THE IMPACT OF THE LEVERAGE PROVIDED BY THE FUTURES ON THE PERFORMANCE OF TECHNICAL INDICATORS: EVIDENCE FROM TURKEY

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—Abstract —

Although in developed countries the futures markets have been in existence since mid-nineteenth century, they are relatively new in the developing countries. In the late twentieth and early twenty first century, many new futures exchanges were established in developing countries and in the majority of these newly established exchanges substantial growth in futures trading have been observed within a small period of time. This fast growth in the futures trading volume was mainly due to the tremendous leverage the futures provides to speculators. Thanks to futures margining system, by committing only a small fraction of the money needed to maintain a position on the underlying security in the spot market, a speculator can attain a much higher return potential by buying or selling a futures contract. This paper studies this effect by employing daily return data on 19 selected stocks listed continuously in IMKB-30 (Istanbul Stock Exchange 30, Turkey) from January 2005 to December 2010. Popular technical indicators are used to generate buy and sell signals in both the spot market (Istanbul Stock Exchange) and the futures market (VOB, a fast growing derivatives exchange located in İzmir, Turkey). The profit/loss resulting from trading strategies are then calculated and compared. The results of the study show that, although the amount invested in both markets is the same, the profit generated from the strategies applied on futures is significantly higher than that on spot market. A CAPM (Capital Asset Pricing Model) based hedge ratio is used to apply the trading strategies generated

from spot market data on futures. The results show that this strategy generates superior returns in the futures market.

Key Words: *Leverage Effect, Futures, Derivatives, Technical Indicators, CAPM Derivatives in Emerging Markets, Turkish Derivatives Market*

JEL Classification: G14, G17, G19

1. INTRODUCTION

Technical analysis, which was originated with the work of Charles Dow in the late 18th century, is an attempt to derive profitable trading signals on the basis of historical price information or other market statistics. According to technical analysts (or chartists) prices move in trends. These trends evolve as a result of the changing behavior of traders toward a variety of economic, political and psychological forces. Technical analysts believe that trends tend to persist, appear again and again in the price charts as the market participants' react to recurrent fundamental conditions in a similar fashion. Therefore, simply by analyzing historical information like price, volume and open interest data one can make predictions on the future direction of the prices, rates, etc.

This is in sharp contrast to one of the commonly held assumptions of Efficient Markets Hypothesis (EMH). EMH (Fama, 1970) has been one of the central propositions of finance over the past four decades. It states that a market is efficient if the prices in it fully reflect all available information. Efficient markets were later subdivided by Jensen (1978) into three types. In a market which is in the weak form of efficient, current prices of the financial instruments fully reflect all past price information. Therefore, technical analysis should not work in a market which is efficient in this sense. Under the semi-strong form all publicly available information and under the strong form all information (whether publicly available or not) is also impounded in the price.

In a market where information is broadly and cheaply available, thousands of informed and intelligent traders assimilate information as soon as it becomes available. As a result of this and of the fierce competition among traders, all relevant information is immediately impounded in the prices of the financial instruments as soon as it becomes available. Therefore, to attempt to predict the future prices of securities on the basis of its past price information should be a fruitless effort. As a result of this belief, which was supported by some early

empirical evidence, technical analysis has long been discredited by the majority of the finance academicians. However, contrary to strong disbelief of the academicians in technical analysis, it has been extensively used by many market participants.

Many recent surveys results indicate technical analysis' widespread acceptance amongst practitioners. Taylor (2000) reports that at least 90% of London Stock Exchange members place some weight in their decision making process on some form of technical analysis, at some time horizon, although the relative weight members give to technical analysis increases as the forecast horizon decreases. Cheung and Wong (2000), Cheung et al. (2004), Menkhoff et al. (2005), Gehrig and Menkhoff (2006), and Taylor (2007) surveys report similar findings.

The reasons of the popularity of technical analysis among market practitioners are beyond the scope of this text and warrant a survey of its own. However, on the basis of the results of the surveys mentioned above, it can be argued that technical analysis is mainly used by traders for short term trading activity and traders turn to more fundamental techniques for longer term decision making (this is especially true for foreign exchange markets). Therefore, it can be argued that technical analysis, as a short-term decision making tool, should be particularly useful in futures markets where high leverage, high liquidity and much lower transaction costs are the main characteristics and these characteristics allow speculators quick short-term profits. In spot markets, many technical rules which are profitable before transaction costs become loss makers after the transaction costs are taken into account. This issue is of lesser importance in futures markets as the transaction costs in these markets are considerably lower than those in spot markets. Moreover, the restrictions on short-sales which are usually the main obstacles that prevent the profitability of technical rules are not of concern to futures market participants.

There have been vast a number of studies analyzing the profitability of technical rules in both spot and futures markets. However, compared to the number of studies on developed markets, the number of studies on emerging markets is scant. Especially the number of studies employing Turkish data appears to be limited in number. Moreover, we are not aware of any study which analyses the profitability of technical rules developed from spot market prices and then applied to futures prices using the CAPM relationship. Therefore, in this study we generate technical trading rules from Turkish spot market data and analyze their

profitability. We then apply these rules on Turkish futures prices using the CAPM relationship and compare the performance of these rules on the futures market with their performance on spot market.

The rest of the paper is organized as follows. Section 2 provides brief information on popular technical rules giving special emphasis on the ones used in this study. Section 3 briefly explains CAPM and the relationship used to apply technical rules generated from spot market prices on futures prices. The results are provided in section 4. Section 5 concludes and provides suggestions for future work.

2. TECHNICAL ANALYSIS

Technical analysis is an enormous collection of forecasting techniques. The exact number of technical rules cannot not be known and probably every day numerous new rules are being developed by analysts around the world. To give an idea about the number of the technical rules available we can cite an empirical study (Marshall et.al., 2010) that uses over 5,000 technical rules to study the profitability of technical rules in 49 countries! The common feature of the technical rules is that they try to generate profitable trading rules deducted from upward and downward price trends that oscillate around a stable level. Technical rules can be classified into two categories: qualitative and quantitative approaches.

The qualitative technical approaches require the visual detection of the patterns such as head and shoulders, flags, pennants and wedges. These approaches are subjective in nature and require human users to identify the patterns with the eye. Although it is possible to represent these formations algebraically, developing algorithms for this is quite a difficult task. Therefore, although these approaches are quite popular among traders, researchers analyzing the performance of the technical rules generally avoid these approaches both because of their subjectivity and because of the difficulty in representing them algebraically.

The quantitative approaches on the hand rely on the simple statistical transformations of past prices. Among these approaches, filter rules, moving average models and momentum models are the most popular ones. These rules are also the most commonly employed techniques in the studies that analyze the profitability of the technical analysis.

Among the quantitative technical rules the simplest ones are the filter rules. A typical filter rule provides a buy signal when the price rises by *x%* above its previous low and a sell signal if it falls *x%* below its previous local high. Depending on the filter size and the time window over which the previous high or low is calculated filter rules can take a variety of forms. In this study we do not employ any filter rules as they generally provide inferior profitability compared to the moving average and momentum models.

A moving average rule involves two moving averages: a short moving average (SMA) of order *n* (usually varies between 1 day and 8 days), and a long moving average (LMA) of order *m* (*m*>*n, m* usually varies between 10 day and 30 days). Moving averages can be used in two ways to generate buy and sell signals. These are Variable Length Moving Average (VMA) and Fixed Length Moving Average (FMA). In FMA, buy and sell signal is assumed to be initiated for a fixed number of days. For example, if a buy or sell signal is generated now, no buy or sell signal will be generated in the next 10 days. However, in VMA buy or sell signals can be generated any time (Bessembinder et al, 1998).

Momentum models' rules rely on the difference between the current price and the price *n* days ago. In its simplest form a momentum rule gives a buy signal if this difference turns from negative into positive, a sell signal in the opposite case. A typical example of a momentum indicator is the stochastic oscillator. This indicator uses support and resistance levels. The term stochastic refers to the location of a current price in relation to its price range over a period of time. The logic of this indicator is that prices tend to close near the extremes of the recent range before turning points. Two lines, %K and %D, are used in this indicator.

where; L- Lowest price over the last n periods

H- Highest price over the last n periods.

In our study, we use highest (H) and lowest (L) prices of last 5 periods. Buy signals are generated at the point where %K line exceeds %D line. The sell signals on the other hand are generated at the point where %K line becomes lower than % D line. Just like VMA, buy and sell signals are generated continuously.

There is a huge variety of modifications of these basic quantitative approaches. Exponential moving averages (EMA), price channel breakout (PCB), stochastic (STOC), relative strength index (RSI) are widely used examples of these

modifications. We use an EMA(5, 20) and a STOC-5 in this study to analyze the profitability of technical analysis in our data set.

3. THE RELATIONSHIP BETWEEN SPOT AND FUTURES PRICES VIA CAPITAL ASSET PRICING MODEL (CAPM) AND COST OF CARRY MODEL

Capital Asset Pricing Model (CAPM) of Sharpe (1964), Lintner (1965) and Mossin (1966) is undoubtedly the most popular approach to model risk-return relationship in finance. According to CAPM a security's return is related to market return in the following way:

$$E(R_i) = r_f + \beta[E(R_M) - r_f] \quad \textbf{(1)}$$

Here $E(R_i)$ is the instrument's expected return, $E(R_m)$ is expected return of the market in which the instrument is traded, r_f is the risk-free rate of return and β is the beta of the instrument.

Cost of carry valuation formula for the stock index futures is as follows:

$$F_o = S_o e^{(r-q)t} \quad \textbf{(2)}$$

Here,

F_0: the stock index futures price,

S_0: the spot index level

r: the risk-free rate of return (continuously compounded)

q: index' dividend yield ((continuously compounded)

If CAPM holds in a market and cost of carry is a valid model for valuing futures then one can easily replicate a spot instrument's payoff using futures contracts. Even if there is no futures on the instrument that is to be replicated, the payoff can be replicated provided that there is a futures contract in that market on an index which represents the market. The following equation shows the relationship between a spot instrument and a futures contract whose underlying is the index that represents the market in which the spot instrument is in:

$$N = \beta \frac{The\ Value\ of\ the\ Spot\ Instrument}{Index\ Level\ x\ Multiplier} \quad \textbf{(3)}$$

In the above equation N refers to the number of index futures and β is the beta of the spot instrument. We use this relationship to apply technical rules generated from spot market prices on futures. The details of this procedure will be provided in the following section.

4. METHODOLOGY AND RESULTS

Our sample consists of 19 stocks that have been listed continuously in Istanbul Stock Exchange 30 (ISE-30) from November 2005 to December 2010. ISE-30 stocks are the most actively traded stocks in Istanbul Stock Exchange. OHCL stock price data for the sample is obtained from IsYatirim (www.isyatirim.com) and futures prices were obtained from Turkish Derivatives Exchange (TURKDEX) website. The sample yielded 1293 observations.

We used three simple technical trading rules. Two of them are moving averages: Simple Moving Average (SMA) and Exponential Moving Average (EMA). We also used a momentum rule: Stochastic Oscillator (SO). We preferred to use simple technical trading strategies as according to many researchers (e.g. Brock et al., 1992) simple technical strategies have superior forecasting power as compared to complex ones. A 5 to 20 averaging is used for both SMA and EMA. A buy signal is simply generated when the 5 day average exceeds the 10 day average. Likewise, a sell signal is generated when 5 day average becomes less than 10 day average. In our analysis, we used FMA method to generate buy and sell signals in both SMA and EMA.

For the stochastic oscillator we used highest (H) and lowest (L) prices of last 5 periods. Buy signals are generated at the point where %K line exceeds %D line. And sell signals are generated at the point where %K line becomes lower than % D line. Again FMA is used for buy and sell signals.

We assume an initial wealth of 1,000,000TL (Turkish Liras) as on November 2005. At the initiation, on the basis of buy and sell signals generated by any of the three technical indicators, we take positions in spot market for each stock. Then, after each complete transaction (after buying shares when a buy signal is generated, a transaction is complete when we sell all the shares are sold following the sell trigger), we calculate our net wealth after deducting transaction costs.[1] We carry on completing transactions with new triggers. This procedure continues till

[1] Transaction cost in spot market is assumed to be 0.1% per transaction.

December 31, 2010. On that date, we close all our positions and calculate our end of period wealth. At that point annual percentage returns (APRs) are calculated for each stock.

For each buy and sell signal generated by the spot prices, we also take positions in in stock index futures using the relationship presented by **(3)** (i.e. we buy *N* Istanbul Stock Exchange 100, ISE-100, futures that are traded on Turkdex). For example, if a buy signal is generated for a stock, we buy *N* ISE-100 contracts in Turkdex. The number of contracts, *N*, to be bought will depend on the hedge ratio of that stock. N is calculated by the following formula:

$$N = \beta \frac{Wealth\ to\ be\ invested}{Index\ Level * 0.1}$$ [2]

Betas for each stock are calculated by regressing returns of each stock against the market returns. ISE-100 returns are used as market portfolio returns to this end. The results of the regressions show that all stocks betas are significantly different from zero (results are not shown due to space limitations).

In futures market, the initial amount of investment is the same initial wealth of 1,000,000 TL. We assume that initial margin in futures market is 10 % of the index level times the multiplier. Therefore, each time a futures transaction is initiated, 10% of the transaction amount is assumed to be deposited in the margin account.[3] When there is a sell trigger from spot market, position by selling the index futures contracts are closed and net wealth is calculated.[4] Again this procedure is repeated until December 31, 2010 and on that date all positions are closed. The end of period wealth after closing all positions and annual percentage return (APR) is calculated for each stock.

Table 1 shows annual percentage returns of each stock for each technical indicator.

[2] In Turkdex, the index multiplier is 10 Kurus or 0.1 TL.
[3] As we will deposit just 10% of the transaction amount into the margin account, the remaining wealth can be invested in any of the risk-free assets. Here, at the moment, we are not considering this extra return in our APR calculations.
[4] Complete transaction cost is assumed to be 0.04%.

Table 1 : APRs (Annual Percentage Returns) (2005-2010)

Stocks	Spot Market			Futures Market		
	Simple Moving Average 5-20	Exponential Moving Average 5-20	Stochastic Oscillator-5	Simple Moving Average 5-20	Exponential Moving Average 5-20	Stochastic Oscillator-5
AKBNK	-8.31%	3.73%	10.57%	81.81%	126.43%	156.53%
AKGRT	42.89%	46.94%	14.18%	116.06%	202.89%	106.02%
AEFES	-8.83%	-8.20%	18.70%	1.01%	7.46%	18.02%
ARCLK	38.62%	23.56%	2.84%	39.56%	49.15%	50.68%
DOHOL	4.19%	10.91%	-2.33%	34.71%	49.83%	47.71%
DYHOL	27.53%	31.29%	14.12%	37.69%	48.35%	26.92%
EREGL	23.39%	19.08%	60.67%	21.15%	41.82%	90.00%
GARAN	53.22%	35.71%	100.28%	171.07%	214.20%	242.35%
HURGZ	9.42%	5.60%	7.02%	39.37%	36.55%	45.73%
ISCTR	15.57%	16.92%	34.30%	78.18%	138.91%	192.45%
ISGYO	27.47%	49.54%	16.75%	70.01%	88.99%	99.55%
KRDMD	22.28%	4.54%	-8.04%	53.50%	65.87%	75.50%
KCHOL	17.60%	24.37%	43.14%	16.47%	18.16%	80.28%
SAHOL	18.47%	8.99%	21.22%	82.31%	90.27%	106.70%
SISE	15.92%	11.04%	5.14%	38.03%	36.99%	77.82%
TOASO	18.61%	18.35%	85.81%	37.23%	38.46%	69.37%
TCELL	-8.70%	-8.11%	9.01%	-1.50%	6.82%	47.64%
TUPRS	-2.85%	-1.42%	111.64%	24.74%	25.61%	56.05%
YKBNK	15.32%	11.92%	49.21%	24.62%	58.47%	115.03%

It is evident from the results that APRs are substantially higher for futures market.

3. CONCLUSION

In this study we analyze the impact of the leverage provided by the futures transactions on the profitability of the technical trading. The results of the study show that the use of futures instead of spot assets in the implementation of technical rules enhances profitability significantly. However, there are a couple of limitations of this study which wil be remedied in future work. First of all, we do not take into account the extra risk that arises by the leverage provided by futures. Risk adjusted returns from futures should be compared with ones generated from spot market.

Moreover, we did not consider the return that will be generated during the periods in which we are out of the market. In future work this issue will also be addressed.

Finally, in future work the artificial intelligence methods will be employed to enhance the profitability of technical indicators.

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