	42	953.17867%	147.07866%
Cum returns of EGX30	403.7017%	42	213.61648%	32.96174%
Pair 3 STDEV of semi-annual returns of system B	.01	42	.006	.001
STDEV of semi-annual returns of EGX30	.02	42	.006	.001

Table 7: presents the descriptive statistics of the paired samples (system “B” and EGX30 Index). It is evident from the results that system “B” outperformed system EGX30 Index representing the benchmark (buy and hold) strategy with regards to the mean of returns (11.23% vs. 7.98% respectively), and the cumulative mean of returns (1328% vs. 403% respectively). Additionally, with respect to the standard deviations of the semi-annual returns, system “B” registered a lower variability in returns than the EGX30 benchmark Index, implying an advantage in system “B” compared to the benchmark Index. As a result, one can conclude that system “B” has superior performance to that of the benchmark Index.

Table 8: Paired Samples Correlations

	N	Correlation	Sig.
Pair 1 Returns of system B & Returns of EGX30	42	.894	.000
Pair 2 Cum returns of system B & Cum returns of EGX30	42	.818	.000
Pair 3 STDEV of semi-annual returns of system B & STDEV of semi-annual returns of EGX30	42	.160	.312

Table 8: presents the correlations between the paired samples (system “B” and the EGX30 Index), and reveals the coefficients of correlations. The results clearly demonstrates a strong positive correlation (with a p-value less than 0.05) between systems “B” and the EGX30 Index for both returns and cumulative returns. However, there is no correlation between the standard deviations of semi-annual returns between system “B” and the EGX30 Index, implying that there is no correlation in the variability of returns between system “B” and the benchmark Index (with a p-value greater than 0.05).

Table 9: Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Returns of system B - Returns of EGX30	3.2490%	13.7807%	2.12642%	0.3358%	-1.045%	1.528	41	.134
Pair 2	Cum returns of system B - Cum returns of EGX30	924.58%	788.034%	121.596%	1178.3%	679.01%	7.604	41	.000
Pair 3	STDEV of semi-annual returns of system B -STDEV of semi-annual returns of EGX30	-.003	.007	.001	-.006	-.006	-3.008	41	.004

Table 9: presents the t-test results of the paired samples (systems “B” and the EGX30 Index). The results reveal a significant difference in the cumulative returns and standard deviation of semi-annual returns between system “B” and EGX30. Specifically, the t-values for the returns and cumulative return and the standard deviation of semi-annual returns are 7.604 and -

3.008, respectively. Furthermore, the corresponding p-values for these statistics are 0.00, and 0.004, both of which are below the typical significance level of 0.05. Therefore, the null hypothesis, which suggests that there is no difference between the two systems, can be rejected in favor of the alternative hypothesis, which indicates that there is indeed a significant difference between system “B” and EGX30 benchmark index. Additionally, based on the average results, it can be concluded that system A outperforms the benchmark Index.

**ANOVA test
Comparing of Systems “A”, “B” with EGX30 Index**

Table 10: Descriptive Statistics

	N	Mean	Std. Dev.	Std. Error	95% Confidence Interval for Mean		Min	Max	
					Lower Bound	Upper Bound			
Returns of system	System A	42	12.09%	28.69%	4.427%	3.1557%	21.039%	-17.20%	135.90%
	System B	42	11.23%	29.76%	4.593%	1.9616%	20.515%	-38.26%	132.89%
	EGX30	42	7.98%	30.02%	4.633%	-1.3671%	17.346%	-51.33%	111.40%
	Total	126	10.44%	29.31%	2.611%	5.2725%	15.611%	-51.33%	135.90%
Cumulative returns	System A	42	1989.6%	1478.61%	228.15%	1528.90%	2450.43%	81.64%	4871.15%
	System B	42	1328.2%	953.17%	147.07%	1031.25%	1625.31%	73.07%	3083.1%
	EGX30	42	403.7%	213.61%	32.96%	337.13%	470.26%	45.40%	729.27%
	Total	126	1240.5%	1206.86%	107.51%	1027.76%	1453.34%	45.40%	4871.1%
STDEV of semi-annual returns	System A	42	1.291%	0.614%	0.0947%	1.10037%	1.4831%	0.273%	2.818%
	System B	42	1.261%	0.556%	0.0859%	1.08774%	1.4348%	0.242%	2.689%
	EGX30	42	1.606%	0.589%	0.0909%	1.42256%	1.7897%	0.669%	3.706%
	Total	126	1.386%	0.603%	0.0537%	1.28006%	1.4927%	0.242%	3.706%

Table 10: presents the descriptive statistics of comparing systems “A” and “B” with the EGX30 benchmark Index. The table clearly shows that system “A” outperforms system “B” and benchmark Index with respect to the mean of returns (12.09%, 11.23%, 7.98% respectively), and mean of cumulative returns (1989%, 1328%, 403% respectively). As for the mean of the standard deviations of semi-annual returns, where system “A” has lower mean of variability of return than the EGX30 benchmark Index, but slightly higher than that of system “B”, yet this result is overcompensated by the cumulative returns achieved by of system “A”. Therefore, it can be concluded that system “A” has a better performance than both system “B” and EGX30 Benchmark Index.

Table 11: ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Returns of system	Between Groups	394.382	2	197.191	.227	.798
	Within Groups	107057.356	123	870.385		
	Total	107451.738	125			
Cumulative returns	Between Groups	53306152.709	2	26653076.354	25.461	.000
	Within Groups	128760037.742	123	1046829.575		
	Total	182066190.451	125			
STDEV of semi-annual returns	Between Groups	3.062	2	1.531	4.440	.014
	Within Groups	42.415	123	.345		
	Total	45.477	125			

Table 11: presents the results of the ANOVA test. As observed, the p-values of the cumulative returns and the standard deviation of semi-annual returns is 0.000 and 0.014 respectively, which is less than 0.05, thus indicating that there is a significant difference

between the means of systems “A”, “B” and the benchmark Index.

Table 12: reveals the results of the Scheffe test. As previously mentioned in this chapter, the ANOVA test was significant, the researcher applied the Scheffe test in order to identify which group means differ significantly from one another. The test indicated that there are no significant differences in the means of returns among systems “A”, “B” and the Benchmark Index. However, the test revealed that there were significant differences in the means of the standard deviation of semi-annual returns and cumulative returns across the three systems. Both system “A” and system “B” have lower standard deviation of semi-annual returns compared to EGX30 benchmark Index, implying that they performed better than benchmark Index. Additionally, System “A” indicated higher cumulative returns than both System “B” and the EGX30 benchmark Index.

Table 12: Scheffe test-Multiple Comparisons

Dependent Variable	(I) Systems	(J) Systems	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Returns of system	System A	System B	0.80652%	5.14984%	.988	-11.9580%	13.5710%
		EGX30	3.61051%	5.14984%	.782	-9.1540%	16.3750%
	System B	System A	-0.80652%	5.14984%	.988	-13.5710%	11.9580%
		EGX30	2.80399%	5.14984%	.862	-9.9605%	15.5685%
	EGX30	System A	-3.61051%	5.14984%	.782	-16.3750%	9.1540%
		System B	-2.80399%	5.14984%	.862	-15.5685%	9.9605%
STDEV of semi-annual returns	System A	System B	0.034023%	0.129655%	.966	-0.28734%	0.35539%
		EGX30	-0.329239%*	0.129655%	.043	-0.65061%	-0.00787%
	System B	System A	-0.034023%	0.129655%	.966	-0.35539%	0.28734%
		EGX30	-0.363262%*	0.129655%	.022	-0.68463%	-0.04190%
	EGX30	System A	0.329239%*	0.129655%	.043	0.00787%	0.65061%
		System B	0.363262%*	0.129655%	.022	0.04190%	0.68463%
Cumulative returns	System A	System B	674.45488%*	227.50344%	.014	110.5602%	1238.3495%
		EGX30	1615.05073%*	227.50344%	.000	1051.1561%	2178.9454%
	System B	System A	-674.45488%*	227.50344%	.014	-1238.3495%	-110.5602%
		EGX30	940.59585%*	227.50344%	.000	376.7012%	1504.4905%
	EGX30	System A	-1615.05073%*	227.50344%	.000	-2178.9454%	-1051.1561%
		System B	-940.59585%*	227.50344%	.000	-1504.4905%	-376.7012%

*. The mean difference is significant at the 0.05 level.

5. Discussions

Hypothesis 1: The study found a statistically significant difference in the returns between strategy "A" and strategy "B" based on the cumulative mean of returns. This was confirmed by the t-test results for paired samples, which showed a significant

difference in cumulative return favoring strategy "A" (661%). The t-value for cumulative return was 7.759, with a corresponding p-value of 0.00, indicating a significance level below 0.05. This result was further supported by the ANOVA test, leading to the acceptance of hypothesis one.

Hypothesis 2: The study also identified a statistically significant difference between the returns of strategy "A" and the Equal Weighted Portfolio (EWP) - Buy & Hold (B&H) strategy benchmark, both in terms of the mean returns and the cumulative mean returns. The t-test results for paired samples yielded p-values of 0.034 and 0, respectively, below the significance level of 0.05. This finding aligns with the previous research of Sabir (2021), Chen (2020), and Jegadeesh and Titman (1993), further supporting the acceptance of hypothesis two.

Hypothesis 3: Similarly, the study revealed a significant statistical difference between the returns of strategy "B" and the EWP-B&H strategy benchmark, specifically in terms of the cumulative mean returns. The t-test results for paired samples yielded a p-value of 0.00, below the significance level of 0.05. This result was consistent with the research of Masry (2017), Chen et al. (2016), and Metghalchi et al. (2016), leading to the acceptance of hypothesis three.

Hypothesis 4: The study found a significant difference in the risk-adjusted returns between strategy "A" and the EWP-B&H strategy benchmark, specifically concerning the standard deviation of semi-annual returns. The standard deviation amounted to -2.473, with a corresponding p-value of 0.018, below the significance level of 0.05. The ANOVA test also supported this finding, indicating that strategy "A" not only outperformed the benchmark in terms of cumulative return but also on a risk-adjusted basis. Hence, hypothesis four was accepted.

Hypothesis 5: Similarly, the study identified a significant difference in the risk-adjusted returns between strategy "B" and the EWP-B&H strategy benchmark, based on the standard

deviation of semi-annual returns (-3.008). The corresponding p-value was 0.004, below the significance level of 0.05. The ANOVA test further confirmed this result, indicating that strategy "B" surpassed the benchmark in terms of both cumulative return and risk-adjusted performance. Therefore, hypothesis five was accepted.

Conclusion

In conclusion to this study, the researcher was able to answer the following questions related to:

i) The capability of this proposed strategies ("A & B") to outperform, or yield abnormal returns compared an equal weighted version of the Egyptian stock market Index both on a pure return basis. In this context, and based on the findings and analysis presented in this study, the researcher was able to provide conclusive evidence supporting the superiority and success of the proposed portfolio-based trading/investment strategies to outperform the passive B&H strategy represented by the EGX30 market benchmark Index on a pure return basis.

ii) The capability of this proposed strategies ("A & B") to outperform, or yield abnormal returns compared an equal weighted version of the Egyptian stock market Index both on a on a risk-adjusted basis. Also, based on the findings and analysis presented in this study, the researcher was able to provide conclusive evidence supporting the success of the proposed portfolio-based trading/investment strategies to outperform the passive B&H strategy represented by the EGX30 market benchmark Index on a risk-adjusted basis.

Thus, the researcher suggests the following research recommendations:

i) The researcher strongly recommends that portfolio managers adopt the TA-based model presented in this study. This model

offers a systematic and unbiased approach, facilitating its application in the financial market. By utilizing this approach, institutional investors can make informed investment decisions while reducing exposure to specific and unsystematic risks through diversification and portfolio security selection.

ii) The researcher also strongly recommends that high-net-worth individuals (HNWI) and retail investors/traders employ the TA-based model presented in this study. This model provides a systematic, unbiased, and non-emotional approach to managing their holdings in a portfolio-style manner. By adopting this approach, they can benefit from diversification and better control of market risks.

iii) Integrating fundamental analysis (FA) criteria with TA within a portfolio framework allows users, including all types of investors, to combine different dimensions of analysis. FA provides insights into the current and future financial condition and strength of underlying securities, which complements TA.

Recommendations

Based on the findings of this study, it can be recommended that investors consider implementing strategy "A" or strategy "B" instead of the Equal Weighted Portfolio (EWP) - Buy & Hold (B&H) strategy benchmark for investing in the Egyptian stock market. Both strategies demonstrated statistically significant differences in returns compared to the benchmark, indicating their potential to outperform.

Strategy "A" showed a higher cumulative return and lower risk, as evidenced by its significant outperformance in terms of both cumulative return and risk-adjusted performance. Therefore, investors seeking higher returns with lower risk may find strategy "A" to be a suitable choice.

On the other hand, strategy "B" also exhibited a significant difference in both cumulative return and risk-adjusted

performance compared to the benchmark. This suggests that investors looking for alternative investment options with potentially higher returns may consider implementing strategy "B."

It is important to note that the findings of this study are specific to the Egyptian stock market and the time period analyzed. Therefore, further research and evaluation may be necessary to assess the generalizability of these findings to other markets or time periods.

Overall, investors should carefully evaluate their investment goals, risk tolerance, and market conditions before making investment decisions. Consulting with a financial advisor or conducting further analysis based on individual circumstances is recommended.

Research Limitations

i) The study utilized a specific set of parameters and durations on the TA tools used on all securities in an attempt to coordinate the frequency of the indicator signals with each other and per the semi-annual durations set as the duration of comparison with the B&H strategy. Moving average durations were set to reflect and capture only MT signals while attempting to avoid shorter-term noise, similar to the semi-annual momentum threshold.

ii) This study was limited to the underlying securities of the EGX30 Egyptian Stock Market Benchmark Index for the previously stated rationale. The research did not cover the Egyptian smaller caps. Benchmark Index: (EGX70 Index), nor did this study cover any other market outside the Egyptian Stock market.

iii) Moreover, this study focused on comparing the B&H strategy with only two types of TA-based systems which both fall into the category of lagging systems in TA.

Additionally, there were no transaction costs (commissions) assumed in the calculation returns for either strategy.

iv) Finally, no consideration for slippage has been accounted for during the purchase and sale of any security on both presented strategies. The researcher assumed no slippage and that both; the sale and purchase transaction of any security were decided on the closing value of that security exactly upon a given technical signal provided by any applied TA technique.

Future Research

- i) The researcher recommends conducting this study on the constituents of the Egyptian smaller caps. Benchmark Index: (EGX70 Index).
- ii) The researcher recommends conducting this study in other Emerging markets to test for consistency of results, or lack thereof.
- iii) The researcher recommends conducting this study with different sets of TA tools and techniques than the ones proposed in this paper to opt for better performance if possible.
- iv) The researcher recommends conducting this study with portfolio leverage.
- v) The researcher recommends accounting for potential slippage and transaction costs when conducting future studies.

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