

PROFITS FROM TECHNICAL TRADING RULES: THE CASE OF CYPRUS STOCK EXCHANGE

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ABSTRACT

We examine the performance of various types of technical trading rules in the emerging Cyprus Stock Market (CSE). Furthermore, we examine the predictability of daily returns for the CSE with respect to the extent that the technical analysis method of moving averages can win the buy-and-hold policy. Also, we further our analysis via the bootstrap methodology under the model of EGARCH. This study becomes necessary given the important changes, which Cyprus is going through since joining the European Union on May 1 May 2004 and as it is preparing for the adoption of the Euro as its currency.

JEL CLASSIFICATION

G120,G140

KEY WORDS

EGARCH, moving averages, bootstrap, Euro zone.

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PROFITS FROM TECHNICAL TRADING RULES: THE CASE OF CYPRUS STOCK EXCHANGE

1. INTRODUCTION

During the last fifteen years there has been a growing interest among portfolio managers for the emerging capital markets as they provide opportunities for higher asset returns compared to those of the developed markets. In the present paper we conducted an analysis of the stock market of Cyprus as an emerging market. This study becomes necessary given the important changes, which Cyprus is going through since joining the European Union on May 1st 2004 and as it is preparing for the adoption of the Euro as its currency (1 January 2008). Besides, Greek and Cypriot shares are trading on a common trading platform. The basic intention of the present study is to investigate the performance of various technical trading rules in the Cyprus Stock Market (CSE).

Technical analysis, which uses past price movements to predict future price movements, is diametrically opposed to market efficiency (Fama, 1970). In theory, technical analysis has no value if prices are weak-form efficient. Otherwise, technical analysis tests historical data attempting to establish specific rules for buying and selling securities with the objective of maximizing profits and minimizing risk of loss. Early studies of technical analysis by Fama and Blume (1966) and Jensen and Bennington (1970) find that technical rules are unable to reliably predict future returns. However, several more recent studies find the opposite. Brock et al. (1992) demonstrate that a relatively simple set of technical trading rules possess significant forecast power for changes in the Dow Jones Industrial Average over the 1897–1986 period.

This paper considers the changes in the returns to the Brock et al. (1992) technical trading rules methodology on the CSE over the 1998–2005 period. Furthermore, we explore various types of the simplest and most popular technical rules: the moving averages. These rules will be evaluated by their ability to forecast future price changes. The methodology that is going to be used for the analysis of the data is standard tests (t-test), which was used in the past in numerous studies for the investigation of technical analysis. In addition, standard tests will be compared with the bootstrap methodology. Bootstrapping is a method, introduced by Efron (1979), for estimating the distributions of statistics that are otherwise difficult or impossible to determine. The general idea behind

the bootstrap is to use resampling to estimate an empirical distribution for the statistic.

This paper contributes to the existing literature by:

1. Investigating the usefulness of Technical Analysis in the Cyprus Stock Exchange.
2. Investigating the performance of various technical trading rules in 16 stocks of the Cyprus Exchange (General Index) with the largest capitalization.

In section 2 we see the literature review. Section 3 describes the data and technical trading rules used. Section 4 reports the methodology of the paper. In section 5 we see the outcomes and findings of the research. Finally, in section 6 the concluding remarks of the research are stated and summarized.

2. LITERATURE REVIEW

Brock William, Lakonishok Josef, LeBaron Blake (1992), tested two of the simplest and most popular trading rules-moving average and trading range break-by utilizing the Dow Jones Index from 1897-1986. Standard statistical analysis is extended through the use of bootstrap techniques. Overall, their results provide strong support for the technical strategies. The returns obtained from these strategies are not consistent with four popular null models: the random walk, the AR(1), the GARCH-M, and the EGARCH.

Fama and French (1988) in tests for the 1926-1985 period examined autocorrelations of daily and weekly stock returns. They found significant statistical serial correlation in price series of small and large firm portfolios of all New York Stock Exchange stocks, over various time horizons. Their state "our results add to mounting evidence that stock returns are predictable".

Vasiliou, Eriotis, Papathanasiou (1999) in their paper examined the performance of various types of technical trading rules in the Athens Stock Exchange (ASE). In particular, they examined the predictability of daily returns for the ASE by using the various moving averages rules. Due to the problem of non-normality on distribution of the abnormal returns identified, the bootstrap methodology under the null models of AR(1) and GARCH(1,1) is proposed. Overall, their results provided strong support for the examined technical strategies.

Ki-Yeol Kwon and Richard J. Kish (2002) investigated an empirical analysis on technical trading rules utilizing the NYSE value-weighted index over the period 1962-1996. The methodologies employed include the traditional t-test and bootstrap methodology. The results indicate that the technical trading rules add a value to capture profit opportunities over a buy-hold strategy.

Wing-Keung Wong, Meher Manzur, Boon-Kiat Chew (2003) focuses on the role of technical analysis in signaling the timing of stock market entry and exit. Test statistics are introduced to test the performance of the most established of the

trend followers, the Moving Average, and the most frequently used counter-trend indicator, the Relative Strength Index. Using Singapore data, the results indicate that the indicators can be used to generate significantly positive return. It is found that member firms of Singapore Stock Exchange tend to enjoy substantial profits by applying technical indicators.

Uri Ben-Zion, Paul Klein, Yochanan Shachmurove and Yosef Yagil (2003) compared the Tel-Aviv Stock Exchange (TASE), TA25 to the S&P 500 Index with respect to the extent that the Technical Analysis method of moving average can beat the buy-and-hold policy. For 1,500 daily observations, their test results imply weak-form efficiency of the S&P 500 Index. For TA25, no market efficiency is found for relatively short moving averages. The results imply that market efficiency is higher in developed financial markets than in an emerging capital market, such as the TASE.

Atmeh M. and Dobbs I.M., (2004) investigated the performance of moving average rule in the Jordanian stock market. The results show that technical trading rules can help to predict market movements. Sensitivity analysis of the impact of transaction costs is conducted and standard statistical testing is extended through the use of bootstrap techniques.

Ong Hen and lao I (2006) used daily stock prices and the trading volume of 39 constituent companies in the SZSE Component A-Share Index on the Shenzhen Stock Exchange to examine the usefulness of technical analysis. It finds very weak evidence to support the view that traders and/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.

3. DATA AND TECHNICAL TRADING RULES

The database used is composed of 1,971 observations covering the period from 2 January 1998 to 30 December 2005 for the General Index, which is the most famous index of the CSE.

The CSE is the primary stock market in Cyprus. It is considered to be a small emerging capital market with a very short history since it was established in April 1993. On 29 March 1996 the first day of transactions took place. The main index is the CSE General Price Index that reflects, approximately, 93% of the trading activity and 96% of the overall capitalization ¹.

¹ The CSE is supervised by the Ministry of Finance and the Minister of Finance is responsible for choosing the seven member executive committee that runs Cyprus Stock Exchange. Furthermore, the Securities and Exchange Committee is mostly responsible for the well functioning of the capital market of Cyprus. Trading takes place electronically through the Automated Trade System. Besides the Cyprus Stock Exchange shows that although significant steps have been taken for the creation of an efficient capital market there are still several steps need to be taken with the purpose of upgrading the market from less developed to a developed one. It is very important that CSE increases its depth and liquidity which will come through the development of the institutional framework to meet the European legislation. [Chrysostomides E (2005),Georgiades, Kouretas G. (2002)].

Moving averages are one of the oldest and most popular technical analysis tools. A moving average is an indicator that shows the average value of a security's price over a period of time. When calculating a moving average, you specify the time span to calculate the average price. According to the moving average rule, buy and sell signals are generated by two moving averages of the level of the index: a long-period average and a short-period average. A typical moving average trading rule prescribes a buy (sell) when the short-period moving average crosses the long-period moving average from below (above). The idea behind computing moving averages is to smooth out an otherwise volatile series. As can be seen, the moving average rule is essentially a trend following system because when prices are rising (falling), the short-period average tends to have larger (lower) values than the long-period average, signaling a long (short) position.

Simple moving averages apply equal weight to the prices. The critical element in a moving average is the number of time periods used in calculating the average. The most popular moving average is the 30-day moving average. This moving average has an excellent track record in timing the major market cycles. These moving averages are used in this paper, as they are the most common in used by the chartists-technical analysts. Adding the closing price of the security for a number of time periods and then dividing this total by the number of time periods calculates a simple moving average. The result is the average price of the security over the time period. All transactions assume 0.08% (of the investing capital) commission as entry fees and 0.08% as exit fee.

4. METHODOLOGY

The technical trading rules that are going to be investigated are simple moving averages. We will follow similar methodology with Brock et al. (1992) adding transaction costs. The investigation of these technical strategies will be achieved by comparing the returns given by the buy signals of the moving averages with the returns of the buy-and-hold-method. Furthermore, the returns given by the buy signals of the moving averages minus the returns of the sell signals of the moving average with the returns of the buy-and-hold-method will be compared. The hypothesis that the returns of the buy and hold method with the returns of the moving average will be examined using the t-test methodology.

Before the investigation of the technical trading rules, using the t-test, descriptive statistics will be used. As we told the methodology that is going to be used for the analysis of the data is t-test, which was used in the past in numerous studies for the investigation of technical rules. [Neftci 1991, Levich, Thomas 1993, Gençay 1998, Fernando Fernández-Rodríguez, Simón Sosvilla-Rivero and Julián Andrada-Félix 1999, Brown, Jennings 1989). The t-test is used in order to assess if the means of two data groups are statistically different from each other in order to compare these means. The t-statistic is calculated by the formulas:

$$\frac{\mu_{buys(sells)} - \mu_{buy\&hold}}{\sqrt{\left(\frac{\sigma^2}{N_{obser}} + \frac{\sigma^2}{N_{buys(sells)}}\right)}} \quad (1) \quad \frac{\mu_{buys} - \mu_{sells}}{\sqrt{\left(\frac{\sigma^2}{N_{buys}} + \frac{\sigma^2}{N_{sells}}\right)}} \quad (2)$$

where σ^2 is the square root of the standard deviation of the returns, μ is the mean return for the buys, sells, buy and hold method, N is the number of signals for the buys, sells, observations.

The results of the t-test will help to either accept the null hypothesis (there is no actual difference between mean returns (buys, sells) or reject our null hypothesis (there is an actual difference the mean returns). We evaluate the following popular moving average rules: 1-9, 1-15, 1-30, 1-60, 1-90 and 1-120 where the first number in each pair indicates the days in the short period and the second number shows the days in the long period. All transactions assume 0.08% (of the investing capital) commission as entry fees and 0.08% as exit fee.

The results presented in t test assume independent, stationary and asymptotically normal distributions. Many times these assumptions certainly do not characterize the returns from the CSE series. Following Brock et al. (1992), this problem can be solved using bootstrap methods (Efron and Tibshiarani, 1993). Bootstrapping is a method, introduced by Efron (1979), for estimating the distributions of statistics that are otherwise difficult or impossible to determine. The general idea behind the bootstrap is to use resampling to estimate an empirical distribution for the statistic. The values from the General index series will be compared with empirical distributions from a null model for stock returns. In the bootstrap procedure our model is to fit the original series to obtain estimated parameters and residuals. We standardize the residuals using parameters standard deviations for the error process. The estimated residuals are then redrawn with replacement to form a scrambled residuals series, which is then used with the estimated parameters to form a new representative series for the given null model. Each of the simulation is based on 500 replications of the null model. This should provide a good approximation of the return distribution under the null model.

The null model that will be estimated and simulated is the Exponential GARCH. This model developed by Nelson (1991):

$$\begin{aligned} r_t &= \alpha + ye^{ht} + b\varepsilon_{t-1} + \varepsilon_t \\ h_t &= \alpha_0 + g(z_{t-1}) + \beta h_{t-1} \quad (3) \\ g(z_t) &= \theta z_t + w(|z_t| - (2/\pi)^{1/2}) \\ \varepsilon_t &= e^{1/2} z_t \quad z_t \sim N(0,1) \end{aligned}$$

where r_t is the return on day t , ε_t is the residual (error), βh_t is a linear function of the square of the last period's errors and of the last's periods conditional variance. EGARCH model tries to capture persistent volatility as does GARCH model but the log of the conditional variance now follows an autoregressive process, and allows previous returns to affect future volatility differently depending on their signs. This is seen in the g function (Brock et al 1992). This is designed to capture a phenomenon in asset returns observed by Black (1976) where negative returns were generally followed by larger volatility than positive returns. Our model is estimated and the standardized residuals and estimated parameters are used to generate simulated Exponential GARCH series. We use Matlab to estimate the parameters for the model via maximum likelihood and then resample the standardized residuals with replacement to create 500 replications of the model. The bootstrap methodology requires high computer power and computer programming. So we estimate the EGARCH model with the maximum likelihood method and we find the parameters and the residues. Afterwards, we checked our sample for conditional heteroskedasticity using LM test, and we found that existence of ARCH effect so we used the EGARCH model.

To test the significance of the trading rule excess returns the following hypothesis can be stated:

$$\begin{aligned} H_0: XR &\leq \overline{XR}^* \\ H_1: XR &> \overline{XR}^* \end{aligned} \quad (4)$$

Under the null hypothesis, the trading rule excess return (XR) calculated from the original series is less than or equal to the average trading rule return for the pseudo data samples (\overline{XR}^*). The p-values from the bootstrap procedure are then used to determine whether the trading rule excess returns are significantly greater than the average trading rule return given that the EGARCH model.

5. FINDINGS

5.1 Standard Statistical Results

Table I reports some summary statistics for daily returns. Returns are calculated as log differences of the General Index of CSE level. As can be seen, these returns exhibit excessive kurtosis (leptokurtosis) and no normality in returns. Besides, Jarque-Bera p-value rejects normality.

If technical analysis does not have any power to forecast price movements, then we should observe that returns on days when the rules emit buy signals do not differ appreciably from returns on days when the rules emit sell signals.

In Table II we present the results from simple moving average trading strategies. The rules differ by the length of the short and long period. For example (1,60) indicates that the short period is one day, the long period is 60 days. We present results for the 6 rules that we examined. In 3 and 4 columns (table II) we report the number of buy "N(Buy)" and sell "N(Sell)" signals generated during the period. The (daily) mean buy and sell returns are reported separately in columns 6 and 7. The last column "Buy-Sell" lists the differences between the mean daily buy and sell returns. The t-statistics for the Buy and Sell statistics are computed using the following Brock et al. (1992) methodology.

As we can see in Table II, the buy-sell differences are significantly positive for all rules and the t-tests for these differences are highly significant rejecting the null hypothesis of equality with zero. [For 0.05 probability the upper (lower) critical values of the t-test values are ± 1.960]. The mean buy-sell returns are all positive with an average daily return of 0.20%, which is about 50% at an annual rate (250 trading days \times 0.20%).

The mean buy returns are all positive with an average daily return of 0.10 percent, which is about 25% at an annual rate (250 trading days \times 0.10%). The t-statistics reject the null hypothesis that the returns equal the unconditional returns (0.0423% from Table I). All the tests reject the null hypothesis that the returns equal the unconditional returns at the 5% significance level using a two-tailed test.

The lowest number of buy signals is for the (1,120) rule. Also, the largest number of buy signals is generated by the (1,9).

Overall our technical strategies win the market. In particular, Buy-Hold Strategy (Table I) give us 10.56% per year (0.0423% \times 250 days) and using moving averages strategy 50% for buy-sell method at an annual rate and using buys method 25% yearly.

5.2 Bootstrap Results

We further our analysis via the bootstrap methodology under the null model of EGARCH. Each of the simulation is based on 500 replication of the null model (EGARCH). The null hypothesis is rejected if returns obtained from the actual General Index of CSE data are greater than the returns of the simulated returns under the null model. Table III contains estimation results for the EGARCH model, which will be used for comparison with the actual Cyprus Stock Exchange series.

In Table IV we present the results of EGARCHs simulations using simple moving average trading strategies via bootstrapping. The rules differ by the length of the short and long period. We present results for the 6 rules that we examined. All the numbers presented in 4,5,6 columns are the fractions of the simulated result which are larger than the results for the original General index of CSE. The mean buy and sell returns are reported separately in columns 4 and 5. Results for returns are presented in the columns 4,5,6 are p-values. The p-values from the

bootstrap procedure are then used to determine whether the trading rule excess returns are significantly greater than the average trading rule return given from original series. The numbers in parenthesis in 4,5,6 columns show how many series from 500 replications are greater than from original returns. More specifically the number in the column labeled Buy, which is (300), shows that 300 of the simulated EGARCHs generated a mean buy return as large as that from the original General index of CSE. As we see from reported numbers in 4,5,6 columns most of the simulated EGARCHs were greater than those from the General index of CSE series. All the buy, sell and buy-sell are highly significant accepting the null hypothesis. For 0.05 probability the p-value must be greater than 0.05 ($p\text{-value} > 0.05$). The results for the returns are consistent with the traditional tests presented earlier.

6. CONCLUSIONS

In this paper we have examined the performance of various types of technical trading rules in the emerging Cyprus Stock Market. This study becomes necessary given the important changes, which Cyprus is going through since joining the European Union on 1 May 2004 and as it is preparing for the adoption of the Euro as its currency (1 January 2008). Besides, Greek and Cypriot shares are trading on a common trading platform.

The Cypriot market is very small and there is not derivative market. This gives hedge funds less incentive to enter the market and trade away inefficiencies. Also, analyst coverage is lower in CSE. This also suggests that the market may be less informed about the true fundamental value of companies. Although it is very important that CSE increases its depth and liquidity which will come through the development of the institutional framework to meet the European legislation.

This paper considers the changes in the returns to the Brock et al. (1992) technical trading rules methodology on the CSE over the 1998–2005 period. Furthermore we have investigated the performance of various technical trading rules in the Cyprus Stock Market and particularly for the General Index. The technical rules that we have explored were simple moving averages.

In our analysis we have used standard tests in combination with bootstrap methods. The bootstrap methodology requires high computer power and computer programming. We evaluate the following popular moving averages rules: 1-9, 1-15, 1-30, 1-60, 1-90, and 1-120. These moving averages are used in this paper, as they are the most common used by the chartists-technical analysts.

In order to test our hypothesis we used the econometric program Matlab 7.0. All transactions assume 0.08% (of the investing capital) commission as entry fees and 0.08% as exit fee.

All the buy-sell differences are positive and the t-tests for these differences are highly significant rejecting the null hypothesis of equality with zero. The mean buy-sell returns are all positive with an average daily return of 0.20%, which is about 50% at an annual rate (250 trading days x 0.20%). Also the mean buy returns are all positive with an average daily return of 0.10%, which is about 25% at an annual rate. The t-statistics reject the null hypothesis that the returns equal the unconditional returns (0.0423%).

Overall our technical strategies win the market. In particular, Buy-Hold Strategy (Table I) give us 10.56% per year profit (0.0423% x 250 days) and using moving averages strategy 50% for buy-sell method at an annual rate and using buys method 25% yearly. So, we find significant evidence to support the predictability and profitability of technical rules for Cyprus Stock Market.

TABLES

Table I: Descriptive Statistics	
num:	1,971
max:	0.247959
min:	-0.111917
mean:	0.000115
median:	-0.000767
range:	0.3486712
std:	0.0202589
skewness:	1.7294597
kurtosis:	23.1256789
Jarque bera:	3.2656352
JB p-value:	0
Buy-Hold mean return	0.00042383

Table II: Standard results for various types of moving averages

Period	Test	N(buy)	N(sell)	Sum	Buy	Sell	Buy-Sell
01/02/1998 to 12/30/2005	(1,9)	51	50	101	0.0015 (4.4810)	-0.0013 (-4.7898)	0.0028 (6.557)
	(1,15)	46	45	91	0.0013 (3.8174)	-0.0012 (-4.1156)	0.0024 (5.6111)
	(1,30)	27	26	53	0.0011 (3.645)	-0.0010 (-3.60-)	0.0019 (4.6807)
	(1,60)	21	20	41	0.0009 (2.1009)	-0.0009 (-3.5542)	0.0018 (4.4371)
	(1,90)	18	17	35	0.0008 (2.1154)	-0.0008 (-3.1470)	0.0015 (3.701)
	(1,120)	9	8	17	0.0006 (2.0312)	-0.0007 (-2.9880)	0.0013 (3.425)
	Average					0.0010	-0.0010

Table III. Parameter estimates for EGARCH model

$$r_t = \alpha + \gamma e^{h_t} + b\varepsilon_{t-1} + \varepsilon_t$$

$$h_t = \alpha_0 + g(z_{t-1}) + \beta h_{t-1}$$

$$g(z_t) = \theta z_t + w(|z_t| - (2/\pi)^{1/2})$$

$$\varepsilon_t = e^{1/2} z_t \quad z_t \sim N(0,1)$$

α_0	β	γ	b	θ	w	$\alpha \cdot 10^4$
0.2446	0.9923	3.765	0.1438	-0.075	0.215	-0.074
(-28.4)	(120)	(4.985)	(18.523)	(-45.19)	(62.4)	(-0.07)

Estimated on daily returns series 1998-2005. The EGARCH is estimated using maximum likelihood. The numbers in parenthesis are t-ratios.

Table IV: Simulations Test for EGARCH tests for 500 replications

Period	Test	Results	Buy	Sell	Buy-Sell
01/02/1998 to 12/30/2005	(1,9)	Fraction>General Index	0.60 (300)	0.46 (230)	0.56 (280)
	(1,15)	Fraction>General Index	0.57 (285)	0.42 (210)	0.53 (265)
	(1,30)	Fraction>General Index	0.56 (280)	0.402 (201)	0.518 (259)
	(1,60)	Fraction>General Index	0.54 (272)	0.418 (209)	0.504 (252)
	(1,90)	Fraction>General Index	0.50 (251)	0.404 (202)	0.478 (239)
	(1,120)	Fraction>General Index	0.48 (240)	0.386 (193)	0.462 (231)
	Average			0.5417	0.415

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DISCLOSURE STATEMENT

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