

Finance and Capital Budgeting  
BE 305E

**Investigating market efficiency in  
Russian stock market by modelling  
and performing trading strategies  
based on technical analysis**

Dmitry Igolnikov

Bodø 2011

## **Preface**

This master thesis is written as the final assignment of the Master of Science in Business program, majoring in Finance and Capital Budgeting.

I am very grateful to my supervisor Professor Øystein Gjerde for his attention, essential advices and constructive critics.

I also would like to thank BCS Company for providing me with demo account, which brought me with a valuable insight to Russian stock market.

Moreover, I am very thankful to Evgeniya Borisova a Master student in Sustainable Management for her strong belief in me and great moral support.

Dmitry Igolnikov

Bodø, 2011

## **Abstract**

From year to year there is a considerable growth in Russian stock market's indexes. There is also a continuous establishment of laws which regulate the functioning of stock market and protect investors from illegal activities. The political stability is observed during last years, which in fact lowers political risks for investors. Nowadays, Russia can be regarded as a country with rather low share of external debt, in comparison with other countries such as USA, United Kingdom, Germany, etc. Therefore, Russian stock market can be considered as valuable instrument for investments' attraction. But in order to gainfully invest funds in the stock market, it should be carefully examined. But before that you should decide which tools of analysis to use in order to successfully make this investigation. This research accurately studies technical analysis which can be assigned to one of the respective schools of stock market analysis. The main aim of the research is to find out, whether we can detect market efficiency or inefficiency in Russian stock market by implementation of technical analysis on group of stocks. The practical part of this research is devoted to modelling and performing trading strategies based on technical analysis on the stocks with high liquidity issues. The demand to liquidity is crucial one for prosperous implementation of technical analysis. The insight to data is provided by demo account which was granted by brokerage's company. Analysis and further discussion revealed that technical trading strategy can be gainfully implemented in Russian stock market. Therefore, it was concluded that Russian stock market is not efficient and you can model and perform trading strategy based on technical analysis.

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**The Holy Grail! —**

**... What is it?**

The phantom of a cup that comes and goes?

Alfred, Lord Tennyson (1842)

## **Introduction**

Nowadays, Russian stock market continues its high development which was started since 2005-2006, when there was an explosive growth in market capitalization and an increase in trading volume for all liquid stocks. If earlier stock market of Russian Federation was a kind of device for property's redistribution, now it performs the main function – attracts investments to Russian economics. According to growth rates, our market became 2-nd in 2010 within BRICS (Brazil, Russia, China, South Africa) group – countries with a very fast economic's development. Analytics forecast that broad market indexes in Russia may increase by 20-25% in 2011 (Mereminskaya, 2010).

Such advantageous progression of stock market in dynamics and significant transition to perform the function of investments' attraction in fact opens opportunity for reasonable analysis and estimation of future development of Russian stocks. However, the question arises which tools to use in order to implement a reasonable analysis. Should it be gauges which are provided by fundamental analysis or it should be devices which have come from technical analysis. Nowadays in Russia as elsewhere else there is a high popularization of stock market among population. Brokers try to attract as much clients as possible, by promotion of favorable sides in stock market's participation, offering discounts and free services and by performing educational classes. They provide you with an introduction to technical analysis, with reference to technical trading strategies, since at first glance it may be more obvious and understandable than fundamental especially for people who do not have financial education and nowadays all these technical tools are available and directly at your disposal and moreover you do not need to calculate them, since special programs on your PC will make all necessary calculations for you. However, the reality is much more complex, and technical analysis should not be regarded as a tool with which you can create automated system and safely earn high incomes. Thus, this research tries to evaluate whether technical analysis actually works, so there will be an attempt to analyze its theory with reference to its performance in the past and demonstrate by testing the impact of using its instruments on trading's results. The author himself is highly interested in technical analysis, due to the fact that there was a lack of it during financial classes, while fundamental analysis was given first

priority. However, he takes a neutral point in the sense that he does not give full preference to one against another of these respective schools of analysis and considers that a reasonable combination is possible. He adheres to idea that weaknesses of fundamental analysis such as ignorance of investor's irrational behaviour or psychological aspect and timing matters, can be replaced with strengths of technical analysis, but fundamental analysis can give a highly reliable indication of choosing a right stock. However, the researcher is not going to use fundamental analysis as a basis for stocks' selection. The very first point that we should take into consideration is to understand the demands which come from technical analysis to different types of stocks.

So, the general aim of this thesis is to find out, whether it is advantageous to trade stocks in Russian stock market with means of technical analysis. Such statement brings us with formulation of the following research question:

Research question: Whether Russian stock market is inefficient in a sense that we can model and perform trading strategies based on technical analysis and earn abnormal return or have more advantageous readings of Sharpe ratio against the performance of holding strategy.

So besides test's performing, this thesis also aims to evaluate suitable technical gauges which can be reasonably combined in the trading strategy.

There will be following important sections in this research:

- **Methodology:** this part will include the choice of philosophical paradigm, research design, unit of analysis, details about measures, data collection and analysis. It will also touch such issues as validity, both internal and external, reliability and threats to these points.
- **Theoretical part:** this section brings us with issues regarding theory of technical analysis. It provides us with explanations about core concepts of technical analysis, differentiates technical analysis from fundamental and puts some criticism on that matter. It also describes trend issues, variety of technical gauges, risk control considerations. Moreover, it send us back to history to test whether technical analysis proved it's efficiency and make an introduction to different trading strategies.
- **Practical part:** After consideration of theory, we can make a step further in understanding demands for successful implementation of technical analysis. On this basis this section will allow us to choose necessary stocks for testing, select and combine needful technical gauges, determine the conditions of



their execution, specify risk control considerations. After such modelling and subsequent testing, all important results will be presented and analyzed.

- Conclusion: final considerations regarding attainability of research's objectives with reference to validity and reliability will be reflected in this part.

Before we start, I would like to put forward the messaging from Jessie Livermore a famous stock trader in the beginning of 20-th century. In the book about him "Reminiscences of a Stock Operator", written in 1923 by Edwin Lefèvre, he calls us never listen to anybody – your broker, different analitics, friends, wife, etc. First, test your findings by yourself and then implement if your results proved to be successful. If it proved to be inefficient in reality – at least it will be your mistake, which you can analyze, fix and carry on with improvement.

### **Methodology**

One of the first and critical decisions that I need to make in designing our research project is the paradigm within I will situate my work. This use of the term "paradigm", which derives from the work of the historian of science Thomas Kuhn, refers to a set of very general philosophical assumptions about the nature of the world (ontology) and how we can understand it (epistemology), assumptions that tend to be shared by researchers working in a specific field or tradition.

Moreover, as I know from literature (e.g. Easterby-Smith M., Thorpe R., Jackson Paul R., 2008), there is often correspondence between ontologies, epistomologies and methodologies. Thus, paradigms also typically include specific mehodological strategies linked to these assumptions, and identify particular studies that are seen as exemplifying these assumptions and methods. Therefore, it means that if you choose a particular philosophical approach, then you will need to choose a particulat methodology, which has a correspondence to this approach.

The question arises, which philosophical approach do I need to choose? First of all, I need to remember that you don't need to adopt in total a single paradigm or tradition. It is possible to combine aspects of different paradigms and traditions, although if you do this, you need to carefully assess the compatibility of the modules that you borrow from each. Second, your selection of a paradigm (or paradigms) is not entirely a matter of free choice. You have already made many assumptions about the world, your topic, and how we can understand these, even if you have never consciously examined these. Choosing a paradigm or tradition primarily involves assessing which paradigms best fit with your assumptions and

methodological preferences (Maxwell, 2005). Taking all of these in mind, let's start with the outcome of this research or what do I want to get at the end. Do I want to get causality, establishing relationships between the variables. Or I want to understand the process in deep details. While the former is concerned with positivistic approach, the latter is about social constructionism (SC). In other words do I want to discover (positivism), or I want to invent (SC)? And according to my research question, what I do is concerned with investigating market efficiency, whether it is worth to adhere only to holding strategy, which implies that markets are efficient or it is more meaningful to use trading strategies based on technical analysis, which in fact leads us to market inefficiency. In this particular case market efficiency/inefficiency or market outcome is a dependent variable, while used strategies, which consist from combination of technical gauges are independent variables. This is typically the aim of positivist management research: to formulate a hypothesis about a "causal law" (a general relationship between input and output) and to use this hypothesis in order to increase efficiency and if efficiency is not increased, it may be necessary to go back and look for another hypothesis about what is correlated with what (Easterby-Smith, Thorpe, & Jacks, 2008, p. 58).

But I need to remember, that there are can not be fundamental laws in social sciences. Everything changes with time. Therefore, I am not going not adhere to "hardcore" positivism, which claims that there is a strict certainty of science. So, I am choosing "softcore" positivism, proposed by Karl Popper, meaning that science is not a house of bricks, but it is a house of straw. The house of science is being knocked down and rebuilt constantly, and that is the way it should be – an infinite process of trial and error (Dybvig, 2010).

I also need to determine the unit of analysis. I am trying to discover the market efficiency\inefficiency via testing strategies on particular stocks, but such terms are too abstract and what I need is to reduce them to simplest terms. So I can measure terms in a sense of rate of return (percentage gain/loss) and risk (standard deviation) for these stocks. Thus, to state it more clearly - market outcome (efficiency/inefficiency) will be represented by measured values of return and risk for particular stock which are provided by holding strategy, versus readings of return and risk for the same stock which are caused by technical trading strategy.

Now, it is necessary to determine research methodology or research design. My primary goal is to test trading strategies in Russian stock market and see the results from such implementation. Therefore, it is suitable to use experimental design, since I am interested in the effect of some process or intervention (in my case testing trading strategies) on some

objects or experimental units, which is Russian stock market, represented by certain Russian stocks. I treat stocks identically in all respects, meaning that I do use the particular strategy with exactly same conditions of its implementation on each of stocks and choose the same period of testing and then compare obtained “yields” (returns and risks) from trading strategies against corresponding values from holding strategy in order to judge about market efficiency or inefficiency.

But before that, I need to come with suitable model for its implementation, since I do not have ready-made strategy. Sure thing I can take ready strategy, which worked successfully in the past but there are thousands of such strategies. Therefore, it is common sense to assume that researcher should be aware of previous work conducted in the general field. In this case, I will study literature, concerning technical analysis, which will help me to understand the general situation about technical analysis, inspect evidence with regard to its effectiveness, choose right tools and methods of their implementation in order to create a specific model. I will view positive and negative sides of most common technical tools and try to combine these gauges in order to partly eliminate weaknesses and increase strengths by such combination. For this purpose a case study will be used as research design, which is a broad-based method which looks in depth at one, or a number of particular units represented as technical tools in my case. It will help me to come up with specific strategy and such design can also be implemented under positivistic paradigm (Easterby-Smith, Thorpe, & Jacks, 2008).

I will use secondary data for my tests which is represented as prices for particular stocks within specified period, which I will estimate later after consideration of theoretical and practical aspects. I can take an access to such financial data via opening a demo account and use broker’s software to view dynamics of prices. Moreover, such software brings you a value in a sense that you get all technical tools at your disposal, which is highly crucial in my case, since I would like to test strategies based on technical analysis. After implementation of strategies on secondary data, I will obtain primary data which will be represented as values of returns and standard deviations and according to which we can judge market’s efficiency/inefficiency. It can be a case that values of return and risk are higher for one stock when you use holding strategy, while at the same time these values are lower for the same stock for trading strategy. Therefore, it is also suitable to establish values of Sharpe ratio, which will help me to choose rightly in this contradictory case. Especially differences in Sharpe ratios between trading strategy and holding strategy will be friendly useful for reader, when they are graphically represented.

In order to estimate outputs of return, standard deviation and Sharpe ratio, following formulas will be used:

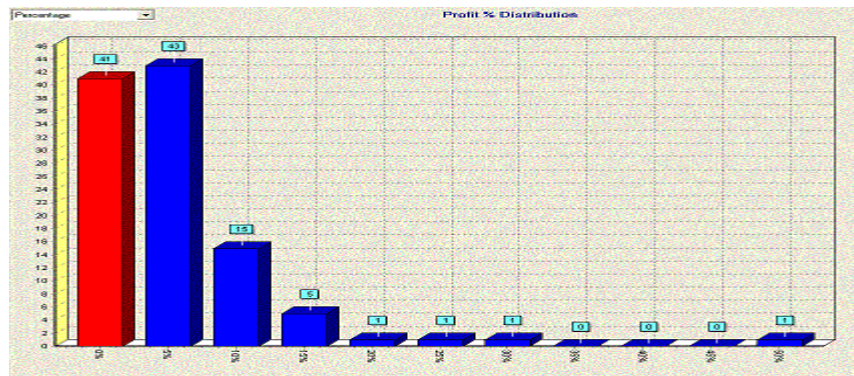
- For rate of return:  $r_{arith}=(P_1-P_0)/P_0$ ; where  $r_{arith}$  – rate of return,  $P_0$  – initial price of the stock,  $P_1$  – ending price of the stock;
- For standard deviation:  $\sigma=(\sum(r_i-r_{av})^2/(n-1))^{0.5}$ , where  $r_i$  and  $r_{av}$  are specific and average returns respectively. This formula is used if data represents a sample from population. If data represents population, then  $\sigma=(\sum(r_i-r_{av})^2/n)^{0.5}$ ; Normal distribution and no correlation between returns intra year are assumed.
- For Sharpe ratio:  $S=(r_i-r_f)/\sigma$ ; where  $r_f$  is a risk-free rate. (Bodie & Kane, 2009).

The data analysis will be performed in the following way. First, all gathered results will pass through first screen of analysis. This screen will analyze readings of total returns, risks and Sharpe ratios for overall period. If it will be a case that strategy proved to come up with negative outcomes of total returns or outcomes which are less advantageous for particular stock than for the same stock within holding strategy, then such stock will be dropped off from further analysis. Second screen of analysis assumes stability of returns from year to year. It does not mean that I should get more or less equal returns, but these rates of returns should have positive values and be more advantageous in comparison with holding strategy at least a half of the time from overall period. If, for instance it will be a case that one year showed great performance for trading strategy, while all other years were poor, but overall performance still higher than in correspondence with holding strategy's case, then such performance could happened by coincidence, which is not reliable indication of market's inefficiency. We can state that if the trading technical strategy is efficient, meaning that you can earn abnormal return with means of this strategy or get advantageous readings of Sharpe, therefore market is considered to be inefficient. Thus, for additional support, to confirm the point of view that strategy is efficient or not, test of significance will be performed on yearly differences in Sharpe ratios between technical strategy and holding strategy. It will be tested whether mean of differences significantly different from zero and have positive reading. If it will be the case, then such test confirms our hypothesis, concerning market's inefficiency. If the result will prove to be insignificant, then market is efficient. Such test is very useful in indication of overall efficiency for specific strategy. The test will be conducted with means of StatTools for Excel provided by Palisade. The logic of the test is provided below (Brooks, 2008, p. 64-65):

- First, I am looking for the value of test statistic, according to the following formula:  $\text{test statistic} = (B - B^*) / \text{SE}(B)$ ; where  $B$  – mean value;  $B^*$  - hypothesized mean value.  $\text{SE}(B)$  – standard error of mean value;
- After, I am searching for critical t value, using necessary significance levels (10%, 5%, 1%) and degrees of freedom. Null hypothesis is that mean value is equal to zero, while alternative hypothesis is that mean value is more than zero;
- I compare test statistics with critical t value in order to understand whether I need to reject null hypothesis (test statistics is higher than t critical) or not reject (test statistics is lower than t critical. This test is one-sided, therefore we are interested in the right tailed rejection region;

In order to have an efficient trading system, which implies that you can beat market, then your goal is to have a distribution of returns as much nicely fitted as possible. First, take a look at the following picture to understand what is that mean (Informational Portal for Private Investors, 2011):

*Picture 1: Profit % distribution for the professional trader*



This picture is taken from professional website whose aim to help in trading with stocks. It is evident that professional traders try to eliminate huge losses, while enjoy with small losses incurred in large quantities. However, they also enjoy with small gains in approximately same quantities which in fact almost cover their losses, while they earn profits making trades of average and more than average rates of return. Therefore, the general aim is to cut left tail of distribution as much as possible and try to optimize and expand right tale. Thus, for futher analysis I will also try to understand main limitations and advantages of this strategy by plotting histogram with help of StatTools for Excel. Such histogram, which reflects distribution of returns within particular intervals and frequency of trades, will friendly help me to make it completely clear with negative and positive sides of this specified technical strategy which in fact reflects the efficiency of this system.

Validity issue includes internal validity and external validity. According to Johnson and Duberley (2000), internal validity measures “whether or not what has been identified as the cause actually produces the effect.” External validity is “the extent to which the research findings can be extrapolated beyond the immediate research sample”. Reliability is “the consistency of results obtained in research, whether another researcher could replicate the original research or the same researcher could replicate the original research at a different time” (Johnson & Duberley, 2000, p. 46). We need both validity and reliability; however, it is not easy to get both to a high degree. There is always a trade-off between validity and reliability. Concerning internal validity, I do not know at the moment if technical strategies actually produce the desired market outcome or not. But I will try to increase internal validity, by choosing a reasonable combination of technical tools and establishing necessary conditions of strategy’s implementation. All of these I will try to achieve by investigation of theory regarding technical analysis. During analysis part, I will also make an attempt to raise internal validity of my results by conducting not one but several screens of analysis with use of graphs, significance tests and distribution’s plotting and study. I will also try to lever up external validity, by testing the strategy not only on one or several stocks, which is rather arguable and market inefficiency can pop up by coincidence, but on number of stocks which represent relatively high share of broad market index. This means in turn, that if more stocks prove to have advantageous readings of return and risk, then overall efficiency of technical strategy proved to be rather high. It will indicate that the probability of successful extrapolation on other stocks will be higher in this case, than in case if I test technical strategies on couple of stocks. I am also concerned about reliability issue. I will try to adhere to objective methods of strategy’s execution provided by means of technical analysis, and drop off subjective methods. It signifies adherence to mechanical trading signals obtained from technical strategy. Such issue lifts up the value of reliability, which in fact leads to more consistent results.

However, there are some threats to internal and external validity as well as to reliability. If I take threats to internal validity, then I can possibly confront with historical issue. It means that theory that was successful at one period of time may be not so applicable at other period of time. For instance, at the present time, with the emergence of China as a global economic force, the theories about the behaviour of financial markets which were developed during the era of US dominance are now have to be rewritten. Moreover, I can run into a problem, which connected with analysis part. The question at issue is that when I conduct test of significance, I can encounter with 2 types of error. I can make type 1 error,

when I consider that result is significant (reject null hypothesis or  $H_0$  that testing result is equal to zero) but in reality  $H_0$  can be true. The probability of doing so is reflected by significance level or size of the test. Sure thing that I can reduce size of the test, e.g. from 5% to 1%, then I will have more strict criterion for rejection, meaning that I reject null hypothesis less often. Doing this I lower chance of type 1 error. However, if I reduce significance level, then I can more likely to incorrectly not reject and by doing so I increase chance of type 2 error (Brooks, 2008, pp. 64-65). Therefore, I should be very careful in interpretation of results. Regarding external validity, it may be so that technical analysis has its own demands to stocks, where it can be successfully implemented, and may work well only with specific types of stocks, for instance with growth stocks or income stocks, or stocks with high liquidity, etc., therefore extrapolation may be higher probable within a particular group where it will prove its efficiency, while less probable on other groups of stocks. Concerning reliability issue, I can possibly encounter with the problem, when established trading system may be rather sophisticated, which brings me with complexity of decision-making, which in fact levers down consistency of results.

Many skeptics, it is true, are inclined to dismiss the whole procedure (chart reading) as akin to astrology or necromancy; but the sheer weight of its importance in Wall Street requires that its pretensions be examined with some degree of care.

Benjamin Graham  
(1934:618)

## **Part 1. Philosophy of technical analysis**

### **1. Introduction to technical analysis**

Over the past 30 years technical analysis has become an accepted part of making investment decisions. In dealing rooms, brokerage houses and fund companies, traders and sophisticated investors have access to charting packages, websites and proprietary software. Some colleges and universities have trading rooms and a few even have classes in the subject. Hedge funds use sophisticated technical approaches involving chaos theory and modeling. Many Wall Street investment banks arrange private courses on technical analysis for trainees. Traditional commodity markets have used technical analysis for decades; newer power and

energy markets are following suit. The golden age of technical analysis may lie just ahead of us (Kamich, 9 July 2001).

The concept of technical analysis is completely at odds with the notion of efficient markets. The efficient market hypothesis makes two important predictions. First, it implies that security prices properly reflect whatever information is available to investors. A second implication follows immediately: active traders will find it difficult to outperform passive strategies such as holding market indexes (Bodie & Kane, 2009, p. 384).

A full appreciation of the technical approach must begin with a clear understanding of what technical analysis claims to be able to do and, maybe even more importantly, the philosophy or rationale on which it bases those claims. So, first, let's define the subject. Martin J. Pring (1991), President of the International Institute for Economic Research and a well-respected technical analyst, defines technical analysis thus: "The technical approach to investment is essentially a reflection of the idea that prices move in trends which are determined by the changing attitudes of investors toward a variety of economic, monetary, political, and psychological forces. The art of technical analysis – for it is an art – is to identify trend changes at an early stage and to maintain an investment posture until the weight of the evidence indicates that the trend has reversed... Since the technical approach is based on the theory that the price is a reflection of mass psychology ('the crowd') in action, it attempts to forecast future price movements on the assumption that crowd psychology moves between panic, fear, and pessimism on one hand and confidence, excessive optimism, and greed on the other... The art of technical analysis is concerned with identifying these changes at an early phase, since these swings in emotion take time to accomplish. Studying these market trends enables technically oriented investors to buy or sell with a degree of confidence, on the principle that once a trend is set in motion it will perpetuate itself."

Pring thus views technical analysis as the art of being able to identify trends early.

In popular book on technical analysis by Edwards and Magee (1992) define technical analysis as: "...the study of the action of the market itself as opposed to the study of the goods in which the market deals. Technical analysis is the science of recording, usually in graphic form, the actual history of trading (price changes, volume of transactions, etc.) in a certain stock or 'the averages' and then deducing from that pictured history the probable future trend."

Whether technical analysis is an art (as Pring believes) or a science (as Edwards and Magee suggest), it is clear that it deals with making inferences about future price trends based on historical market information.



There are three premises on which the technical approach is based (Murphy, 1986, pp. 2-4):

1. Market action discounts everything: all the technician is really claiming is that price action should reflect shifts in supply and demand. If demand exceeds supply, prices should rise. If supply exceeds demand, prices should fall. This action is the basis of all economic and fundamental forecasting. So, it follows that if everything that affects market price is ultimately reflected in market price, then the study of that market price is all that is necessary. By studying price charts and a host of supporting technical indicators, the chartist in effect lets the market tell him or her which way it is the most likely to go. He or she just does not believe that knowing what those reasons are is necessary in the forecasting process.
2. Prices move in trends: the whole purpose of charting the price action of stock market is to identify trends in early stages of their development for the purpose of trading in the direction of those trends. So, most of the technicians are trend-following in nature, meaning that their intent is to identify and follow existing trends. It should be noted that the entire trend-following approach is predicated on riding an existing trend until it shows signs of reversing.
3. History repeat itself: much of the body of technical analysis and the study of market action has to do with the study of human psychology. It is assumed that patterns which have worked in the past will continue to work well in the future. Therefore, the key to understanding the future lies in a study of the past, or that the future is just a repetition of the past. For instance, if a certain pattern of activity has in the past produced certain results nine times out of ten, one can assume a strong likelihood of the same outcome whenever this pattern appears in the future.

However, it should be emphasized that a large part of the methodology of technical analysis lacks a strictly logical explanation.

Technicians do not deny the value of fundamental information, but believe that prices only gradually close in on intrinsic value.<sup>1</sup> As fundamentals shift, astute traders can exploit the adjustment to a new equilibrium (Bodie & Kane, 2009, p. 395).

There are several different titles applied to practitioners of the technical approach: technical analyst, technician, chartist, market analyst. They all meant pretty much the same thing. However, with increased specialization in the field, it has become necessary to make

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<sup>1</sup> Here, PVGO is included in intrinsic value

some further distinctions and define the terms a bit more carefully. The broader area of technical analysis is being increasingly divided into two types of practitioners, the traditional chartist and, for want of better term, statistical, or computer, technicians. Admittedly, there is a lot of overlap here too and most technicians combine both areas to some extent. But, as in the case of the technician versus the fundamentalist, most seem to fall into one category or the other. The traditional chartist uses computer technology to supplement his or her analysis, charts remain the primary working tool. Everything else is secondary. The success of the approach depends, for the most part, on the skill of the individual chartist. But, the statistical, or computer analyst takes these subjective principles, quantifies, tests, and optimizes them for the purpose of developing mechanical trading systems. These system, or trading models, are then programmed into a computer that generates mechanical “buy” and “sell” signals (Murphy, 1986, p. 12).

It is possible to base investment decisions directly on technical signals without knowing anything about the company behind a price chart. Many traditional investors will probably be a bit surprised at first by such a statement, but we can think about it in the following manner: What is it you as an investor are interested in? Is it a company’s sales, turnover, quarterly results, expectations of possible future profits or the quality of its management and workforce? Depending on what kind of investor you are, all of these factors and probably many more could influence your investment decision. However, especially as a private investor it is impossible to get an accurate and up-to-date overview of all these factors. By using technical analysis, you let the market evaluate these factors for you. All buyers and sellers evaluate all these factors and together this determines the price. Then we can simply take the price and use it to analyze the stock. How much money the company could make or how well it is managed is of no interest to an investor if it is not reflected in the price of the stock (Linlokken & Frolich, 2004, p. 97).

## **2. Technical versus fundamental forecasting and criticisms of the technical approach**

Flags, pennants, saucers, and head-and-shoulders formations. Stochastics, moving average convergence divergence indicators, and candlesticks. Such is the arcane language of the technical analyst. Few areas of investment analysis have attracted more critics, yet no other area has a core of such dedicated, ardent supporters. Technical analysis, often dismissed by academic economists as being no more useful than astrology, is being given a new look, and some of the recent evidence is surprisingly positive.

While technical analysis concentrates on the study of market action, fundamental analysis focuses on the economic forces of supply and demand that causes prices to move higher, lower, or stay the same. The fundamental approach examines all of the relevant factors affecting the price of stock in order to determine the intrinsic value of that stock. The intrinsic value is what the fundamentals indicate a stock is actually worth based on the law of supply and demand. If the intrinsic value is under the current market price, then the stock is overpriced and should be sold. If market price is below the intrinsic value, then the market is undervalued and should be bought.

Both of these approaches to market forecasting attempt to solve the same problem, that is, to determine the direction prices are likely to move. They just approach the problem from different directions. The fundamentalist studies the cause of market movement, while technician studies the effect. The technician believes that the effect is all that he or she wants or needs to know and that the reasons, or the causes, are unnecessary. The fundamentalist always has to know why. It is sometimes said that fundamental analysis is designed to answer the question what and technical analysis to answer the question when. (Murphy, 1986, pp. 5-6).

Most traders classify themselves as either technicians or fundamentals. Some think that technical analysis is superior to fundamental, other think that vice a verse. In reality, there is a lot of overlap. Most fundamentalists have a working knowledge of the basic tenets of chart analysis. At the same time, most technicians have at least a passing awareness of the fundamentals. The problem is that the charts and fundamentals are often in conflict with each other. Usually at the beginning of important market moves, the fundamentals do not explain or support what the market seems to be doing. It is at these critical times in the trend that these two approaches seem to differ the most. Usually they come back into sync at some point, but often too late for the trader to act.

One explanation for these seeming discrepancies is that market price tends to lead the known fundamentals. Stated another way, market price acts as a leading indicator of the fundamentals or the conventional wisdom of the moment (Murphy, 1986, p. 5).

Practical traders, who believe themselves to be quite exempt from any intellectual influences, are usually slaves of some defunct mathematician. For instance, some traders very strong believe in Fibonacci numbers. It is the sequence formed by adding consecutive components of a series – 1, 1, 2, 3, 5, 8 and so on. Numbers in this series crop up frequently in nature and the relationship between components tends towards 1,618, a figure known as the golden ratio in architecture and design. If it works for plants (and appears in “The Da Vinci

Code”), why shouldn’t it work for financial markets? Therefore, some traders believe that markets will change trend when they reach, say, 61,8% of the previous high, or are 61,8% above their low. But there is a bad news for such traders. A new study which is called “No Magic in the Dow – Debunking Fibonacci’s Code,” working paper, Cass Business School, written in September 2006 by Professor Roy Batchelor and Richard Ramyar of the Cass Business School, finds no evidence that Fibonacci numbers work in US stockmarkets.

Experience suggests that chartists defend their territory with an almost religious zeal. But their arguments are often anecdotal: “If technical analysis doesn’t work, how come so-and-so is a multi-millionaire? This “survivorship bias” ignores the many traders whose losses from using charts drive them out of the market. Furthermore, the recommendations of technical analysts can be so hedged about with qualifications that they can validate almost any market outcome. (The Economist, September 21, 2006).

There are few questions which crop up in the discussion of technical approach. One of them is the self-fulfilling prophecy. Another is the question of whether or not past price data can really be used to predict future price direction. The Random Walk Theory questions whether prices trend at all and doubts that any forecasting technique can beat a simple buy and hold strategy (Murphy, 1986, p. 17). These issues require explanations.

The issue about self-fulfilling prophecy is raised very often. In other words it is stated that the use of most chart patterns has been widely publicized, so many traders are quite familiar with these patterns and often act on them in concert. This creates a ‘self-fulfilling prophecy’, as waves of buying or selling are created in response to ‘bullish’ or ‘bearish’ patterns. Defenders of technical approach response that even most technicians did agree on a market forecast, they would not all necessarily enter the market at the same time and in the same way. Some would try to anticipate the chart signal and enter the market early. Others would buy or sell the ‘breakout’ from a given pattern or indicator. Still others would wait for the pullback after the breakout before taking action. Some traders are aggressive; others are conservative, some use stops to enter the market, while others like to use market orders or resting limit orders. Some are trading for the long pull, while others are day trading. Therefore, the possibility of all technicians acting at the same time and in the same way is actually quite remote (Murphy, 1986, pp. 17-18).

Another question often raised concerns the validity of using past price data to predict future. As one statistical text puts it: “The first step in forecasting the business or economic future consists, thus, of gathering observations from the past” (Freund & Williams, 1969, p. 383). Chart analysis is just another form of time-series analysis, based on a study of the past,

which is exactly what is done in all forms of time series analysis. We can only estimate the future by projecting past experiences into that future. So, it seems that the use of past price data to predict the future in technical analysis is grounded in sound statistical concepts.

The Random Walk Theory developed and nurtured in the academic community, claims, that price changes are ‘serially independent’ and that price history is not a reliable indicator of future price direction, that price movement is random and unpredictable. The first to make this connection was Frederick MacCauley, an economist in the early part of 20-th century (June 1925, p. 248). More than 30 years later, Harry Roberts, a professor at the University of Chicago, simulated movements in the market by plotting price changes that resulted from completely random events, such as flips of a coin. These simulations looked like the charts of actual stock prices, forming shapes and following trends that are considered by chartists to be significant predictors of future returns. But since the next period’s price change was, by construction, a completely random event, such patterns could not logically have any predictive power. This early research supported the belief that the apparent patterns in past stock prices were the result of completely random movements. The book that also popularized the theory was “The Random Character of Stock Market Prices” by Paul H. Cootner (ed.), published by MIT Press, 1964.

But does the randomness of stock prices make economic sense? Factors influencing supply and demand do not occur randomly and are often quite predictable from one period to the next. Should not these predictable factors make stock prices move in nonrandom patterns?

In 1965, Professor Paul Samuelson of MIT showed that the randomness in security prices did not contradict the laws of supply and demand (Samuelson, 1965, p. 49). In fact, such randomness was a result of a free and efficient market in which investors have already incorporated all the known factors influencing the price of the stock. This is the crux of the ‘efficient market hypothesis’.

Much has been written on both sides of the issue after. The theory is based on the efficient market hypothesis, which holds that prices fluctuate randomly about their intrinsic value. It also holds that the best strategy to follow would be a simple ‘buy and hold’ strategy as opposed to any attempt to ‘beat the market’.

While there seems little doubt that a certain amount of randomness or ‘noise’ does exist in all markets, it’s just unrealistic to believe that all price movement is random. A casual glance through any chart will demonstrate the presence of trends in a very graphic way. How do the “random walkers” explain the persistence of these trends if prices are serially independent, meaning that what happened yesterday, or last week, has no bearing on what

may happen today or tomorrow? How do they explain the profitable “real life” track records of many trend-following systems? It seems fair that to observe any process appears random and unpredictable to those who do not understand the rules under which that process operates. An electrocardiogram printout, for example, can appear like a lot of random noise to a layperson. But to trained medical person, all those little blips make a lot of sense and certainly not random. These are arguments of proponents who protect technical analysis. But imagine 8 charts: 4 of them are real and other 4 are generated by computer simulation. Try to differentiate! In fact, most of the top brokers at a leading Wall street firm found it impossible to tell the difference between real and counterfeit data (Siegel, 1998, p. 243).

However, evidence on the side of Random Walk Theory is presented, leaving the academic debate alive. Another book on the subject is “A Random Walk Down Wall Street” by Burton G. Malkiel, published by W. W. Norton & Co., New York, 1973.

Ultimately, if the efficient market theory is correct, technical analysis should not work at all; the prevailing market price should reflect all information, including past price movements. However, technical analysis runs counter to the weak-form EMH (Romeu & Serajuddin, 2001, p. 40)<sup>2</sup> (while fundamental analysis runs counter to the semi-strong form EMH (Romeu & Serajuddin, 2001, p. 40)<sup>3</sup>). For the EMH to work, investors must be highly intelligent and rational, and they must react immediately and accurately to all information in the market (Romeu & Serajuddin, 2001, p. 40). But academic fashion has moved in favor of behavioral finance, which suggests that investors may not be completely rational and that their psychological biases could cause prices to deviate from their “correct” level (since human actions make the stock market what it is, lots of human failings and apparently illogical and irrelevant factors may contribute to making a market move). Technical analysts also make the perfectly fair argument that those who analyze markets on the basis of fundamentals (such as economic statistics or corporate profits) are no more successful (The Economist, September 21, 2006).

Summarizing, we can say that investors who use technical analysis gain because of the following main reasons. First of all technical analysis incorporates the attitude of the complete market towards a stock. It includes fundamental, psychological and all other factors, since all these factors together determine the prices at which buyers and sellers trade their stocks.

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<sup>2</sup> The weak form of EMH states that one cannot predict future stock prices by looking at past stock prices..

<sup>3</sup> The semi-strong form says that one cannot use information concerning a particular stock (in addition to simple price information) that is public knowledge to predict its future prices.

Secondly technical analysis makes it much easier for investors to evaluate a large number of stocks very efficiently and quickly (Linlokken & Frolich, 2004, p. 97).

All that talk of long waves is distinctly mystical and seems to take deterministic view of history that human activity is subject to some pre-obtained pattern. Chartists fall prey to their own behavioral law, finding “confirmation” of patterns everywhere, as if they were reading clouds in their coffee futures.

### **3. Empirical evidence regarding the effectiveness of technical analysis**

Early studies found little evidence showing that technical analysis was useful in enabling investors to “beat the market”. Many “proofs” of the ability of technical analysis to beat the market were offered, but most committed serious analytical errors that invalidated their results. Burton Malkiel (1990) has been quite clear in his denunciation of technical analysis. In his best-selling work, “A Random Walk Down Wall Street”, he proclaims: “Technical rules have been tested exhaustively by using stock price data on both major exchanges, going back as far as the beginning of the 20<sup>th</sup> century. The results reveal conclusively that past movements in stock prices cannot be used to predict future movements. The stock market has no memory. The central proposition of charting is absolutely false, and investors who follow its precepts will accomplish nothing but increasing substantially the brokerage charges they pay” (Malkiel, 1990, p. 133).

However, several more studies have indicated that technical analysis may be useful to investors. The evidence presented in these studies can be divided into two groups which are based on strategies involved. The first group, consisting of momentum (Alexander, Sharpe, & Bailey, 2001, p. 288)<sup>4</sup> and contrarian (Alexander, Sharpe, & Bailey, 2001, p. 288)<sup>5</sup> strategies, simply examines the returns on stocks during a recent time period to identify candidates for purchase and sale. The second group, consisting of moving average and trading range breakout strategies, is based on the relationship of a security’s price during a relatively short but recent time period to its price over a longer time period (Alexander, Sharpe, & Bailey, 2001, p. 288).

For the first group imagine the following test design (Alexander, Sharpe, & Bailey, 2001, p. 289):

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<sup>4</sup> Momentum investors seek stocks that have recently risen significantly in price. They believe that these stocks will continue to rise because of an upward shift in their demand curves.

<sup>5</sup> Contrarians do just the opposite of what most other investors are doing in the market: they buy stocks that others have shunned and think of as losers, and they sell stocks that others have feverishly pursued and think of as winners.

1. Identify those stocks listed on either the NYSE or National Market Issues of Nasdaq. This step focuses the technician's attention on established stocks.
2. Rank these stocks based on the size of their returns over a just-ended time period, referred to as the portfolio "formation period".
3. Assign some of the stocks with the lowest average return in the formation period to the "loser" portfolio and some of the stocks that have the highest average return in this period to the "winner" portfolio.
4. Determine the returns on the winner and loser portfolios over a just-started subsequent time period, the portfolio "test period".
5. Repeat the analysis, starting with step 1, but moving forward one time period. Stop after several repetitions.
6. Determine the abnormal returns on the winner portfolio by subtracting the returns on a benchmark portfolio having a comparable level of risk, calculate the average of these abnormal returns. Similarly, determine the average abnormal returns on the loser portfolio.

If a momentum strategy works, then the winner portfolio should have a significantly positive average abnormal return and the loser portfolio a significantly negative one. Conversely, if a contrarian strategy works, then the loser portfolio should have a significantly positive abnormal return and the winner portfolio a significantly negative one. However, if stocks are priced efficiently, then their past price behavior is out of use in terms of its predictive value. Neither momentum nor contrarian strategies should "work", winner portfolios should perform no differently than loser portfolios. Both portfolios should have average abnormal returns of approximately zero.

Here are results, which presented in the following table (Alexander, Sharpe, & Bailey, 2001, p. 290):

*Table 1: Returns from Momentum and Contrarian Strategies*

Length of Portfolio formation and Test period	Annualized Abnormal Returns	
	Winner Portfolio	Loser Portfolio
a) Weekly: Top 50% and bottom 50% of NYSE and AMEX stocks	-24,9%	89,8%
b) Monthly: Top 10% and bottom 10% of all NYSE and AMEX stocks	-11,6%	12,1%
c) Semiannually: Top 10% and bottom 10% of all NYSE and AMEX stocks	8,7%	-3,5%
d) Annually: Top 10% and bottom 10% of all NYSE and AMEX stocks	5,0%	-16,1%



e)Three years: Top 35 and bottom 35 NYSE stocks	-1,7%	6,5%
f)Five years: Top 50 and bottom 50 NYSE stocks	-12,4%	7,2%

There does appear to be some merit to the contrarian strategy for both very short (a week or a month) and very long (three or five years) time periods. Surprisingly, for intermediate periods such as six months and one year, an exact opposite strategy – momentum – seems to have merit. Unfortunately, both strategies involve a high degree of turnover because portfolios are reconstituted frequently – particularly for the weekly contrarian strategy. The strategies would incur substantial transaction costs, so it remains to be seen whether they would be profitable after such costs were fully accounted for (Alexander, Sharpe, & Bailey, 2001, p. 290).

For the second group take in mind the following design (Alexander, Sharpe, & Bailey, 2001, p. 291):

1. Calculate the average closing price of a given stock during the past 200 trading days.
2. Take today’s closing price and divide it by the 200-day average to form a short-to-long price ratio.
3. A ratio greater than 1 is a buy signal that indicates the stock is to be bought tomorrow. A ratio less than 1 is a sell signal that indicates the stock is to be sold tomorrow.
4. Tomorrow after closing, repeat the process.
5. At the end of a test period, calculate the average daily return during both the “buy “ and “sell” days.

If the stock market is efficient, the average return during the buy days should be approximately the same as the average return during the sell days. That is, the difference in their returns should be approximately zero. However, technical analysis might have merit if they are significantly different.

You can see the results in the following table (Alexander, Sharpe, & Bailey, 2001, p. 291):

*Table 2: Returns from Moving Average and Trading Range Breakout strategies*

	Annualized average returns		
	Buy signal	Sell signal	Buy return less sell

			return
a)Moving average tests:			
Variable length	10,7%	-6,1%	16,8%
Fixed length	13,8%	-4,8%	18,6%
b)Trading range breakout tests	11,8%	-5,8%	17,6%

A study examined this strategy used more than 25000 trading days. The daily closing level of the Dow Jones Industrial Average (DJIA) was used instead of daily closing prices for individual stocks. As shown in the table, the strategy of moving average (variable length) resulted in markedly different returns on buy and sell days. In particular, the annualized average return on buy days was 10,7%, whereas the return on sell days was -6,1%. The difference of 16,8% was, statistically speaking, significantly different from zero (as were the differences in other parts of this table). Since, this strategy classifies every day as either a buy day or a sell day, thereby allowing a given stock to be bought on consecutive days, it is referred to as a variable length moving average strategy. However, it can result in many trades during a year because an investor using it could be “whipsawed” into buying and selling repeatedly. The frequency of changing positions from buying to selling, or from selling to buying, can be reduced by modifying the strategy to make it a fixed-length moving average strategy. Buy signals would then be generated only when the ratio changes from less than 1 to greater than 1, and sell signals would be generated only when the ratio changes from greater than 1 to less than 1. Furthermore, when a buy signal is generated, the stock is bought the next day and held for ten days. Similarly, when a sell signal is generated, the stock is sold and not bought for ten days. In either case, when the ten days are over, the investor starts looking again for a buy or a sell signal. So, we can see that the fixed length moving average strategy performed similarly to the variable length one. The annualized average return on buy days was 13,8% and on sell days it was -4,8%, resulting in a statistically significant difference of 18,6%. (Alexander, Sharpe, & Bailey, 2001).

The trading range breakout strategy is similar to the fixed length moving average strategy. The high and low prices during the past 200 trading days are noted. A buy signal is generated on a given day only when that day’s closing price is greater than the high, provided that the previous day’s closing price was less than the high. Conversely, a sell signal arises when the closing price moves from above the low on one day to below the low on the next day. When a buy signal is generated, the stock is purchased the next day and held for ten days.

Similarly, when a sell signal is generated, the stock is sold and not bought for ten days. In either case, when the ten days are over, the investor starts looking again for a buy or a sell signal. The lower part of table shows us that the trading range breakout strategy performed similarly to the two moving average strategies. The annualized average returns on buy days was 11,8%, and on sell days it was -5,8%, with a significant difference of 17,6% (Alexander, Sharpe, & Bailey, 2001, p. 292).

The usefulness of such strategies remains a subject to debate. Although the strategies seem to be profitable, even after transaction costs have been considered, it is possible that a more complete accounting of these costs (including the impact of bid-ask spreads) will reveal that the strategies are incapable of generating abnormal profits. Hence evaluating investment systems will not always provide unambiguous answers to their potential usefulness (Alexander, Sharpe, & Bailey, 2001, p. 292).

It should be mentioned here another interesting research, made by Jeremy J. Siegel (1998). In order to test the 200-day moving average strategy, he examined the daily record of the Dow Jones Industrial Average from 1886 to the 1997. In contrast with previous studies of this strategy, the holding period returns included the reinvestment of dividends when in the market and interest when out of the stock market. Annualized returns were evaluated over the entire period as well as the subperiods. There was the following criteria in order to determine the buy-sell strategy: Whenever the DJIA closed at least 1 percent above<sup>6</sup> its 200-day moving average, stocks were purchased at these closing prices. Whenever the DJIA closed by at least 1 percent below its 200-day MA, stocks were sold. Reinvestment out of the market was assumed to be made in Treasury bills (Siegel, 1998, pp. 246-247).

According to Siegel (1998) the MA strategy appeared to work extremely well. Investors were in stocks during all the important bull markets, and out of stocks during all the major bear markets. Investors followed the 200-day MA strategy would avoided the Great Crash and also exited the market on October 19, 1987 crash. The following table summarizes the returns from 200-day MA strategy and a “buy-and-hold” strategy of not timing the market.

*Table 3: Timing and Holding strategy annualized returns, January 1886 to June 1997*

Period	Holding strategy		Timing Strategy		% in Market	# of switches
	Annualized return (%)	Risk (%)	Annualized Return (%)	Net Trans Costs (%)		

<sup>6</sup> Such filter was made in order to reduce number of whipsaws for investor.

			Return	Risk	Return	Risk		
Overall	9,98	22,91	11,51	17,63	10,05	18,22	63,42	292
1886-1925	9,11	23,86	10,01	19,20	8,32	19,61	57,08	122
1926-1945	6,24	32,91	11,98	22,90	10,42	23,70	62,69	56
1946-1997	12,16	17,24	12,50	13,96	11,26	14,62	68,66	114
Excl. 1929-1932 Crash								
1926-1945	18,40	27,63	16,77	22,44	15,31	23,13	72,73	53
Overall	11,91	21,65	12,19	17,46	10,75	18,01	65,05	289

From 1886 through June 1997, the 11,51 percent annualized return from the timing strategy beat the return on the holding strategy return of 9,98 percent per year. As noted earlier, however, the timing strategy has its biggest success from avoiding the 1929-32 crash. If that period is excluded, the returns over the whole period are about the same. Since 1982, when the last secular bull market began, the holding strategy beats the timing strategy. The major gain of timing strategy is a reduction in risk. Since you are in the market less than two-thirds of the time, the standard deviation of returns is reduced by about one-quarter. This means that on a risk-adjusted basis the return on the 200-day moving average strategy is quite impressive. If the transaction costs of implementing the timing strategy are included in the calculations, the excess return over the whole period, including the 1929-32 Great Crash, virtually vanish. Nevertheless, there is no question that the 200-day moving average strategy, even with transaction costs, avoids large losses while reducing overall gains only slightly (Siegel, 1998, pp. 249-250).

Some other econometric researchs has shown that such simple trading rules as 200-day moving averages can be used to improve returns (Brock, Lakonishok, & LeBaron, December 1992).

Furthermore, Jeremy J. Siegel (1998:252) has repeatedly noted throughout his book that actions by investors to take advantage of the past will change returns in the future. As Benjamin Graham stated so well more than 60 years ago: “A moment’s thought will show that there can be no such thing as a scientific prediction of economic events under human control. The very “dependability” of such a prediction will cause human actions which will invalidate it. Hence, thoughtful chartists admit that continued success is dependent upon keeping the successful method known to only a few people” (Graham & Dodd, 1934, p. 619).

#### **4. The Dow Theory: basic concepts of trend**

Analyzing market behavior dates back to the 1800s, when there was no such thing as industry or company analysis. Detailed financial information about individual companies simply was not made available to stockholders, let alone the general public. About the only thing investors could study was the market itself. Some investors used detailed charts to monitor what large market operators were doing. These charts were intended to show when major buyers were moving into or out of particular stocks and to provide information useful for profitable buy-and-sell decisions. The charts centered on stock price movements. These movements were said to produce certain “formations” indicating when the time was right to buy or sell a particular stock. The same principle is applied today: Technical analysis argue that internal market factors, such as trading volume and price movements, often reveal the market’s future direction long before it is evident in financial statistics (Joehnk & Gitman, 2008, p. 318).

The concept of trend is absolutely essential to the technical approach. The first person to note different time-dimensions trends was Charles Dow (the founder of the Dow Jones new service), around 1900. In 1897, Charles Dow developed two broad market averages: the Industrial Average of 12 blue-chip stocks and the Rail Average of 20 railroad enterprises. Nowadays, these averages are known as the Dow Jones Industrial Average and the Dow Jones Transportation Average. The Dow theory forms the basis of many modern methods of technical analysis. Interestingly, the theory itself originally focused on the use of general stock market trends to indicate general business conditions rather than to forecast stock prices. However, subsequent work by analysts and writers has focused almost exclusively on forecasting (Levy & Post, 2005, p. 597). Dow’s successor, William Hamilton, extended Dow’s technical approach and published “The Stock Market Barometer” in 1922. Ten years later, Charles Rhea formalized Dow’s concepts in a book entitled “Dow Theory”.

Dow Theory is based on six principles (Linlokken & Frolich, 2004, p. 8):

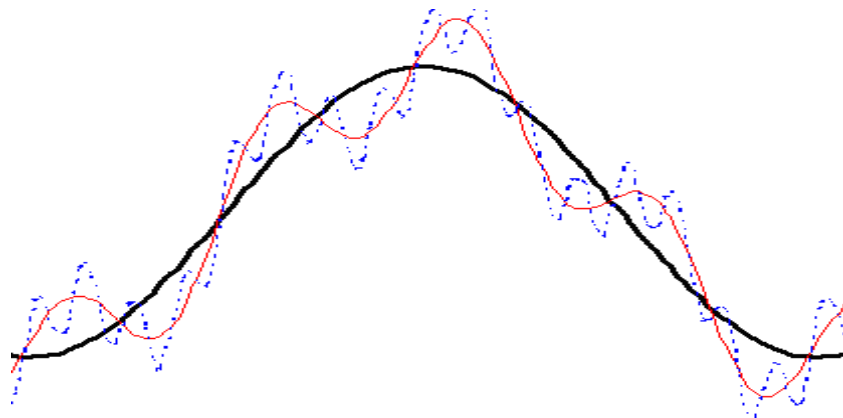
1. The closing price of the indices reflect the total of all market participants’ view of the market;
2. The market has three separate movements: one long, one medium and one short;
3. Main trends have three phases: an early phase, a main phase and a final phase;
4. The development in one index must be confirmed by the development of the other index;

5. Prices and trading volume are related; volume should increase when the price is moving in the direction of the trend;
6. A trend is assumed to be in effect until a definite signal is given that it has been reversed.

The Dow Theory posits three forces simultaneously affecting stock prices (Bodie & Kane, 2009, p. 397):

1. The primary trend (black colour) is the long –term movement of prices, lasting from several months to several years;
2. Secondary or intermediate trends (red colour) are caused by short-term deviations of prices from the underlying trend line. These deviations are eliminated via corrections when prices revert back to trend values;
3. Tertiary or minor trends (dotted blue colour) are daily fluctuations of little importance.

*Figure 1: 3 types of trend*



In evaluating the Dow Theory, don't forget the lessons of the efficient market hypothesis (EMH). The Dow Theory is based on a notion of predictability recurring price patterns. Yet the EMH holds that if any pattern is exploitable, many investors would attempt to profit from such predictability, which would ultimately move stock prices and cause the trading strategy to self-destruct. It should be noted that recognizing patterns as they emerge is far more difficult! (Bodie & Kane, 2009, p. 397)

It is widely acknowledged that the use of Dow Theory would have gotten an investor out of the stock market before the October 1929 stock crash, but not before the crash of October 1987. Martin J. Pring (1991, p. 31), a noted technical analyst, argues that, starting in 1897, investors who purchased stock in the Dow Jones Industrial Average and followed each

Dow Theory buy and sell signal would have seen an original investment of \$100 reach \$116508 by January 1990, as opposed to \$5682 with a buy and hold strategy (these calculations exclude reinvested dividends) (see also (Glickstein & Wubbels, April 1983). But confirming profits by using Dow Theory is difficult because the buy and sell signals are subjective and not given to precise numerical rules.

Moreover, this theory is not without criticisms. One of the criticisms is that if you follow the theory, it will result in an investor acting after rather than before or at market tops and bottoms. With Dow Theory, there is an inevitable lag between the actual turn in the primary trend and the recognition of the change in trend. The theory is not able to recognize a turn until long after it has occurred and confirmed. However, if the theory is properly interpreted, then it will recognize that primary trend has changed and this will allow us not to have a large loss. Dow's contention was that concentrating on any direction change of shorter duration than the primary trend increased the chances of having one's portfolio whittled away by high turnover, many errors in judgment, and increased transaction costs. Thus, Dow theory is biased toward late recognition of a change in trend to minimize the costs of wrongly identifying a change in trend. Also, it has been criticized for the fact that different trends are not strictly defined. It is very often difficult to interpret assignment of price swings to a specific trend type. Secondary trend beginnings often appear like primary trend beginnings, for example. This makes the determination of the primary trend unclear at times and can incite investment in the wrong direction (Kirkpatrick & Dahlquist, 2010, p. 85).

So, three trends affect the stock market: the primary tide, secondary reactions and ripples. If the market is making successive higher highs and higher lows, then the primary tide is up (a bull market). If the market is making successive lower highs and lower lows, then the primary tide is down (a bear market). Sperandeo (1991) has quantified Dow Theory definitions. He examined it and found that 75% of primary tide bear markets declined from 20,4 to 47,1% in price. Also, 75% of bear markets lasted between 0,8 and 2,8 years. Bull markets lasted much longer: 67% lasted between 1,8 and 4,1 years. It is no wonder then why buy position is often called as 'go long' and sell position titled as 'go short'. Secondary reactions are intermediate, corrective reactions to the primary tide. Sperandeo found that 65% last from three weeks to three months, and 98% last from two weeks to eight months. Further, Sperandeo found that 61% retrace between 30 and 70% of the previous primary swing in price. Ripples are short-term movements lasting from one day to three weeks. Secondary reactions are typically comprised of a number of ripples. The Dow theory holds that, since stock prices over the short term are subject to some degree of manipulation (primary and

secondary reactions are not), ripples are unimportant and can be misleading. Spenandeo found that 98,7% last less than two weeks.

The search for patterns in stock market prices is nearly irresistible, and the ability of the human eye to discern apparent patterns is remarkable. Unfortunately, it is possible to perceive patterns that really don't exist. This can be a case. A problem related to the tendency to perceive patterns where they don't exist is data mining. After the fact, you can always find patterns and trading rules that would have generated enormous profits. If you test enough rules, some will have worked in the past. Unfortunately, picking a theory that would have worked after the fact carries no guarantee of future success. ((Bodie & Kane, 2009, p.403)

In evaluating trading rules, you should always ask whether the rule would have seemed reasonable before you looked at the data. If not, you might be buying into the one arbitrary rule among many that happened to have worked in the recent past. The hard but critical question is whether there is reason to believe that what worked in the past should continue to work in the future (Bodie & Kane, 2009, p. 403).

Such terms as resistance level and support level should be mentioned, since these are concepts of trend. When a stock goes up, at a certain point the buyers evaporate, stalling the up move. That point is called the resistance level. A stock or index is said to hit resistance when sellers (bears) outnumber the buyers (bulls), sending the stock back down. The flip side is when the stock or index is going down: the point at which the buyers overpower the sellers and the stock begins heading back up is called the support level (Fontanills & Gentile, 2001, p. 263).

A price formation is a collection of resistance and support points that develop as a result of corrections in a trend. Together, resistance and support points form a visually recognizable formation in the price chart. When the price forms a formation, this indicates that investors in the market have a particular psychological attitude towards the stock. Insight into investors attitudes makes it possible to predict investors actions and to forecast future price movements. It is possible to categorize these price formations and the subsequent most likely reaction of the price. Trading volume, which has a strong and relatively stable relationship with the price trend, can be used as a complementary indicator to support the predictions from price formations (Linlokken & Frolich, 2004, p. 34).

We can divide the different types of price formations into two groups, which are called reversal formations and continuation formations. Reversal formations are found at tops and bottoms of trends, whereas continuation formations occur at different levels within a trend. (Linlokken & Frolich, 2004). There are a lot of different formations, so I will not describe



them here, since I am not going to use them in practical part of my work since they will not give me clear buy/sell indications, thereby results will lack consistency. But it should be noted that these tools are quite powerful, and some traders base their decisions only on them, since we can determine the future objective of stock price and place stop orders quite effectively.

## **5. The use of major indicators and oscillators**

To the technical analyst, the chart is the place to find clues regarding the future price direction of an asset. Technical analysts use several different charts, including bar charts, point-and-figure charts and candlestick charts. All these charts are based on historical prices. Thus, the users of these charts obviously do not believe in weak-form market efficiency. Charts typically are analyzed using moving averages and relative strength indicators. In addition, technical analysis implement technical indicators to interpret trends. Technical indicators typically draw from additional historical market-related data, such as volume of trading. Several technical indicators are believed to be leading indicators of future security price movements. The users of these technical indicators apparently do not believe in semi-strong-form market efficiency, because the inputs to the analysis are publicly available information (Levy & Post, 2005, p. 601).

### *Key indicators:*

So, generally speaking, technical indicators are mathematically derived representations of price that purport to provide additional information above and beyond what price alone reveals. There are countless indicators in existence, most with their unique calculations that package price action in a different, and often innovative, way. Some of these indicators are meant to be used for a specific financial market, such futures or equities. Others can be used equally well on charts of all financial markets. In this chapter I will cover only universal and most common indicators. These key indicators have withstood the test of time and have prevailed, are much more than sufficient to choose from (Chen, 2010, p. 136).

Within the whole world of indicators, oscillators are a special subset. Their primary goal is to give readings of momentum. This includes the ubiquitous extreme readings of “overbought” and “oversold”. Oscillators usually “oscillate”, as their name suggests, within a defined range, and so are often used by traders and investors to help define price turns and reversals within a horizontal range, as opposed to a trending market. Some of these oscillators can, however, be applied effectively during trends. However, it is important to note that most indicators suffer the same inherent limitations that plague moving averages as well as any other derivative of price. That is, indicators that are mathematically derived from price are

often considered simply to be lagging reflections of price. Many experts will argue that because of this lagging effect, indicators that simply follow price action cannot reveal anything more than price alone could reveal. These people would argue that while indicators may be great at describing what price has done in the past, they would be hard-pressed to provide any reliable clues as to what might happen next. For this reason, indicators are often relegated to serving as secondary confirmation tools by traders who support this argument. (Chen, 2010, p. 136-139).

However, while it can be true that most indicators are simply a modified or repackaged version of price itself, it is often exactly that kind of repackaging that is needed to illuminate high-probability trading opportunities. Some traders may fail to see opportunities on price bars alone, but such opportunities can clearly be seen on an indicator derived from price. Thus, many professional traders perform their chart analysis exclusively on a chosen indicator or oscillator often even to complete exclusion of price bars. Such type of trading is not quite mainstream, but it illustrates how relevant indicators can be in technical analysis and trading. And even if indicators are not used as the primary analytical tool, they can still be extremely valuable in augmenting price action analysis (Chen, 2010, pp. 138-139).

*1) Moving averages:*

Successful technical trading requires not only identifying the trend but, more importantly, identifying when the trend is about to reverse. A popular tool for determining when the trend might change examines the relation between the current price and a moving average of past price movements, a technique that goes back to at least the 1930s.<sup>7</sup>

A moving average is simply the arithmetic average of a given number of past closing prices of a stock or index over a fixed interval of time. For instance, a 50-day moving average is the average of the past 50 days of closing prices. For each new trading day, the oldest price is dropped and the most recent price is added to compute the average (Siegel, 1998, p. 246). The example of 50 days simple moving average is presented in a graph below (FINAM Company, 2011):

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<sup>7</sup> The first definitive analysis of moving averages comes from a book by H.M. Gartley “Profits in the Stock Market” (1930)

*Figure 2: Example of 50 days SMA*



Most technical analysts use moving averages for longer time periods. For example, one popular approach is that if the Dow Jones Industrial Average is above its 200-day moving average, then security prices should rise, and if it is below its 200-day moving average, then security prices should fall. One of the early supporters of this strategy was William Gordon, who indicated that, over the period from 1897 to 1967, buying stocks when Dow broke above the moving average produced nearly seven times the return as buying when the Dow broke below the average (Gordon, 1968). Colby and Meyers (1988) claim that for the United States the best time period for a moving average of weekly data is 45 weeks, just slightly longer than the 200-day moving average.

The length of moving average should fit the market cycle you wish to follow. For example, if you determine that a security has a 40-day peak to peak cycle, the ideal moving average length would be 21 days calculated using the following formula (Achelis, 1995, pp. 185-186):

$$\text{Ideal Moving Average Length} = (\text{Cycle Length}/2)+1;$$

Here is the the table, which suggests optimal length of moving average for different trend's lengths (Achelis, 1995, p. 186):

*Table 4: Optimal length of moving average*

Trend	Moving average
Very Short Term	5-13 days
Short Term	14-25 days
Minor Intermideate	26-49 days

Intermideate	50-100 days
Long Term	100-200 days

The purpose of moving average is to identify or signal that a new trend has begun or that an old trend has ended or reversed. It does not, however, predict market action in the same sense that standard chart analysis attempts to do. The moving average is a follower, not a leader. It never anticipates; it only reacts. The moving average follows a market and tells us that a trend has begun, but only after the fact (Murphy, 1986, p. 235).

Many technical analysts use moving averages in an attempt to identify the primary, intermediate and short-term trends. Moving averages can be used with individual stocks. For example, if a particular stock's price has been falling, then the moving average will typically be above the bar chart. If the stock's price subsequently rallies, breaking through the moving average line from below, then technical analyst view this as a bullish sign. Alternatively, if a particular stock's price has been rising, then the moving average typically will be below the bar chart. If the stock's price subsequently falls, breaking through the moving average line from above, then technical analysts view this as a bearish sign. As with other technical analysis tools, there are many possible interpretations of moving averages (Levy & Post, 2005, p. 610). However, there are many questions concerning best way to employ the moveing average: how many days should be averaged? Should a short-term or a long-term average be used? Is there a best moving average for all markets or for each individual market? Is the closing price the best to average? Which type of average works better – a simple, linearly weighted or exponentially smoothed? Are there times when moving averages work better than at others?

Answering these questions, I can note the following from literature: There can be different time dimensions of moving averages. A shorter one, such as a five or 10-day average, would hug the price more closely than a 40-day average. The time lag is reduced with the shorter averages, but can never be completely eliminated. Shorter-term averages are more sensitive to the price action, whereas longer-range averages are less sensitive. If a very short-term average is used (a 5 or 10-day), the average tracks closing prices very closely and several crossings occur. This can be either good or bad. The case is that a very sensitive average produces more trades (which means higher comission costs) and results in many false signals. So, if the average is too sensitive, some of the short-term random price "noise" activates bad trend signals! But, while the shorter average generates more false signals, it has

the advantage of giving trend signals earlier in the move! So, there is a trade-off at work here. The trick is to find that average that is sensitive enough to generate early signals, but insensitive enough to avoid most of the random “noise”. In certain types of markets, it is more advantageous to use a shorter average and, at other times, a longer and less sensitive average proves more useful. Analysts often use a combination of averages. Once, price begins to trend (up or down) the longer range moving average becomes more advantageous. It tracks the trend from a greater distance (since it has a longer time lag), does not get caught up in minor corrections or consolidations and, as a result, rides with the major trend a lot longer. The shorter average gets stopped out of positions on minor trend reversals and may even signal trades against the prevailing trend. Thus, the conclusion here is that no average is best for all times! The correct approach is to use a shorter average during nontrending periods and a longer average during trending periods. One more corollary should be added: The longer averages work best as long as the trend remains in force; but a shorter average is better when the trend is in the process of reversing. Or we can state that the longer one is used for trend identification, and the shorter one for timing purposes. It should be also noted that in order to reduce the number of whipsaws that occur when using a single moving average, technicians impose filters on the moving average signals such as time filters, percentage envelopes or volatility bands, high-low band and others (Murphy, 1986, pp. 236, 240-242).

The closing price is considered to be the most important price of the trading day and the price most commonly used in moving average construction. However, some technicians prefer to use other prices such as midpoint value (dividing the day’s range by two), others include the closing in their calculation by adding the high, low, and closing prices together and dividing the sum by three. Still others prefer to construct a price band by averaging the high and low prices separately (Murphy, 1986, p. 237).

However, there are some questions about its usefulness. The first criticism is that only the period covered by the average (the last ten days, for example) is taken into account. The second criticism is that the simple moving average gives equal weight to each day’s price. In a 10-day average, the last day receives the same weight as the first day in the calculation. Each day’s price is assigned a 10% weighting. Some analysts consider that a heavier weighting should be given to the more recent price action. In order to correct this problem, some analysts use a linearly weighted moving average. In this case, the closing price of the tenth day (in the case of a 10-day average) would be multiplied by ten, the ninth day by nine, the eighth day by eight, and so on. Therefore, the greater weight is given to more recent closings. The total is then divided by the sum of the multipliers. However, such average still does not

address the problem of including only the price action covered by the length of the average itself. Thus, a more complicated average that addresses both of the charges is called the exponentially smoothed moving average. It solves two problems at once. It has a sophisticated formula which requires the aid of computer. But does it mean that it is the best average from all 3 types? Not necessarily (Murphy, 1986, pp. 238-239).

The advantage of using moving averages is that they are trend-following systems. The convenience of moving average is that it can be applied to virtually any indicator or technical data. It can be used on open interest and volume figures, including on balance volume. The moving average can be used on various indicators, spreads, and ratios. The very big disadvantage is that they perform very poorly when markets get choppy and trade sideways for a period of time. The fact that they do not work well for significant periods of time, however, is one very compelling reason why it is dangerous to rely heavily on the moving average technique. It should be stressed that technical trader must have at his or her disposal an arsenal of many different technical tools. In certain trending markets, the moving average can't beat. At other times a nontrending method like the overbought-oversold oscillator is more appropriate.

## 2) *MACD (also can be used as oscillator):*

One indicator for trend continuation or reversal is known as moving average convergence-divergence (MACD). Generally credited to Gerald Appel as a stock market indicator originally, MACD shows the relationship between two moving averages of prices. The MACD is the difference between a 2 exponential moving averages. An exponential moving average of MACD levels, not of the price of the investment vehicle or index that is being tracked is called the "signal" (or "trigger") line according to Achelis (1995, pp. 166-167) and Appel (2005, p. 169).

There are following basic concepts concerning MACD (Appel, 2005, pp. 167-168):

- MACD represents the difference of the short-term exponential moving average minus the long-term exponential moving average.
- When market trends are improving, short-term averages will rise more quickly than long-term averages. MACD lines will turn up.
- When market trends are losing strength, shorter-term averages will tend to flatten, ultimately falling below longer-term averages if declines continue. MACD lines will fall below 0.

- Weakening trends are reflected in changes of direction of MACD readings, but clear trend reversals are not usually considered as confirmed until other indications take place.
- During the course of price movements, short-term moving averages will move apart (diverge) and move together (converge) with longer-term moving averages – hence, the indicator name moving average convergence-divergence.

The example of MACD is presented below (FINAM Company, 2011):

*Figure 3: Example of MACD 12-26-9*



What length moving averages should be employed for MACD? There are no hard and fast rules. But as a general rule, the longer-term moving average will be two or three times the length of the shorter-term average. The shorter the shorter-term moving average is, the more sensitive the MACD will be to short-term market fluctuations.

MACD is particularly effective on weekly charts as a direction indicator (you trade only in the direction of MACD, using indicators from your daily charts as entry and exit techniques). The MACD proves most effective in wide-swinging trading markets. According to Achelis (1995, pp. 166-167) there are three popular ways to use MACD: crossovers, overbought/oversold conditions, and divergences.

- 1) Crossovers. The basic trading rule concerning MACD is to sell when the MACD falls below its signal line. Similarly, a buy signal occurs when the MACD rises above its signal line. It is also popular to buy/sell when the MACD goes above/below zero.
- 2) Overbought/oversold conditions. The MACD is also useful as an overbought/oversold indicator. When the shorter moving average pulls away dramatically from the longer moving average (i.e., the MACD rises),

it is likely that the security price is overextending and will soon return to more realistic levels. MACD 39verbought and oversold conditions vary from security to security.

- 3) An indication that the end to the current trend may be near occurs when the MACD diverges from the security. A bearish divergence occurs when the MACD is making new lows while prices fail to reach new lows. A bullish divergence occurs when the MACD is making new highs while prices fail to reach new highs. Both of these divergences are most significant when they occur at relatively overbought/oversold levels.

Here are very important supplementary buy and sell rules (Appel, 2005, p. 170):

- Buy signals are much more reliable, when the MACD has crossed from above to below 0 at some time since the most recent sell signal. The MACD does not have to be below 0 at the time of the buy signal, but it should have been below 0 at some time since the start of the recent decline.
- Sell signals are more reliable when the MACD has crossed from below to above 0 at some time since the most recent buy signal. The MACD does not have to be above 0 at the time of the sell signal, but it should have been above 0 at some time since the start of the most recent advance.
- During very strong market periods, usually during the early and best stages of bull markets, the MACD will retreat during market reactions to a level just above 0. In this case, you can shade the previous rules a bit as you might if the MACD tops out just below 0 during a bear market or severe intermediate decline. Most often, however, the 0 crossing condition should be respected.

MACD signals are more likely to prove reliable if shorter-term MACD signals are confirmed by longer-term trends in the stock market, perhaps reflected by longer-term MACD patterns. For example, purchases made based on daily MACD lines are more likely to succeed if weekly or monthly MACD patterns are favorable, indicating strength in the primary market cycle. Short-term short sales are more likely to prove profitable if longer-term market trends are down. As a general rule, it is best to sell positions following market movements that take prices from oversold to overbought levels, and to buy new positions when the market has become oversold, or at least somewhat extended to the downside. By waiting for the MACD to fall below 0 for buying and to rise above 0 for selling, you are setting up procedures by which you “buy weakness” and “sell strength” rather than buying and selling on every change in minor trend. As result from these rules, described above, we are likely to both reduce the



frequency of trading (with its attendant transaction costs) as well as reduce the number of unproductive whipsaws (Appel, 2005, pp. 168-170).

Stock prices decline at more rapid rates than they rise, so it is generally good practice to employ at least two, and perhaps even three, MACD combinations. Different combinations are useful for buying and selling. Here are some “golden rules” with using such combinations, provided by Gerald Appel (2005):

- You should maintain at least two MACD combinations: a faster one for buying and a slower one for selling.
- When market trends are very positive, buy very fast and sell very slow. You can employ the 6-19 combination for buying, or you can employ the somewhat more reliable 12-26 combination. The 19- to 39-day combination is used for selling.
- When market trends are neutral to somewhat positive, buy fast and sell slow. Use the 12-26 combination for buying. Use the 19-39 combination for selling.
- When market trends are clearly negative, buy fast and sell fast. You can use MACD combination for both buying and selling, in which case you will sometimes be selling before the slower-moving 19- to 39-day MACD has crossed from below to above 0. However, unless a stop-out takes place, the 12-26 MACD lines should generally rise above 0 as a precondition for a sell.

### *3) Bollinger Bands*

Developed by their namesake, John Bollinger, a well-known trader and portfolio manager, Bollinger Bands are generally overlaid directly on a chart’s price bars/candles. These bands consist of simple moving average (SMA) with two additional lines: one that is a certain number of standard deviations above the SMA and the other that is the same number of standard deviations below the SMA. This tool is usually set with a 20-period SMA along with outer lines, each at 2 standard deviations away from the SMA, one above and the other below. However, these settings can be changed readily (Chen, 2010, p. 140). You can see how an indicator looks in the graph below (FINAM Company, 2011):

*Figure 4: Example of Bollinger bands*



The basic interpretation of Bollinger Bands is that prices tend to stay within the upper and lower band. The distinctive characteristic of Bollinger Bands is that the spacing between the bands varies based on the volatility of the prices. During periods of extreme price changes (i.e., high volatility), the bands widen to become more forgiving. During periods of stagnant pricing (i.e., low volatility), the bands narrow to contain prices (Achelis, 1995, p. 72).

Mr. Bollinger notes the following characteristics of Bollinger Bands (Achelis, 1995, p. 72):

- Sharp price changes tend to occur after the bands tighten, as volatility lessens;
- When prices move outside the bands, a continuation of the current trend is implied;
- Bottoms and tops made outside the bands followed by bottoms and tops made inside the bands call for reversal in the trend;
- A move that originates at one band tends to go all the way to the other band.

This observation is useful when projecting price targets.

#### *4) The average directional index (ADX)*

It was developed by a prolific developer of indicators, J. Welles Wilder. The ADX (sometimes you can meet such indicator's name as DMI or Directional Movement Index, ADX is an improved addition to DMI to allow for volatile, extreme periods) resides vertically either above or below the bar or candle price chart (Jobman, 1995, p. 134). Its purpose is to measure the strength, lack of strength, of the current trend as well as whether the trend is increasing or decreasing in strength. Strong trends have high ADX readings, while nontrending markets have low ADX readings. An increasing ADX reading is a sign that the trend may be increasing in strength, while a decreasing ADX reading is a sign that the trend

may be decreasing in strength or moving toward consolidation phase. Many traders who use ADX will place a horizontal line of demarcation on the indicator to mark the general boundary between trending and nontrending. A popular location to place this line is at the 30 level. Another well-popular border is 20. Once this level is set, the trader may then institute a guideline that if the ADX moves above the 30 level, it is moving into strong trending mode. Conversely, if the ADX moves below the 30 level, it is approaching a nontrending, consolidating phase. This is an important distinction that can help the trader determine when to use trending techniques and when to turn to range-trading techniques. It is also important to note that ADX by itself does not provide any indication as to the direction of the trend. This function is fulfilled by two other indicators that are closely related to and frequently used with ADX: DI+ and DI-, where “DI” stands for directional indicator. These two indicators provide the directional component to the ADX. When DI+ is moving up and DI- is moving down, it means that price is bullish, or going up. When DI- is moving up and DI+ is moving down, it means that price is bearish, or going down. Some traders will look for crossovers of the DI+ and DI- to provide directional trading signals. ADX, in conjunction with DI+ and DI-, can give vital clues to aid in the important task of determining market trend strength. This system also involves an extreme point rule: on the day of crossover, the extreme price that day is a reverse point for a stop. If long, it is the low of the crossover day; if short, it is the high, according to Chen (2010, pp. 142-144) and Jobman (1995, p. 136).

The example of ADX is presented below (FINAM Company, 2011):

*Figure 5: Example of ADX:*



##### 5) *The parabolic stop and reverse (SAR)*

According to Chen (2010) it is an indicator that excels at providing a sensible trailing stop and reverse methodology. Trailing stops are useful elements of an overall stop-loss and

risk management strategy. This indicator was originated by J. Welles Wilder in his pioneering work on chart indicators. The parabolic SAR is usually comprised of dots that follow price in such a way that if a dot is below a price bar, the trade should be long with a dynamic stoploss at the dot. Conversely, if the dot is above the price bar, the trade should be short with dynamic stop-loss at the dot. This indicator, therefore, provides the trader with built-in trading system for being long or short, with the added bonus of convenient locations for stop-losses. Like many other indicators, however, the parabolic SAR can be prone to vicious whipsaws where the trading signals result in a string of losses due to the lack of a strong trend. But the fact that this indicator stresses a logical use of the trailing stop-loss concept makes it a valuable tool for any technical trader. SAR is presented in a graph below (FINAM Company, 2011):

*Figure 6: Example of SAR*



*The Volume of trading:*

Volume is secondary in importance and are used primarily as confirming indicator. The thorough technical analyst should include this figure in his or her checklist of things to watch, and always be on the alert for those situations where important messages are being alert.

On one hand, if a stock makes an unexpected move to the upside and there's no news on the company, a large increase in trading volume indicates something significant has probably happened, but has not yet been reported. This price movement prior to a news report is a common occurrence because information about a major event within a company is often leaked before the official news release is published. On the other hand, a price move with a small or no increase in trading volume is more likely to develop from temporary imbalance in the supply and demand relationships. Watching the volume of trading and making

comparisons to average trading volume enables an investor to distinguish (Pistolesse, 2006, p. 19).

Thus, the level of volume measures the intensity or urgency behind the price move. The volume confirms the trend! The Dow theory focuses primarily on price action. Volume is used to confirm uncertain situations. If the primary tide is down, then volume should increase during market declines. If the primary tide is up, then volume should increase during market advances (Levy & Post, 2005, p. 599). To state the rule more concisely, volume should increase or expand in the direction of the existing price trend.

The chartist is also watching for signs of divergence. Divergence occurs if the penetration of a previous high by the price trend takes place on declining volume. This action alerts the chartist to diminishing buying pressure. If the volume also shows a tendency to pick up on price dips, the analyst begins to worry that the uptrend is in trouble (Murphy, 1986, pp. 182-183).

One of the simplest and best known of volume indicators is on balance volume or OBV. Developed and popularized by Joseph Granville in his 1963 book, "Granville's New key to Stock Market Profits". It is a technical indicator that signals the buying and selling momentum of a stock by comparing price to volume (Fontanills & Gentile, 2001, p. 258). OBV actually produces a volume line or curve along the bottom of the price chart. This line or curve can be used either to confirm the quality of the current price trend or warn of an impending reversal by diverging from the price action. The construction of the OBV line is simplicity itself. The total volume for each day is assigned a plus or minus value depending on whether prices close higher or lower for that day. A higher close causes the volume for that day to be given a plus value, while a lower close counts for negative volume. A running cumulative total is then maintained by adding or subtracting each day's volume based on the direction of the market close (Murphy, 1986, p. 185).

### *Key oscillators*

As mentioned earlier, there is a special subset of indicators that are called oscillators. These indicators fulfill a special role in that they generally concentrate on market momentum and excel at providing readings of price overextension that are normally referred to as overbought and oversold. (Chen, 2010).

Generally, when an oscillator reading is above a certain overbought threshold during a trading range, the indication is that upward momentum may soon be exhausted and that an impending downward turn may potentially occur. On the other side, when an oscillator

reading is below a certain oversold threshold during a trading range, the indication is that downward momentum may soon be exhausted and that an impending upward turn may occur. Also, there is another important key function of chart oscillators. It is in their use in providing divergence signals. Divergences can provide important clues as to the possible direction of near-future momentum (Chen, 2010, p. 148). The concept of divergence should be touched here and explained.

The most important technical concept for confirmation of a trend is named a divergence. As long as an indicator – especially one that measures the rate of change of price or other data (called momentum) – corresponds with the price trend, the indicator is said to “confirm” the price trend. But, if an indicator or oscillator fails to confirm the trend, it is called a negative divergence or positive divergence. It depends on whether peaks or bottoms fail to confirm price peaks or bottoms. A divergence is an early warning of a potential trend change. It means that the analyst must keep an eye on price data more closely than when the indicators and oscillators are confirming new highs and lows. Divergence analysis is used between almost all indicators and prices; a divergence can occur more than one time before a price reversal (Kirkpatrick & Dahlquist, 2010, p. 132).

It is important to note here that there can be two types of divergences that any technical trader should be aware of: regular divergence and hidden divergence. Regular divergence is the most popular type, and it is what most traders mean when they refer to the general concept of divergence. The signal is manifested in an uptrend when price makes a higher high while the oscillator makes a lower high. This is called bearish regular divergence, and warns of a potential reversal and possible subsequent move to the downside. The opposite is called bullish regular divergence and occurs during downtrends. In a bullish divergence, price makes a lower low while oscillator makes a higher low. In both cases, bearish and bullish, the oscillator diverges from the price, giving an indication that price momentum in the currently prevailing direction may be warning (Chen, 2010, pp. 149-150).

In contrast to regular divergence, the second type of divergence, called hidden divergence, can be considered the polar opposite. This signal is also a technical imbalance between price movement and oscillator movement. But instead of signalling a potential reversal, hidden divergence is used primarily to signal a potential continuation in the prevailing trend. Bearish hidden divergence usually occurs during a downtrend and is characterized by price making a lower high while the oscillator makes a higher high. In this case, price and the oscillator are diverging in their signals, but the overriding signal that should be taken from an occurrence of bearish hidden divergence is a potential continuation

of the lower highs in price, which is the equivalent of a potential continuation in the prevailing downtrend. Bullish hidden divergence usually occurs during an uptrend and is characterized by price making a higher low while the oscillator makes a lower low. In this case, price and the oscillator are diverging in their signals, but the overriding signal that should be taken from an occurrence of bullish hidden divergence is a potential continuation of the higher lows in price, which is the equivalent of a potential continuation in the prevailing uptrend (Chen, 2010, p. 150).

*1) The rate of change indicator (ROC):*

One quick is an indicator called the rate of change indicator (ROC). It is merely a plot of the ratio or difference between today’s closing price and the closing price at some specified time in the past, such as 20 days. When the market or stock is hitting a new high and the 20-day ROC is hitting a new high, we have a confirmation of the price action. If the ROC is not hitting a new high at the same time as the market or stock, then we have a negative divergence. It is a warning that the upward momentum in price is slowing down (Kirkpatrick & Dahlquist, 2010, p. 133). An example of Momentum (graphically has the same representation and interpretation as ROC, however it is not the ratio, but the difference between today’s closing price and the closing price at some specified time in the past) is figured below (FINAM Company, 2011):

**Figure 7: Example of Momentum**



*2) The relative strength index (RSI):*

The relative strength index is a popular indicator introduced by J. Welles Wilder in his 1978 book, “New Concepts in Technical Trading Systems”. This oscillator is among the most widely used by technical traders in all financial markets. Some innovative traders have

developed this tool far beyond its original purposes, to serve as a primary trading tool almost as important as price action itself. Other traders use RSI as a key confirmation tool on the bottom of their charts (Chen, 2010, p. 151).

During horizontal ranging markets, RSI is a classic oscillator that excels at providing a measure of price momentum as well as providing overbought and oversold indications. In this way, it uses the same concept of reversion to the mean that is behind the linear regression indicator. In order to derive it mathematically, then RSI is a simply a comparison of magnitude of recent gains to recent losses, with formula that looks in the following way:

$$100/(1+RS)$$

where RS=average of x periods closes up divided by the average of x periods closes down.

The x number of periods is the primary RSI setting, which is usually set at a default of 14 periods but it can be changed. Also by default, the overbought and oversold boundaries are usually set at 70 and 30, respectively. A cross above the 70 level is considered an indication of price being potentially overbought, while a cross below the 30 level is considered an indication of price being potentially oversold. Some technical traders use RSI as a trade signaling and confirmation tool in this manner. Potential long trades in a ranging market would be confirmed on a cross of the RSI from the oversold region above the 30 level. Potential short trades in a ranging market would be confirmed on a cross of the RSI from the overbought region below the 70 level (Chen, 2010, pp. 152-153). RSI is figured in a picture below (FINAM Company, 2011):

*Figure 8: Example of RSI*



During trending markets, RSI can also serve as a useful oscillator. Innovative technical analysts have made certain observations regarding RSI during trends. Perhaps the most important of these observations is that RSI often fails to reach the oversold area during



uptrends and, conversely, fails to reach the overbought are during downtrends. This is a readily observable phenomenon that can be measured with horizontal line well above 30 or well below 70. The RSI oscillator's tendency to do this can help both in identifying trends in a market as well as in pinpointing entries into a trending market (Chen, 2010, pp. 153-154).

Here is another interesting way of RSI using and interpretation: many technical analysts use relative strength to assess a security. Relative strength measures the relationship between two historical series of financial assets' data (the rate at which one asset falls or rises relative to the second asset). Although relative strength can be expressed in various ways, it is typically expressed as a ratio of the price performance of one asset or index to the price performance of another asset or index. For example, a technical analyst might use relative strength to compare the overall market performance as measured, for example, by the S&P 500 with the performance of a certain stock. This RSI can range from 0 to 100%. A high RSI value means that industry stock prices have been outperforming the market (Levy & Post, 2005, p. 611).

### 3) *Stochastics*

The stochastics oscillator was introduced in the 1950s by George Lane, a trader and pioneering technical analyst, and is therefore often referred to as Lane's stochastics. The stochastic oscillator compares where a security's price closed relative to its price range over a given time period. Generally two different varieties of stochastics can be found on most charting software: %K (fast) and %D (slow). The main line is called %K. The second line, called %D, is a moving average of %K (which is usually set at a three-period moving average). These lines travel between the extremes of 0 and 100, where the default oversold and overbought levels are generally set at 20 and 80, respectively. The calculation of %K is:

$$100*[(C-L_n)/(H_n-L_n)]$$

where C=most recent closing price, L<sub>n</sub>=low of the last n days, H<sub>n</sub>=high of the last n days. Stochastics is pictured below (FINAM Company, 2011):

**Figure 9: Example of Stochastics**



There are several ways to interpret a stochastic oscillator. Three popular methods include:

1. Buy, when the Oscillator (either %K or %D) falls below a specific level (e.g., 20) and then rises above that level. Sell when the Oscillator rises above a specific level (e.g., 80) and then falls below that level.
2. Buy when the %K line rises above the %D line and sell when the %K line falls below the %D line.
3. Look for divergences, for example, where prices are making a series of new highs and the stochastic oscillator is failing to surpass its previous highs.

As far as stochastics has two lines as opposed to RSI's one line, stochastics can give off an additional signal that results when the %K line crosses the %D line, much in the same way that trading signals are derived from moving average crossovers, according to Chen (2010, pp. 154-156) and Achelis (1995, p. 268).

#### *4) Williams %R*

Williams %R is a momentum indicator that measures overbought/oversold levels. Williams %R was developed by Larry Williams. The interpretation of this indicator is very similar to that of the Stochastic oscillator, except that %R is plotted upside-down and the Stochastic Oscillator has internal smoothing. While %K in Stochastics compares the closing price with the lowest low for n periods, %R (the name comes from percent of range) compares the close with the highest high. Instead of reading from 0 percent at the bottom to 100 percent at the top, the index scale for %R is flipped upside down so an overbought condition occurs when the indicator is less than 20 percent or 30 percent and the oversold area is above 70 percent or 80 percent (we can derive %R quickly by taking 100 minus %K. Or we can find %K by taking 100 minus %R). In addition, the time period for %R traditionally is 10

periods vs. 5 for %K, and %R usually does not show the three-day moving average (%D). There is an interesting phenomenon of the %R indicator in its uncanny ability to anticipate a reversal in the underlying security's price. The indicator always forms a peak and turns down a few days before the security's price peaks and turns down. Likewise, %R usually creates a trough and turns up a few days before the security's price turns up, according to Jobman (1995, p. 177) and Achelis (1995, p. 316). %R is presented below (FINAM Company, 2011):

*Figure 10: Example of Williams %R*



As with all overbought/oversold indicators, it is best to wait for the security's price to change direction before placing your trades. For example, if an overbought/oversold indicator (such as the Stochastic Oscillator or Williams %R) is showing an overbought condition, it is wise to wait for the security's price to turn down before selling the security. It is not unusual for overbought/oversold indicators to remain in an overbought/oversold condition for a long time period as the security's price continues to climb/fall. Selling simply because the security appears overbought may take you out of the security long before its price shows signs of deterioration (Achelis, 1995, p. 316).

Divergences analysis provides us with the oscillator's greatest value. However, we should be cautioned against placing too much importance on divergence analysis, as well as to trading signals from oscillators if basic trend analysis is ignored or overlooked. Most oscillator analysts stress that oscillator buy signals work best in uptrends and oscillator sell signals are most profitable in downtrends. So, the place to start your market analysis is always by determining the general trend of the market. If the trend is up, then a buying strategy is called for. Oscillators can then be used to help time market entry. Buy when the market is oversold in an uptrend. Sell short when the market is overbought in a downtrend (Murphy, 1986, p. 311).

## 6. Risk control

What many traders, especially beginners, lack is an adequate grounding in the proper approach to risk management. Without this key component of successful trading, failure is almost assured. Conversely, if good risk management is securely in place, even traders with less than stellar trade entry strategies can survive and even thrive.

With regard to exits, technical analysis excels at facilitating initial stop-loss placement as well as dynamic or trailing stop-loss placement once a given trade has entered into profit. In addition, technical analysis also supplies potential profit target exits. If you would like to set initial stop-losses, the underlying philosophy as dictated by technical analysis principles is to get out of any trade once the market proves that your original reason for getting into the trade was wrong. For example, if a long trade is entered shortly after the breakout of a major resistance level, there are several logical locations for an initial stop-loss. For one, a stop-loss can be placed right below the resistance level, as a price reversion back below that level will have proven that the original reason for getting into the trade (a breakout) was ultimately wrong, at least for the time being. Perhaps more practically, however, the stop-loss might be better placed right below the closest swing low that resides below the resistance level. This is due to the frequent tendency of breakout moves to fluctuate around support or resistance before either making a true breakout or falling altogether (Chen, 2010, pp. 262-263).

The concept of getting out when the basis for a trade is wrong can also be extended to dynamic stop-losses, otherwise known as trailing stops. This technique of trailing stops allows you to lock in profits while progressively limiting risk during the course of a trade that moves into greater profit. In an uptrend situation, for example, when a long trade is already in profit, the trader would move the stop-loss progressively higher as price continues to move in the direction of the trade. The location for each of these stop-loss moves mirrors initial stop-loss placement very closely. As price recovers from each minor dip, or swing low, in the uptrend, the trader would move the trailing stop-loss to just under the last swing low. If price breaks down below the last swing low, it is a strong indication that the trend might be changing or reversing. In this instance, the trend following trade, which is the prevailing uptrend, will have been seriously challenged with breakdown below the last swing low. Conversely, if price continues to make progressively higher swing lows, the trailing stop may continue to be trailed, locking in progressively greater profits (Chen, 2010, pp. 264-265).

Trade exits are an important aspect of risk control when you use technical analysis. Risk control has two primary purposes (Chen, 2010, p. 265):

1. One purpose is never to have a single catastrophic loss cripple one's trading account. When stop-losses are measured and predetermined according to strict rules of risk control, one can be assured that any single loss, and even any moderate string of losses, can be absorbed without too much pain.
2. The second purpose of proper risk control is that it helps foster an environment where overall profit can exceed overall loss, preferably by a substantial amount. Clearly, this principle is absolutely crucial to achieving consistent profitability as a trader.

It follows that the single most important priority for all successful traders is the preservation of capital.

Stops can be used in two ways. First of all, you can place them at the same time as you give your broker the order for the trade, or you can follow the market and deal with the stops yourself. Of course, there are advantages and disadvantages connected with both these methods. The first method can, especially for stocks with low liquidity, mean that you sell at a low price if the stock accidentally is traded at a low price during the day. For stocks with a high liquidity, a placed stop loss order will make sure that you get out of the stock quickly and at a price close to the stop level. If you handle the stops yourself, you have more control, especially for stocks with low liquidity. The risk is that you do not execute the stop and become tempted to lower the stop loss level, or not use it at all. It should be mentioned here that for stocks with low liquidity, stop loss is especially difficult. If you invest in stocks with low liquidity, selling at stop loss will result in higher losses than for liquid stocks because the price usually falls much quicker and the spread between buyers and sellers is larger. For example, if the stock is traded at 4,90 with a bid at 4,00 and an ask at 4,90, it is difficult to sell the stock at a reasonable price. If you want to invest in stocks with low liquidity, you should consider not using stop loss in these cases (Linlokken & Frolich, 2004, p. 92).

A time stop uses a different criterion for selling. It is unlike a stop loss or a stop profit, and actually is a supplement to these forms of stops. A time stop is used to manage your capital in an efficient manner. How long do you expect a certain trend movement to last? If the price does not react how you expected within a certain time, you may sell because of a time stop. This means that you put a limit on the time you are willing to wait for a certain price movement. A time stop is especially interesting for investors who trade often and base their decisions on short-term price swings. (Linlokken & Frolich, 2004, p. 93).

A change stop is also a stop that is not related to a price. If the conditions that caused you to initiate a trade have changed, you should get out of the market, regardless if you have

won or lost. Never stay in the market that no longer meets the conditions that attracted you in the first place (Linlokken & Frolich, 2004, p. 93).

When dealing with stops, you should remember the golden trading rule: “Cut your losses short, let your profits run”.

One of the key components to a good risk management plan is closely related to the preservation of capital is an optimal risk:reward ratio. This ratio can be fine-tuned using predetermined stop-losses and profit targets that are derived from the prudent use of technical analysis concepts.

While optimal reward:risk ratios can be difficult to attain in everyday trading, all traders should always try to attain the highest ratios that are practically possible. The ramifications of the reward:risk ratio are considerable. With a high ratio, traders can actually lose significantly more trades than they win and still be consistently profitable. This is because their average profits are much larger than their average losses (Chen, 2010, pp. 266-267).

Technical analysis lends itself well to setting an optimal reward:risk ratio in one's trading. As mentioned earlier, stop-loss placement is straightforward when trading technically. So it requires only a calculation of the profit aspect in order to decide whether a particular trade conforms to one's minimum ratio and therefore if the particular trade is indeed worth taking. But profit targets are not as straightforward to set as stop-losses. When it comes down to it, no one can ever know definitively where or how far price will go. That is why trailing stop-losses are popular trading tools – they allow traders to lock in profits while still letting profits run, even if the ultimate price destination is utterly unknown. However, for the purposes of keeping to a reasonable and profitable reward:risk ratio, however, concrete profit targets need to be used. Both parallel trend channels and horizontal trading ranges have targets at the far side of the channel or range. Support/resistance breakout trades have targets of further support or resistance levels. The same can be applied to different price formations (Chen, 2010, p. 267).

But what exactly is the optimal reward:risk ratio? It really depends on the trading strategy used and the trader's particular style of trading. In practical day-to-day trading, it can be difficult to attain ratios as high as 4:1, because with higher ratios, the clear trade-off is that losses become much more frequent than wins. Since the wins would be much larger in dollar value than the losses, this is acceptable from a long-term profitability standpoint. But the psychological toll of excessively frequent losses, even if relatively smaller in value, can eventually become devastating for a trader who does not possess a steel will and iron

determination. So, practically speaking, depending on one's trading strategy and style of trading, many traders seek to target a reward:risk ratio at least 2:1 or 3:1. This means that each trade profit is targeted to be at least two times or three times as large as each loss (Chen, 2010, pp. 268-269).

Besides targeting an optimal reward:risk ratio, traders should also set a maximum allowable loss per trade. This is often called a fixed fractional money management and refers to a percentage of total account equity. Setting a maximum loss limit is crucial to the all-important goal of preserving capital.

As mentioned earlier, technical analysis affords an optimal approach to setting stop-losses according to market price action, not according to an arbitrary dollar amount. When setting a maximum loss limit, this approach should be preserved. Therefore, prudent technical traders will first set their stop-losses according to the market (where price action proves the original reasons for getting into the trade to be wrong) and then set the size of the trade position in conjunction with the size of the stop-loss to conform to the maximum loss percentage. Therefore, if the stop-loss represents a greater loss according to market price action, the trade position size should be set to a smaller value in order to conform to the acceptable loss limit. Conversely, if the stop-loss represents a smaller loss according to market price action, the trade position size may be set to a greater value to conform to the acceptable loss limit (Chen, 2010, pp. 269-270).

What is the optimal percentage to set as this maximum loss level? It depends on many factors, including the trading strategy used and the trader's specific risk tolerance. The figure that is most often talked about in trading circles is a maximum loss of 2 percent of account equity per trade. (Chen, 2010, p. 270).

## **7. Introduction to technical trading strategies**

To be successful, it is important not to let results depend on coincidence, but to have a plan. This is very true for stock trading. When you invest in the financial markets, it is crucial to plan as much as possible, put this into a strategy, and then follow that strategy closely with a positive and objective attitude. It is very important not to let fluctuating emotions influence your plan (Linlokken & Frolich, 2004, p. 89).

In table below I will introduce basic technical trading strategies with some description. These strategies are used as a ground basement in decision-making process by traders and investors around the world who are involved in many different global financial markets.

Table 5: Technical trading strategies<sup>8</sup>

Type of strategy	Description	Technical tools in use
Moving average crossovers	When the price crosses above a certain moving average, that is a signal to buy, or go long. Conversely, when price crosses below that same moving average, that is a signal to sell short. Several MA can be used. Decisions are made again upon crossovers of MA.	Moving averages (MA)
Breakout trading	Support and resistance levels should be respected. Thus, it is assumed that you will be rewarded (not always) in participating in breakout opportunity, if important support and resistance levels will be broken.	Dinamic and static support and resistance levels (trendlines), MA
Trend trading	It is assumed to exploit natural directional bias of a given financial market. You trade in the direction of current trend.	Trendlines, MA
Range trading	Exploiting the ups and downs in a sideways, ranging market.	Trendlines, MA, Bollinger Bands
Price-Oscillator divergences	Divergences between prices and oscillators direction are considered as important signals to enter a trade. However, divergences alone should be confirmed by other technical factors, thus their reliability much greater, when they are used in conjunction.	RSI, Stochastics, ROC, MACD, Williams %R
Oscillator trading	Trading is based in concentrating on the movements of certain osciallators (overbought/oversold conditions or signals from crossovers, which can serve as entry/exit decisions), even to the exclusion of the price bars.	RSI, Stochastics, ROC, MACD, Williams %R
Fibonacci Trading	It is concerned primarily to determine potential retracements within trends. This allow traders to estimate price regions where price may retrace during dips and rallies.	Fibonacci retracement percentages

It is notable here that these strategies are basis or ground for subsequent development and you can combine single-dimensional strategy all the way up to the more complex multifaceted strategies or you can provide it with other technical tools (price formations, indicators/oscillators) for confirmation purposes.

In discussing trading strategies, you first need to be clear which trends and breakouts you are trying to catch. Trading weekly, daily or hourly, trends calls for different techniques. To be successful, you need to combine several trading techniques, selected so their negative

<sup>8</sup> Based on Chen, J. (2010) *Essentials of technical analysis for financial markets*, Wiley



features can cancel out each other, while their positive features stay undisturbed. The secret is to apply each technique to a different time frame of market events (Jobman, 1995, pp. 200-218).

It is crucial to follow the signals from the system that you have chosen. You should not trade when the signal is merely expected; rather, you should wait until the signal is actually given and confirmed. It is a case often, when an expected signal does not actually occur, or it proves to be a false signal. However, if you like to take risks, you may define a strategy that under certain circumstances allows you to trade before a signal is given (Linlokken & Frolich, 2004, p. 90).

It should be also noted that knowledge of a large variety of technical indicators does not make an analyst valuable or cause him or her to profit, but knowing when to apply which indicator does. Because it is almost impossible to understand all indicators, the technical analyst often selects just a few and studies them intently (Kirkpatrick & Dahlquist, 2010, p. 132). A warning should be carried from this point, that basing decisions on only one model is very risky, that is why one should always combine several models of technical analysis. When different models give the same signal, or signals in several models confirm each other, we have a reliable prediction of future price development.

No matter how complex or detailed, there is no technical analysis system that will always result in profits. As with many things, it is not an easy task to choose a few indicators from such large variety which are provided by technical analysis. It is often the more simple systems that provide best results. But it should not be too simple. There should be a kind of balance. Results from using a system are often dependent on your understanding of the system and your ability to react quickly to its signals. The more complex a system, the more difficult it is to quickly understand and react to its signals. In addition to choosing an orderly and simple system, it is crucial to follow the system you have chosen. The better you know the tool at your disposal, the better the results will be (Linlokken & Frolich, 2004, p. 90).

Certain conditions have to be met before technical strategies can reliably be used as an independent investment analysis tool. The most important criteria is that there has to be a sufficient amount of trading in the stock, i.e. liquidity has to be relatively high. Another criteria is the spread, the difference between the buying and selling price, which should be small. If these two requirements are not fulfilled, the price will often jump up and down and show great volatility. In such cases, the chance of correct technical signals will decrease, the technical analysis will be less relevant and we should not base our trades on the technical

analysis only. If we want to trade such stocks, fundamental analysis is often the most valuable tool (Linlokken & Frolich, 2004, p. 100).

## **Part 2. Modelling and performing technical strategies and making analysis of results**

### **1. A brief overview of Russian stock market and choice of stocks for testing**

The history of the Russian stock market has a number of stages in its development. Our stock market took a long road of evolution before it became fully civilized. Such formation and history of Russian stock market had a direct connection with Russia's transition to market relations. There were the following stages (Informational Portal for Private Investors, 2011):

1. During the first stage, there was a formation of prerequisites for its development. Stock exchanges were formed, and stocks of different commercial companies appeared. Before that, savings motive was almost absent. The population was trying to save money to make purchases in the future. Soon, MICEX (Moscow Interbank Currency Exchange) appeared in place of usual credit institutions. MICEX received most of the rights to carry on commercial transactions in the market.
2. In the second stage (1993 – first half of 1994) the history of Russian stock market was marked by the rise and fall of vouchers<sup>9</sup> market. During this time, most checks were issued by state in large quantities. People exchanged checks for privatized companies' shares and sold them at markets. It was a relatively short period of time when the stock market was formed. However, it did not perform its primary functions: to mobilize funds for specific purposes of organizations in order to improve companies' production.
3. Finally, the important feature of the third and last phase was that in 1994 a new stock market trading was formed. Trading was performed with using securities of the leading stock companies of Russia. In July 1995 there was a development of RTS (Russian Trading System) which became modern stock exchange as well as MICEX.

The modern stock market in Russia is relatively young, and we can see that its birth occurred in the early 90's. It can be attributed to the category of emerging markets, which are

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<sup>9</sup> Voucher privatization is a privatization method where citizens are given or can inexpensively buy a book of vouchers that represent potential shares in any state-owned company. Voucher privatization has mainly been used in the early-to-mid 1990s in the transition economies of Central and Eastern Europe - countries such as Russia, Poland, Bulgaria, Slovenia and Czechoslovakia. ([http://en.wikipedia.org/wiki/Voucher\\_privatization](http://en.wikipedia.org/wiki/Voucher_privatization))

characterized by high yield, but as a rule – a higher degree of risk. In recent years, there were some positive changes in the Russian stock market: market liquidity has increased as well as informational transparency of issuers; legislative framework has strengthened; new mechanisms appeared to protect investors' rights.

All above together with improved economic and political situation within the country contributed to the international recognition of Russia and to high increase in its credit ratings from such international rating agencies as Moody's, Standard & Poor's, Fitch.

Due to globalization of world economy, stock exchange indices are basic indicators of stock market's conditions in developed as well as in developing countries. Such indices used to be average characteristics of securities' price parameters. Nowadays, there are hundreds of stock indices, which are calculated by exchange markets, international banks, informational agencies and other infrastructures. The existing countries' differences in calculation's methodology are due to established historical circumstances and because of specific features inherent to each country in stock market development. Dynamics of Russian stock market and its industries is reflected by a variety of stock indices. But we can distinguish two of them which are the basic ones. So, the most popular are MICEX and RTS indices.

MICEX Index is a capital-weighted price index of the 30 major and most liquid Russian stocks traded at the MICEX Stock Exchange (MICEX SE), calculated in real time (dividend income is excluded in the index calculation) (MICEX Stock Exchange, 2011). For detailed information see Appendix 1.

MICEX Index is one of the oldest Russian stock indices, which has been calculated since September 22, 1997 (the initial value of the index is 100 points). MICEX Index is the main index of MICEX SE which tracks the Russian equity market and serves as underling for derivatives and structured products. MICEX Index is the leading indicator of the Russian securities market, which covers nearly 80% of the market capitalization of the Russian equity market (MICEX Stock Exchange, 2011). Sector distribution of MICEX index is presented in table below:

*Table 6: Sector distribution of MICEX index*

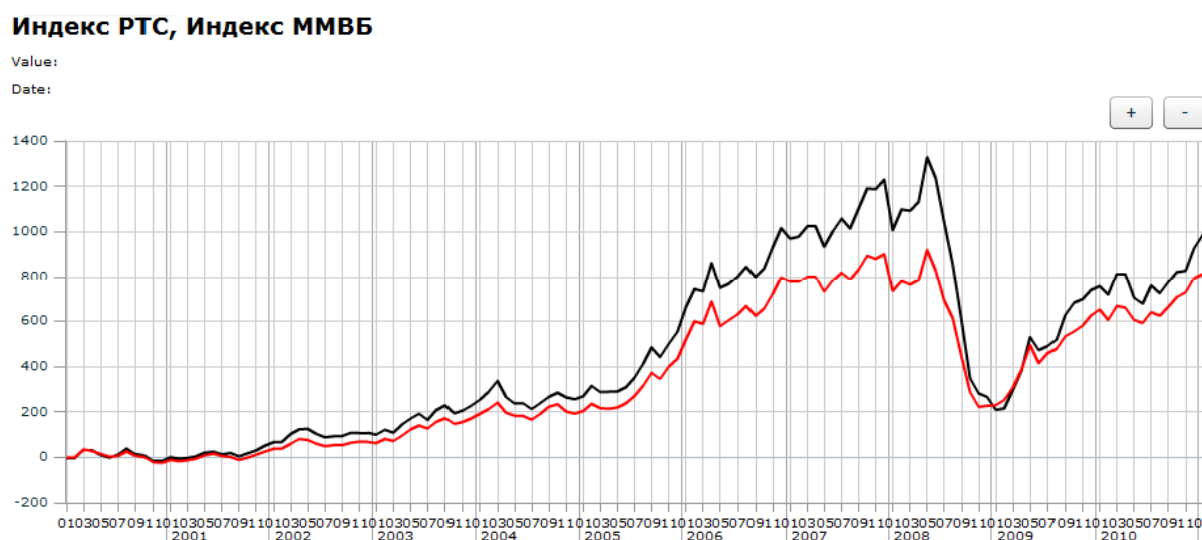
(MICEX Stock Exchange, 2011)

Sector	Number of stocks	Weight in MICEX index
Oil and gas	9	52,0%
Metals and mining	7	16,9%

Banking	3	16,3%
Telecommunications	4	7,0%
Electric Utilities	5	5,3%
Chemicals	1	2,2%
Transportation	1	0,3%
Total	30	100%

RTS index – is also capitalization-weighted, with free-float coefficients but there are 50 of most liquid companies (RTS Stock Exchange, 2011). Some experts used to say that it is the leading indicator of Russian economy, since it includes 50 most liquid and capitalized Russian companies. However, other experts assert that MICEX index is the general indicator of investor’s business activity, since the trade volume is higher in MICEX stock exchange than in RTS stock exchange. Many professionals refer to both indexes, when they speak about general condition of Russian stock market. One of the key differences is that the majority of Russian private investors and foreign investors trade stocks in MICEX exchange, while part of foreign investors and large investment companies trade stocks in RTS exchange. If an investor is interested in futures, options and other derivatives, then it is better to trade such instruments in RTS exchange, since it is more superior to its counterpart. You can see the dynamics of MICEX and RTS indexes in a graph below (Informational Portal for Private Investors, 2011):

**Figure 11: Dynamics of MICEX index (red line) and RTS index (black line)<sup>10</sup>**



<sup>10</sup> <http://www.2stocks.ru/main/invest/stocks/isprofile?ticker=MICEXINDEXCF>

The author himself is more interested in MICEX stock exchange, since it is more liquid and more developed for private investors if we mean stocks here. And according to my topic which connected with stocks, then I am going to appeal to MICEX stock exchange as well as to most liquid stocks which included in MICEX Index.

Thus, what I need to do is to reduce the large quantity of stocks (approximately 700 totally) which are traded on MICEX stock exchange. I will concentrate on blue chips as the most liquid stocks. As it was mentioned earlier, the demand to liquidity is crucial in order to successfully implement technical analysis. There is an additional condition for testing: starting date for testing is January 2007. Such precondition is important, since this time is the starting date of very fast development and high growth in trading activity on the stock market. This is evident from the fact that foreign investments increased a lot starting from this period (Federal Service of State Statistics, 2011):

**Figure 12: The inflow of foreign investments to Russian economy**  
(in billions of USD)



The ending date is 31 december of 2010. Therefore, there will be 4 full years altogether.

There are 15 stocks which can be attributed to be blue chips. Unfortunately, my demo account gives me an insight to 10. The platform which is going to be used for stocks testing is QUIK version 5.17 provided by BCS (BCS Company, 2011), the company which is one of the leader in Russian investment market. Informational and trading system QUIK is a software system for providing access to stock trading via the Internet in real time (online trading). This platform is multifaceted system, which has all necessary technical tools, which were described in theoretical part. I opened a demo account which was also provided by BCS.

So, after description of these preconditions, let's choose stocks:

*Table 7: Chosen stocks and their description*

Ticker	Stock title	Sector	Short description
GAZP	"Gazprom"	Oil and gas	Gazprom is one of the world's largest energy companies. Its major business lines are geological exploration, production, transportation, storage, processing and marketing of hydrocarbons as well as generation and marketing of heat and electric power. Gazprom's mission is to ensure maximally efficient and balanced gas supply to Russian customers and reliably fulfill long-term gas export contracts. More info on <a href="http://www.gasprom.com">www.gasprom.com</a>
LKOH	"Lukoil"	Oil and gas	Main activities of the Company are exploration and production of oil & gas, production of petroleum products and petrochemicals, and marketing of these outputs. Most of the Company's exploration and production activity is located in Russia, and its main resource base is in Western Siberia. LUKOIL owns modern refineries, gas processing and petrochemical plants located in Russia, Eastern and Western Europe, near-abroad countries. The Company's products are marketed in Russia, Eastern and Western Europe, in near-abroad countries and USA. More info on <a href="http://www.lukoil.com">www.lukoil.com</a>
GMKN	"Norilsk Nickel"	Metals and mining	Norilsk Nickel is the world's largest producer of nickel and palladium and one of the leading producers of platinum and copper. It also produces various by-products, such as cobalt, chromium, rhodium, silver, gold, iridium, ruthenium, selenium, tellurium and sulfur. The Group is involved in prospecting, exploration, extraction, refining and metallurgical processing of minerals, as well as in production, marketing and sale of base and precious metals. More info on <a href="http://www.nornik.ru/en">www.nornik.ru/en</a>
ROSN	"Rosneft"	Oil and gas	Rosneft is the leader of Russia's petroleum industry, and ranks among the world's top publicly traded oil and gas companies. The Company is primarily engaged in exploration and production of hydrocarbons, production of petroleum products and petrochemicals, and marketing of outputs. Rosneft has been

			included in the Russian Government’s List of Strategic Enterprises and Organizations. The state holds 75.16% in the Company (through OJSC ROSNEFTEGAZ), while approximately 15% of shares are in free-float. More info on <a href="http://www.rosneft.com">www.rosneft.com</a>
SNGS	“Surgutneftegas”	Oil and gas	<p>Oil and gas producer Surgutneftegas is one of the largest companies in the Russian oil sector. It accounts for almost 13% of the country’s crude output and 25% of gas produced by domestic oil companies.</p> <p>The company was the first in Russia to develop the complete cycle of gas production and processing, gas-based power generation, and output of finished products and petrochemical feedstock. Fifty-nine divisions of the company are involved in the whole range of prospecting and reservoir management operations, construction of facilities and pipelines, environmental safety, and process automation. Surgutneftegas’ crucial competitive advantage lies in advanced petroleum production technology successfully applied by its own service subdivisions. Oil is supplied to Russian refineries and exported to CIS and Western Europe. More info on <a href="http://www.surgutneftegas.ru/en">www.surgutneftegas.ru/en</a></p>
PLZL	Polyus Gold	Metals and mining	<p>Polyus Gold is an international company, the leading gold producer in Russia and the only Russian company among the world’s largest gold producers. Headquartered in Moscow, Polyus Gold’s operating mines and development/exploration projects are located in 5 major gold mining regions of Russia – the Krasnoyarsk Territory, the Irkutsk, Magadan, Amur Regions, the Republic of Sakha (Yakutia), as well as in the Republic of Kazakhstan, Romania and Kyrgyzstan. More info on <a href="http://www.polyusgold.com/eng/">www.polyusgold.com/eng/</a></p>
RTKM	“Rostelecom”	Telecommunications	<p>The Company owns and operates a technologically advanced nationwide fiber-optic backbone network, approximately 160,000 km in length, enabling it to provide voice, data and IP services to business and residential customers across the entire Russian Federation and to both domestic and international operators. The Company is a major provider of telecommunications services to state organizations and governmental</p>

			agencies as well as to the largest corporate companies including television and radio broadcasters. The high capacity of Rostelecom's network enables it to handle the majority of long-distance traffic transit and leased line services for both Russian and international operators. More info on <a href="http://www.rt.ru/en">www.rt.ru/en</a>
CHMF	"Severstal"	Metals and mining	Severstal Resources is one of the biggest Russian mining companies and manages all Severstal's mining assets: two iron ore mining complexes (Karelsky Okatysh and Olcon) and a coking coal complex (Vorkutaugol) in northwest Russia, one coking coal complex in USA (PBS Coals), an exploration project Severstal Liberia Iron Ore in Western Africa and a mine design institute SPb-Giproshakht. In 2007 the Gold division was established. This now includes a number of gold mining assets in Russia, Kazakhstan and Burkina Faso as well as several gold exploration fields in these regions. More info on <a href="http://www.severstal.com/eng/">www.severstal.com/eng/</a>
TATN	"Tatneft"	"Oil and gas"	TATNEFT is one of the largest, internationally recognized Russian oil companies, operating as a vertically integrated Group. The Company ranks No 6 in Russia by the volume of oil production after Rosneft, Lukoil, Surgutneftegaz, TNK-BP and Gazprom neft. In the competitive refining market the Company develops its own facilities, at the same time expanding the export of oil, gas and petrochemical products. More info on <a href="http://www.tatneft.ru/wps/wcm/connect/tatneft/portal_rus/homepage/">www.tatneft.ru/wps/wcm/connect/tatneft/portal_rus/homepage/</a>
SBER03	"Sberbank"	Banking	It is the largest bank in Russia and Eastern Europe. The company's headquarters are in Moscow and its history goes back to Cancrin's financial reform of 1841. In many regions Sberbank is practically the only bank capable of providing local administrations with complex banking services and of rendering significant financial support in implementing investment and social programs. More info on <a href="http://www.sbrf.ru/en/">www.sbrf.ru/en/</a>



## 2. Modelling design of trading strategies

The primary purpose of technical analysis is to create effective strategy to trade financial markets. With all of the essentials of technical analysis, discussed so far, the tools for formulation and implementing high-probability technical strategies are already present. All we need is to connect all of the pieces.

The goal of the research is testing multiple trading systems, which are different according to its type and level of complexity and evaluating whether they are efficient or not. Under efficient trading system I mean that such system gives a maximum increase in capital's return and less risk or has advantageous readings of Sharpe for a period from 2007 till 2010 (including) in comparison with return and risk from "buy and hold" strategy. Afterwards, strategies which would be efficient under such condition would reflect the market outcome. If no timing strategies would be efficient, then "buy and hold" strategy would be considered to be best from all strategies.

The precisely derived behavior of mathematical indicators and oscillators stands in contrast to the decidedly less objective methods surrounding such charting tools as Fibonacci and Elliot Wave. In order to be more objective and scientific, I will base my strategies only on indicators. Thus, I will get clear buy/sell signals. But I am not trying to say here that indicators are any better than Fibonacci and Elliot ways or other methods. Different traders and investors have found different value in the various available analysis tools, whether these tools are considered to be more subjective or more objective. Some traders gravitate toward mathematically complex indicators (like in my case), while others find success with more subjective trend line analysis. Yet other traders combine the strengths of a variety of analysis tools.

It should be added that I will use closing prices of price bars as basis for entrance or exit decisions. This is so, since closing prices are concerned to be very important prices of trading day according to theoretical part.

There will be 2 timing strategies based on technical indicators, which I am going to test and which will be compared to holding strategy. One simple single-dimensional strategy, where I implement only 1 trend-following indicator, and one multifaceted strategy which include two subsystems of trend-following and range trading tools. The logic behind that choice is the following: I would like to know whether trend following indicator alone can be more or less efficient than combination of trend following and range following tools. So, these are the timing strategies: 1) Simple moving averages (SMA) crossovers; 2) Multifaceted

strategy, which includes trend-following system, where such indicators as SMA, MACD, ADX go in action, and range trading system, where RSI and Stochastics play their role. In order to be more objective, I will base all my decisions on mechanical trading signals, which are given from chosen indicators. Meaning this, I drop out drawing of trendlines and analysis of support/resistance lines, since such activities will be based on my own understanding of current situation which can lead to subjectivity and inconsistency of results. The intent here is to reduce the subjective human element in trading, to make it more scientific. However, I am aware that technical analysis is not only a science, but also an art, and human intervention is highly influential and therefore not all trades should be based on automated signals. But, here I stick to mechanical trading systems because of desire to get results of higher consistency. There is one more point that should be mentioned and which can be a suspect to possible subjectivity of my results. Nowadays, it is possible to test mechanical trading systems, via writing necessary inputs, using professional programming language and then test it with software and eliminate human participation in such testing, because the machine will do it for you. But in my case, I will use only trading platform and my “human eye” due to lack of my programming skills.

First of all, let's start with holding strategy. It is assumed that investor buy a stock in the beginning of a year and sell it at the end of a year. This is done for number of years from 2007 to 2010 (including). Accumulated return is a sum of returns for this overall period.

Now, let's turn to moving averages crossovers strategy. The logic behind choosing exactly moving averages is not accidental. This indicator or its combinations were tested in the past for many times and proved to be rather powerful and at the same time it was easy to implement this tool. It implies that I can possibly get results of high consistency. So, there is a hypothesis that efficient trading system is the system based on 2 Simple moving averages crossovers. It is very powerful indicator and at the same time there are very straightforward rules, so such type of strategy is commonly used by novice traders. In my case I will use two moving averages of different periods. If the shorter-period moving average crosses above the longer one, it would be considered a signal to buy. Conversely, if the shorter-period moving average crosses below the longer one, it would be considered a signal to sell. In this approach, the system is assumed to be continuous, meaning that it is always in the market on the long or on the short side, but it is not like that in my case, due to additional filter for risk control. I will also implement some filters, which will help me to partly get rid of false trades. I apply 2 SMA of closing prices (since the closing price is considered to be the most important price of the trading day and the price most commonly used in moving average construction) in order

to partly get rid of number of whipsaws during sideways market. But I am also aware that this technique lags the market a bit more than single SMA. The number of periods which should be applied is a tricky question. If I want to evaluate ideal length of MA according to formula describe in theoretical part, I should evaluate price cycle of each security and that's a lot of very complex work since I am going to trade with 10 securities, then in this case I think that a better way is to apply standardized periods for MA. I know from theory that there are two popular combinations exist: the 5 and 20 day averages and 10 and 40 day averages. I know that the monthly cycle is very popular among traders, therefore it may explain the popularity of 5, 10, 20 and 40 day moving averages.<sup>11</sup> Thus, I will take standardized periods measuring monthly cycle and weekly cycle. So the 20 day cycle measures monthly cycle and the 5 day cycle measures weekly cycle. Moreover, these periods possibly will capture important movements much more faster than their slower 10 and 40 periods "counterparts". I will also add an entry filter for crossover: to wait until the shorter MA moves a minimum price increment in the direction of the trade after the crossover takes place. The usual standardized filter is determined as 2% for 1 MA, but in my case I will implement 1% to balance this tradeoff between whipsaws and market lag (since I chose 2 MA, which make less whipsaws, but have a market time lag). When two moving averages are employed, the longer one is used for trend identification, and the shorter one for timing purposes. Crossover method allows me to follow the concept which I adhere behind successful moving average method and which centers on the goal of gaining large profits during trending periods when crossovers are few and far between while at the same time withstanding the inevitable small losses during sideways whipsaw periods when crossovers are abundant.

It should be noted that I will use daily charts for analysis for this type strategy, since this type of chart is concerned to be efficient for identification of entry and exit points.

One more point which should be discussed: if a trade starts for instance in 2007 and ends in 2008, then the result is attributed to 2008.

So, after this consideration and explanation, let's establish definite design of this strategy:

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<sup>11</sup> 5,10,20, 40 important numbers for indicators and oscillators, because they are based on calendar day periods of 7,14,28,56.

Table 8: Design of 2 SMA strategy

Item	Description
Tools in use	2 Moving averages of closing prices with periods of 5 and 20 and with simple method of their calculation.
Type of chart	Daily chart.
Entry decision	If shorter SMA 5 crosses from below to above the longer SMA 20 and if such crossover provided by 1% penetration, then take long position. Or if shorter SMA 5 crosses from above to below the longer SMA 20, and if such crossover provided by at least 1% penetration, then take short position.
Exit decision	Assumed to be continuous, meaning that reverse crossing is a signal to enter an opposite trade. However, due to risk control you have to follow exit signal before reverse crossover happens.
Risk control	Your exit (stop loss) is provided by penetration of longer SMA by price bars in the opposite direction from the trade. Filter in this case is at least half of such penetration by price bars is strong must to exit the trade. However, note that it can be penetrated by shadows from price bars.

Figure 13: Visual representation of 2 SMA strategy

(BCS Company, 2011):



Now, let's turn to second technical strategy. Here is a table below, which indicates on main advantages and disadvantages of using technical indicators. It helped me to reasonably find out which indicators I should use for my multifaceted strategy, since I understood the main limitations and how to use these indicators in conjunction.

*Table 9: Strengths/weaknesses of indicators/oscillators*

<b>Indicator/Oscillator</b>	<b>Strengths</b>	<b>Weaknesses</b>	<b>Reasonable combination<sup>12</sup></b>
Moving averages	Easy to use and interpret. Best works with strong trending markets. Can be used as static as well as dynamic support and resistance levels, which helps to understand critical price points. Can include two, even three (or more) MA at once, which helps to reduce whipsaws. Well-suited for plotting on MACD, Price ROC, Stochastics in order to see general trend of each of these indicators.	Too much whipsaws during the corrections and sideways movement. Risk of losing potential profit if one uses too long MA. Risk of losing money if one uses too short MA. Therefore, always a kind of trade-off decision.	ADX, Bollinger Bands, MACD
MACD	Very flexible, works good enough with trending markets and with sideways markets. Particularly effective on weekly charts as a direction indicator. Also MACD proves most effective in wide-swinging trading markets. Can be applied to virtually all timeframes. Precedes the price move.	No definite borders for understanding of overbought/oversold conditions. Can make whipsaws if applied for short trends. It does encounter occasional difficulty in dealing with steadily trending, narrow-channeled market advances or declines.	RSI, Stochastics, Williams %R, MA, ADX, Bollinger Bands, ROC
Stochastics	Tends to work well when a market is in a trading range or near to	It is of little use during most of a trending move.	RSI, Williams %R, MACD, ROC

<sup>12</sup> It is meant here that you can combine indicators only for confirmation of each other.

	the end of trending move. Especially does a good job of identifying intermediate daily reactions against weekly trends. Precedes the price move.		
RSI	Tends to work well when a market is in a trading range or near to the end of trending move. Precedes the price move.	It is of little use during most of a trending move.	Stochastics, Williams %R, MACD, ROC
ADX	Does well when a market is in a trend. Very effective in measuring the strength or lack of strength of the current trend, therefore helps to understand when to use trend-trading techniques and when to turn to range-trading techniques	Makes false signals when a market is in a trading range.	MA, MACD, Bollinger Bands
Bollinger Bands	Same as MA. Bands are self-adjusting, widening during volatile markets and contracting during calmer periods, therefore good for measuring price's volatility around the mean.	Same as MA.	MA, MACD, ADX
Williams %R	Tends to work well when a market is in a trading range or near to the end of trending move. Precedes the price move.	It is of little use during most of a trending move.	Stochastics, RSI, MACD, ROC
SAR	Efficient as a trend-following system. Providing a good stop loss signals, during a trending mode.	Not efficient in range trading markets for generation trading signals. Establishment of stop losses is of little use due to whipsaws during range trading mode.	ADX, MA, Bollinger Bands

ROC	Good for measuring the acceleration or deceleration in the current advance or decline in the price trend. Precedes the price move.	No definite borders to understand overbought/oversold conditions, therefore no definite trading signals.	Stochastics, RSI, MACD, Williams %R
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Now we had a second hypothesis based on assumption that efficient trading system is the system which is based on multifaceted trading system of using both oscillators and indicators. So, I need to establish the trading system, which will include two subsystems: one of them is trend-following system which will help me to trade when market has a good enough trend indication. Another system is range-trading system for nontrending markets.

Moving averages crossovers is assumed to be continuous strategy, meaning that you have to enter a trade on all crossings, using mostly daily charts, since this kind of chart is well-suited for identification of entry/exit points. The idea is to capture a big move. But you can lose money during whipsaws and enter the next crossing even if it is against the major trend. Therefore, weekly charts were not concerned there. However, this strategy is assumed to be not continuous, meaning that you do not have to be in market all the time, which gives you a flexibility to use weekly charts to understand major direction of market, as well as daily charts in order to enter or exit a trade.

First of all I will apply basic concepts of trend analysis in order to identify major trend. Since my first goal is to identify the major trend, I will start by examining weekly charts. Such longer-term perspective puts me a jump ahead of those who watch only daily charts. I can use several techniques to find the weekly trend. Trendlines and channels are certainly useful, but are rather subjective in this case, since I will draw them by myself and this is an art, but not science. Therefore, such tool as moving averages, which can smooth week-to-week fluctuations will be used instead. I will use SMA 20, since it is concerned to be a nice-suited for weekly chart analysis. ADX set to 14 as default is quite impressive tool and will be used as filter in identifying the strength/weakness of the major trend. Therefore, such first screen or market test before entering a trade involves finding signs of trend and if it exists then it also indicates which position I should take – long or short, and this depends on the direction of market tide. In a trending case I will use trend-following system. If I deal with horizontal market, then I will switch to range-trading system.

In developing a trading system, I also need to determine when to enter a market, when to exit the market with a loss and when to exit with a gain. As I have already known from theory, the most popular method is to use technical indicators. I can conclude from table above that trend-following indicators, such as moving averages, ADX, SAR, MACD (as an exception that can also be well used in range-bound markets) are ideally suited for markets that have established well-defined trends but tend to get chopped up in range-bound markets. On the other hand, overbought/oversold indicators, such as Stochastics, RSI, ROC, Williams %R are well suited for markets that are locked in sideways trading ranges or markets in up or down channels. They tend to be less reliable when markets enter strong trends either up or down. Therefore, in order to combine any or all of these indicators into a successful trading system, I must determine the market stage I am in to know which indicators to use. So in other words, I should use the strengths of each indicator and try to eliminate its weaknesses.

So, after finding the weekly trend (if it exist), I will switch to daily charts and indicators for the second screen to identify the trading signals. For this screen, I will use combinations of MACD with daily charts. The choice of MACD is not accidental. This indicator is arguably one of the most reliable market timing gauges according to some experts (Gerald Appel an inventor of MACD and with 30 years of impressive “real” money results, and Jeffrey A. Hirsch who is editor of stock Trader’s Almanac – are several of such experts). But this can be also evident from table, since such indicator provides us with good flexibility and that direction of MACD line and the histogram’s tracking will indicate me growing bullish or bearish sentiment and forecast a turn in market direction, frequently in advance of the price reversal. For these purposes I am going to implement basic rules of using MACD, which I described in theory, provided by its inventor Gerald Appel (2005). In particular, I am going to apply 3 MACD in total and 1 SMA. In case of SMA, I am going to use a period of 20 (monthly cycle). In this case I do not use too sensitive SMA because I implement SMA only for understanding the direction of trend, and for risk control (as back up exit strategy), but not for generating signals for entrance. Too sensitive SMA will produce too fast exit, which in turn could be false and profit potential will be missed. For MACD, I am going to use 6-19, 12-26, 19-39 combinations with signal line’s period which equal to 9 in all combinations. It is not accidental choice, since the theory tells me that when I will see that trends are very positive, then I will employ 6-19 combination for buying and 19-39 combination for selling. If trends are neutral to somewhat positive, then I use 12-26 combination for buying and 19-39 combination for selling. When market trends are clearly negative, I will use 12-26 combination for both buying and selling. I am also going to implement divergences of MACD



lines and price lines to confirm my entry/exit positions. The general signal for buying, using daily charts, will be given when MACD line crosses its signal line from below to above. The general signal for selling will given when MACD line crosses its signal line from above to below. There will be cases (for instance weekly up, but daily down), when you go countertrend. It does not mean that you trade against a major tide, it just indicates that you are trying to buy low in order to sell high afterwards. That can be dangerous. But you can rely here with confidence on weekly positive/negative trend, which can make logical sense of such actions. When the market tide is up/down every pause and wave that goes against this tide – such shorter countertrend moves – offers an opportunity to get in trade. It is probable that the weekly trend will reassert itself, which will lead to profits. When the weekly trend is upward, you can use negative readings of a daily MACD to get ready to buy. When the weekly trend is down, use positive readings of a daily MACD to get ready to sell short.

Once the prevailing trend has ended, Stochastics (set to 5-3-3 as default) and RSI (set to 14 as default) begin to take over the leadership role from the trend-following indicators. So, if I deal with range trading market on weekly charts, then I will switch to daily charts and will use Stochastics and RSI which is two more daily oscillator that do a good job of identifying intermediate daily reactions. RSI will be taken into consideration as supplementary indicator, which should support Stochastics, while Stochastics itself will provide me with trading signals. However, I should remember that not every price range is suitable for range trading. Narrow ranges are generally better suited for breakout trading above resistance or below support. Wide ranges are much better suited for range trading, as the expected profit potential between the support and resistance boundaries is greater and therefore more worthwhile from a risk:reward perspective. In order to determine a proper range, I will use Bollinger Bands which is reliable indicator of the presence of a trading range. If I use it, then I have an ability to monitor the slope of the simple moving average (SMA 20 also will be used in range trading) running through the middle of the bands to ensure that it is flat, or at least approaching flat, which give me a confirmation that a range trading situation is potentially in place. Also, Bollinger Bands (BB) will be used as precondition to breakout trading. If BB are narrow for a long time, then we search for confirmation of SMA 20 penetration with condition that SMA should be below/above price bars (depends on the direction of breakout) in order to enter a trade. In this particular case we do not use MACD, since it behaves badly in a too narrow-channeled market. Now, after this general consideration, let's establish definite instructions and steps:

Table 10: Design of Multifaceted strategy

Item	Description
Tools in use	<ol style="list-style-type: none"> <li>1. Moving average of closing price with period of 20 and with simple method of its calculation;</li> <li>2. Average directional index (ADX) with DI+ and DI-, with period of 14, with simple method of its calculation and with level 20 which concerned to be a crucial level for understanding the strength/weakness of a market.</li> <li>3. Bollinger bands with period 20 with simple method of its calculation and with 2 standard deviations above and below.</li> <li>4. Moving average convergence/divergence (MACD). Exponential moving averages (EMA) are applied for calculation of MACD line. Exponential method of calculation is used to calculate signal line. There are 3 MACD indicators (do not confuse with MACD line), where first two numbers are used to identify number of periods for EMA and last number is used for signal line's period: 6-19-9, 12-26-9, 19-39-9.</li> <li>5. Relative strength index (RSI) of closing prices with period of 14. Levels 30 and 70 are concerned to be important borders for understanding overbought/oversold conditions.</li> <li>6. Stochastics. Parameters for %K line: number of periods 5 with smoothing which equals to 3. Parameters for %D line: number of periods 3. Simple method of calculation is applied. Levels 20 and 80 are crucial borders for identification of overbought/oversold conditions.</li> </ol>
Type of chart	Weekly chart is used for major trend identification. Daily chart is used for planning entry/exit points.
Major trend identification	<p>Identify the major trend by using weekly charts and implementing SMA 20 and ADX 14. Uptrend is established when SMA 20 is below price bars (can be crossed by shadows), <math>ADX &gt; 20</math>, DI+ is above DI- is below. Downtrend is established when SMA 20 is above price bars (can be crossed by shadows) and DI- is above DI+ is below. ADX line (on daily charts) will give you an instruction which tools to use on daily charts: if it is rising or horizontal and above 20, then use MACD and SMA 20 on daily charts; if it is falling or horizontal and less than 20, then use RSI 7 and Stochastics 5-3-3 and SMA 20 in case if market is not too narrow on daily charts, or Bollinger Bands and SMA 20, if market is too narrow on daily charts. Narrowness depends on risk:reward ratio, which is set to 2:1 when market is narrow. It means that less volatile markets are estimated as less risky and therefore reward is smaller. When we mean trending mode, then we set this ratio to 3:1 and can say that markets are more volatile, and risks are higher, therefore higher reward is demanded. If ADX 14 on weekly charts is falling and still above 20, then trend loses its strength, and approaches to range trading market, meaning that you should be careful in implementing MACD since trending mode is changing to range trading.</p>
Entry/exit decision (1)	<p>If you identified that major trend is positive (Rising or horizontal <math>ADX &gt; 20</math>, DI+ is above, while DI- is below or also possible that DI+ comes to cross DI- from below to above, SMA 20 is not flat and below price bars (it can be crossed by shadows from price bars), then, in this case you search for daily charts for taking only long or buying positions. Risk:reward is set to 3:1 in</p>

	<p>all cases. You implement combinations of MACD on daily charts:</p> <p><b>a)</b> If you found that trend on daily chart is positive (Rising or horizontal ADX&gt;20, DI+ is above DI- is below, SMA 20 below price bars (remember about shadows). then employ 6-19-9 MACD for buying positions and 19-39-9 MACD for selling (does not mean taking short positions). The signal for buying is when MACD line crosses it's signal line from below to above. The signal for selling is when MACD line crosses it's signal line from above to below. At the time that the first crossing of the sell MACD line from above to below its signal line takes place, check whether there have been any negative divergences, either in the MACD that is being used for buying or in the MACD that is being used for selling. If there are no divergences – MACD lines and price are moving in conjunction – and trends of the market are favorable, with prices above a rising SMA 20, you can ignore the first sell signal generated by MACD. You should, however, take a second sell signal. If there is negative divergence, then use first sell signal generated by MACD as to exit position. Remember the filter that the the MACD line does not necessarily have to be below 0 at the time of the buy signal, but it should have been below 0 at some time since the start of the recent decline. Also remember not to enter into a trade, when crossing of MACD line with signal line takes place in positive area which can be rather above from a zero border. Try to trade in near distance from zero border. This is true for all MACD cases.</p> <p><b>b)</b> If you found that trend on daily chart is somewhat to horizontal (horizontal or falling ADX&lt;20, but also it can bigger a little bit than 20 but falling, DI+ somewhat to flat and DI- somewhat to flat, SMA 20 is crossed by price bars). In this case you should use 12-26-9 MACD combination for buying and 19-39-9 MACD combination for selling. In this case sell when you will have the first crossing signal from selling MACD. You still go long. Filters are the same.</p> <p><b>c)</b> If you defined that trend on daily chart is negative (Rising or horizontal ADX&gt;20, DI+ is below and DI- is above, SMA20 is above price bars and can be touched by shadows. Go long. Good potential to buy very cheap. Especially you can rely on MACD line that can be too negative for convenient buy position. In this case you can use the 12-26-9 combination for both buying and selling. Everything else is the same, including ignoring the first crossing in case of exiting.</p>
Entry/exit decision (2)	<p>If you found that major trend is negative on weekly chart (Rising or horizontal ADX&gt;20, DI+ is below and DI- is above, or DI- is going to cross DI+ from below to above, SMA 20 is above price bars and can be touched by shadows. Risk reward is set to 3:1 in all three cases. You go only short in these cases:</p> <p><b>a)</b> If you found that trend on daily chart is positive. Good opportunity to sell high and then buy low, however again very dangerous. You can rely, if MACD histogram is too positive on daily charts, therefore a downturn is very probable which is very convenient for taking short positions in order to sell very high. But now, use 6-19-9 MACD to enter short positions and 19-39-9 MACD for exiting from a position. Everything else is the same, including ignoring the first crossing, but except the things concerning that instead of negative divergence, you search for positive one. Filter is reversed: MACD line does not necessarily have to be above 0 at the time of</p>

	<p>the sell signal (short), but it should have been above 0 at some time since the start of the recent incline. Also remember not to enter into a trade, when crossing of MACD line with signal line takes place in negative area which can be rather below from a zero border. Try to trade in near distance from zero border. This is true for all MACD cases.</p> <p><b>b)</b>If you found that trend is negative on daily chart, then in this case you can use the 12-26-9 combination for both buying and selling.</p> <p><b>c)</b>If you found that trend is somewhat to horizontal on daily chart. Use 12-26-9 MACD for entering short positions and 19-39-9 for exiting. You can not ignore first crossing!</p>
Entry/exit decision (3)	<p>If you found that major trend is somewhat to horizontal on weekly chart (horizontal or falling ADX&lt;20, but also it can bigger than 20 a little bit but falling, DI+ somewhat to flat and DI- somewhat to flat, SMA 20 is crossed by price bars). Risk:reward ratio is set to 2:1 in all cases. You solely rely on oscillators in you buying/selling decisions:</p> <p><b>a)</b> If you found that trend on daily chart is positive, then you go only long then. Then use RSI 7 and Stochastics 5-3-3. But you use Stochastics for generation of trading signals, when K line crosses from below to above D line. This must be confirmed by RSI 7, which should be below or equal to 30 before that signal or at the moment of this signal. You exit the trade when K line crosses from above to below D line and this must be confirmed by RSI 7, which should be above or equal to 70. If it is not confirmed, then ignore the signal. However, you can not ignore the second signal from Stochastics, when exiting a trade. You also search for divergences as you did in MACD case, especially during and after the first crossing. If they are present, then exit the trade immediately after the first signal.</p> <p><b>b)</b> If you found that trend on daily chart is negative, then you go only short. But you use Stochastics for generation of trading signals, when K line crosses from above to below D line. This must be confirmed by RSI 7, which should be above or equal to 70 before that signal or at the moment of this signal. You exit the trade when K line crosses from below to above D line and this must be confirmed by RSI 7, which should be below or equal to 30. If it is not confirmed, then ignore the signal. However, you can not ignore the second signal from Stochastics, when exiting a trade. You also search for divergences as you did in MACD case, especially during and after the first crossing. If they are present, then exit the trade immediately after the first signal.</p> <p><b>c)</b> If you found that trend on daily chart is somewhat to horizontal, you can go long or short depending on oscillators analysis. Use rules provided in previous two paragraphs.</p>
Entry/exit decision (4)	<p>This is a special case, concerning the narrowness of market. If you estimated that market is too narrow on daily charts (this depends on swings from Bollinger bands, which will be very narrow in this case and from inability to adequately establish risk:reward ratio). Then you wait and prepare yourself for breakout trading, when price bars will be above/below SMA 20, which depends on the direction of breakout. This should be confirmed by ADX, which will be rising and DI+ will cross DI- in the direction of breakout (if it is up, then DI+ crosses DI- from below to above,</p>

	if it is down, then from above to below). This will be the signal to start a trade. Risk:reward ratio is set to 3:1, since we are waiting for a strong move after breakout, thus volatility increases a lot. Exit a trade when DI+ will cross DI- in the opposite direction of breakout.
Risk control	<p>1) Risk control for long position: Stop loss is set as minimum of day which is previous to entry trade day. If this price is higher than minimum price of entry trade day, then stop loss is set as minimum of 2 days before. Also as a warning signal, you can use a crossing of the price of your investment from above to below the SMA 20, which would probably take place after the MACD first sell out signal that you did not follow. If afterwards, price bar will be below SMA 20, then exit a trade immediately (remember to do it only after the first MACD sell out signal that you did not follow).</p> <p>2) Risk control for short position: Stop loss is set as maximum of day which is previous to entry trade day. If this price is lower than maximum price of entry trade day, then stop loss is set as maximum of 2 days before. Also as a warning signal, you can use a crossing of the price of your investment from below to above the SMA 20, which would probably take place after the MACD first buy out signal that you did not follow. If afterwards, price bar will be above SMA 20, then exit a trade immediately (remember to do it only after the first MACD buy out signal that you did not follow).</p>

**Visual representation of strategy (BCS Company, 2011):**

1) In case of MACD implementation, see weekly:<sup>13</sup>

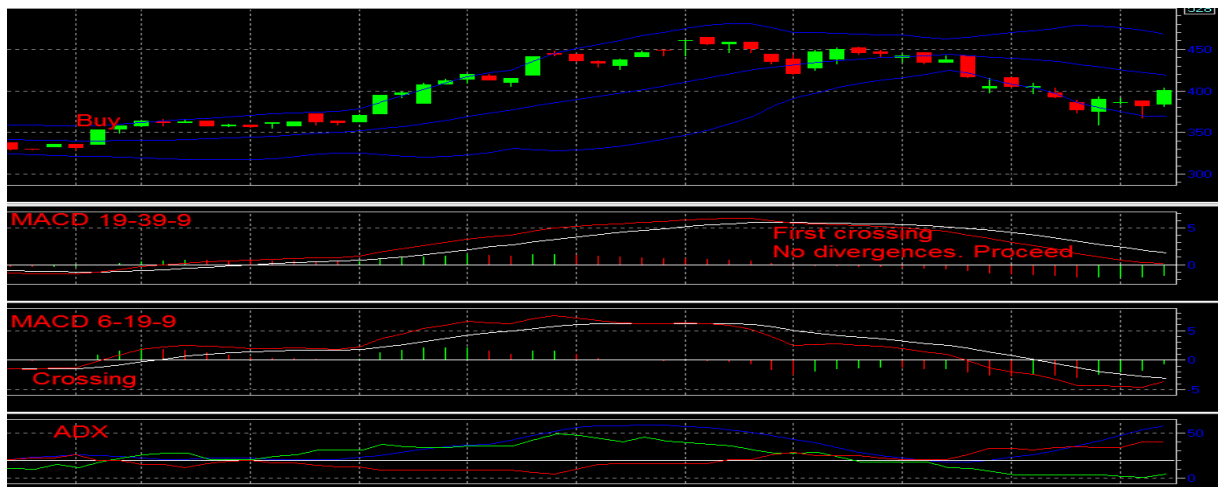
*Figure 14: Visual representation of Multifaceted strategy - weekly depiction of indicators*



<sup>13</sup> Buy and sell marks are established on the basis of daily chart analysis

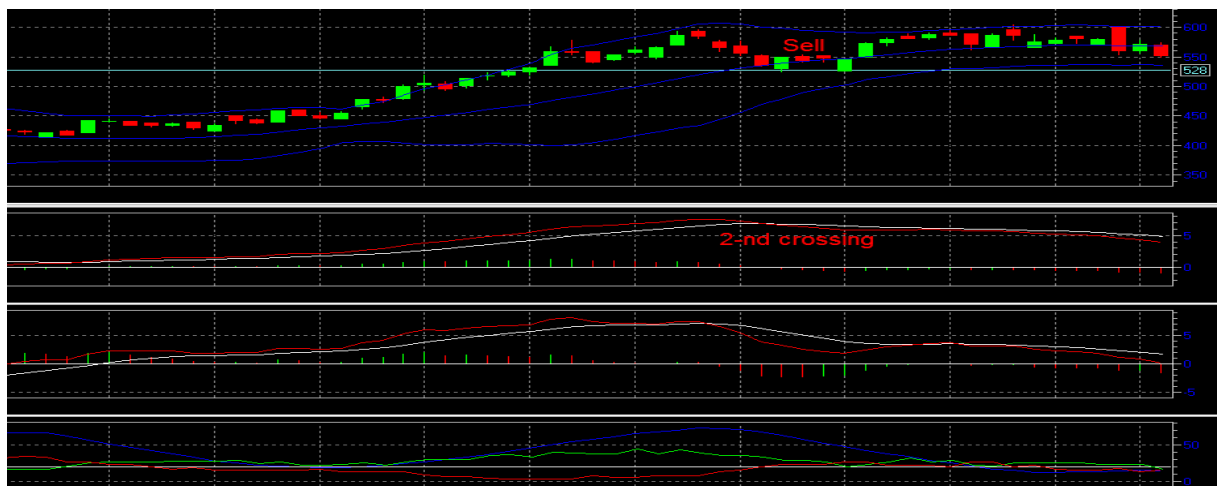
Now, see daily for entry decision:

**Figure 15: Visual representation of Multifaceted strategy - Daily depiction of indicators (1)**



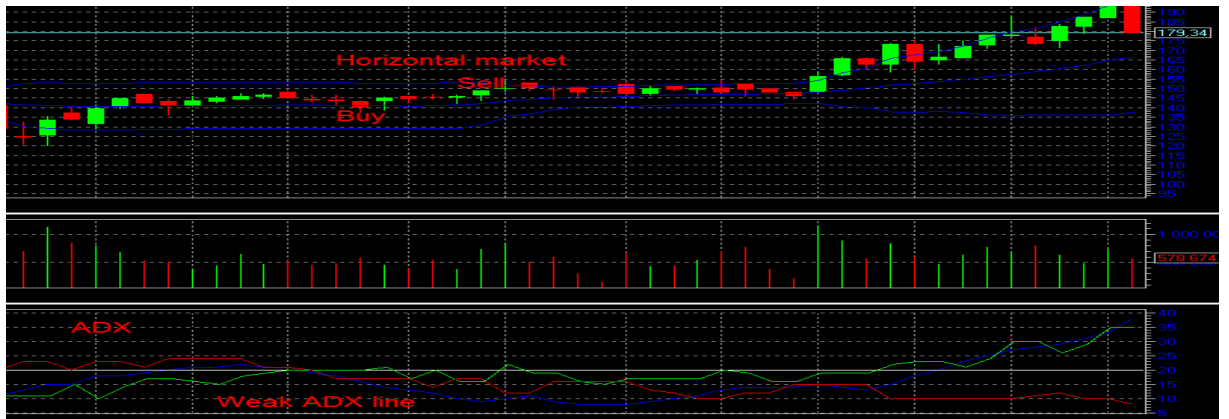
Daily exit (continuation of previous graph):

**Figure 16: Visual representation of Multifaceted strategy - Daily depiction of indicators (2)**



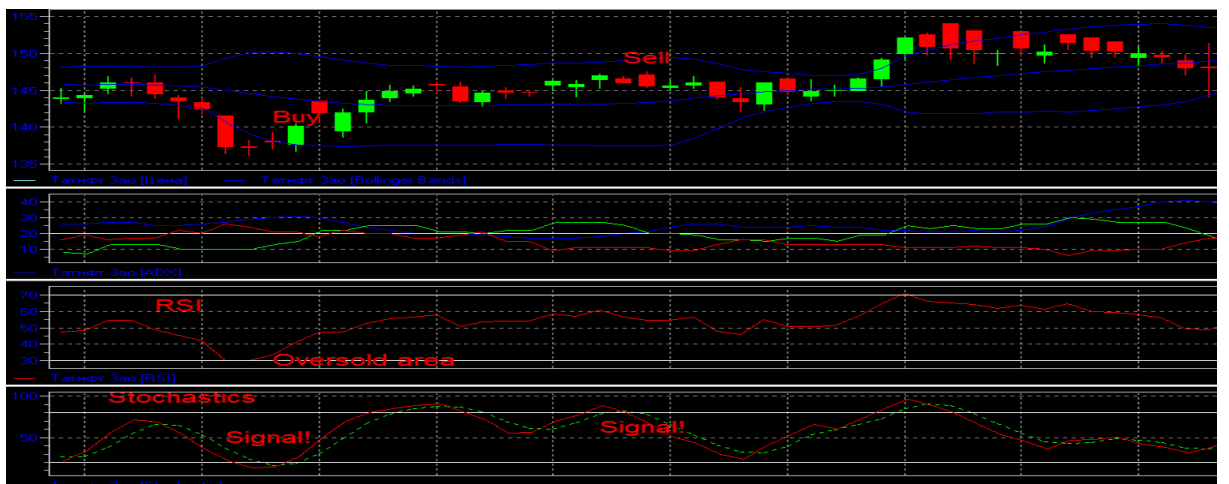
2) See weekly first in case of oscillators implementation:<sup>14</sup>

**Figure 17: Visual representation of Multifaceted strategy - Weekly depiction of oscillators**



Now, see daily for entry and exit decisions:

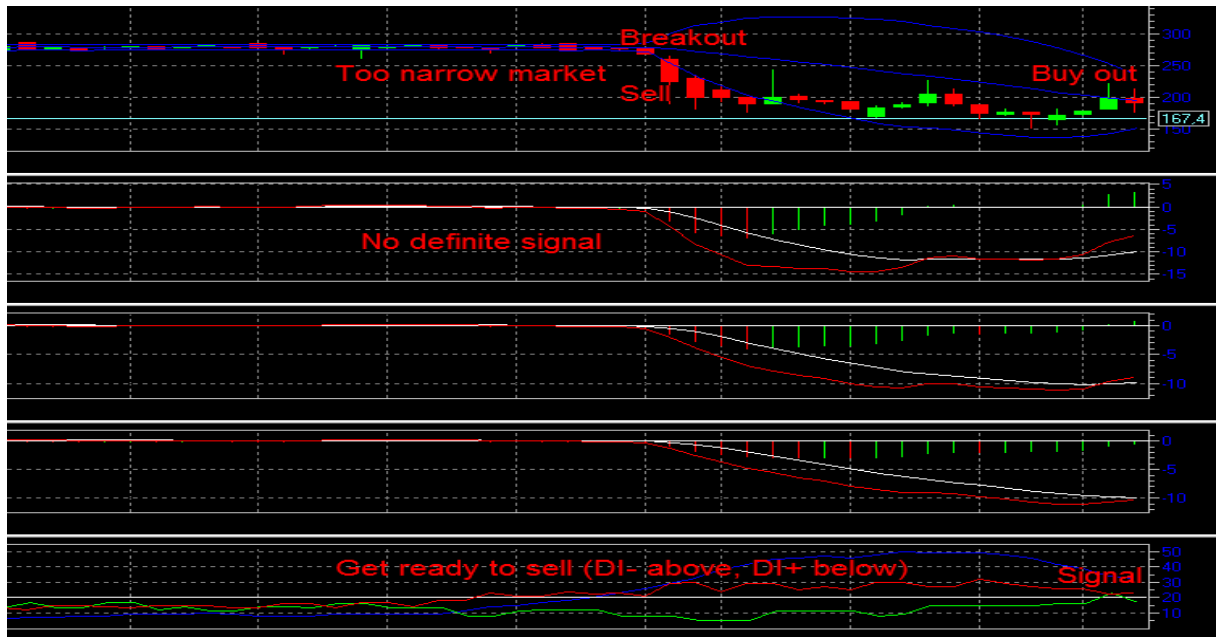
**Figure 18: Visual representation of Multifaceted strategy - Daily depiction of oscillators**



<sup>14</sup> Buy and sell marks are established on the basis of daily chart analysis

3) Bollinger bands breakout trading, see daily:

*Figure 19: Visual representation of Multifaceted strategy - Depiction of breakout*



### **3. Analysis of results: simple moving averages crossovers strategy versus holding strategy.**

Before establishing results and making analysis, let's consider the requirements according to which we will judge the overall effectiveness for timing strategy in the sense of returns and risk readings. The main criterias concerning the effectiveness of timing strategy are: 1) it should have strictly positive total values of return for period of 2007 till 2010 (including) and these values should be higher than corresponding values for holding strategy. If it is unable for comparison, especially when return is lower for one strategy, but risk is also lower for the same strategy, while it is reverse situation in another strategy, then Sharpe ratios should be established and compared; 2) Even if it is satisfied with previous paragraph, the strategy should also demonstrate stable readings of return from year to year, implying that these values should be more favorable (returns for timing strategy should be positive at least). The minimum passing criteria in the sense of return and risk should be that at least 2 years for timing strategy should be more superior against holding strategy. If there is again a vague situation concerning these readings, then Sharpe ratios should be compared. Therefore, it can be seen that it is stricter to be efficient for timing strategy than for holding, due to 2 facts:

- There are larger commission costs imposed for timing strategy – both hidden like spread and not hidden such as fixed amount per month or percent per trade;



- You use your time on implementation of timing strategy, while with holding strategy you do not have to spend your time and you can earn additional income somewhere else.

Thus, after implementation of 2 SMA strategy and testing it on historical data with using Quik as trading platform, following results were gathered and reflected against results from holding strategy in the table below:

*Table 11: Summary results of 2 SMA strategy versus Holding strategy:<sup>15</sup>*

Ticker	Period	Holding strategy			2 SMA strategy				
		Net Return	Risk	Sharpe ratio	Net Return	Risk	Sharpe ratio	% in Market	# of trades
GMKN	2007	72,0373%	24,1175%	2,5516	37,3012%	8,3795%	3,1984	60,0806%	9
	2008	-68,8474%	30,4682%	-2,6230	27,2220%	9,3123%	1,7343	62,8571%	15
	2009	117,9683%	44,9359%	2,3855	64,7854%	23,3211%	2,3160	55,0201%	13
	2010	52,5962%	12,5063%	3,5459	45,9751%	11,5634%	3,2625	74,5968%	14
	<b>Overall</b>	<b>173,7543%</b>	<b>43,9035%</b>	<b>3,0330</b>	<b>175,2838%</b>	<b>14,0838%</b>	<b>9,5635</b>	<b>63,1313%</b>	<b>51</b>
ROSN	2007	2,0480%	4,4073%	-1,9177	-12,9641%	2,1188%	-11,0742	63,3065%	19
	2008	-51,3041%	25,8970%	-2,4086	21,4383%	17,1925%	0,6030	66,1224%	14
	2009	120,6706%	38,5340%	2,8520	-0,06815603	8,7656%	-2,0065	53,0120%	13
	2010	-19,4516%	6,6492%	-4,1662	2,4767%	2,2808%	-2,5313	60,8871%	15
	<b>Overall</b>	<b>51,9629%</b>	<b>41,8004%</b>	<b>0,2720</b>	<b>4,1353%</b>	<b>9,0864%</b>	<b>-4,0125</b>	<b>60,8081%</b>	<b>61</b>
GAZP	2007	19,6037%	9,6168%	0,9466	8,1601%	3,8520%	-0,6074	55,2419%	13
	2008	-69,3782%	25,0166%	-3,2158	-32,9284%	9,7439%	-4,5156	41,6327%	11
	2009	64,0885%	22,4499%	2,3749	-21,7210%	4,6579%	-6,9761	57,8313%	14
	2010	-0,5141%	6,0919%	-1,4387	-8,3011%	3,5220%	-4,6994	64,5161%	17
	<b>Overall</b>	<b>13,7999%</b>	<b>31,0984%</b>	<b>-0,8616</b>	<b>-54,7903%</b>	<b>5,6024%</b>	<b>-17,0258</b>	<b>54,8485%</b>	<b>55</b>
SBER03	2007	22,1118%	7,0795%	1,6402	3,1382%	2,9335%	-2,5096	50,8065%	12
	2008	-77,4178%	24,1255%	-3,6679	145,7297%	48,5896%	2,7713	58,7755%	9
	2009	264,0122%	88,9798%	2,8460	187,3936%	56,2039%	3,1425	75,1004%	10
	2010	20,1753%	11,4873%	1,0381	21,0383%	6,7436%	1,8964	82,2581%	16
	<b>Overall</b>	<b>228,8816%</b>	<b>66,7201%</b>	<b>2,8221</b>	<b>357,2999%</b>	<b>33,0306%</b>	<b>9,5883</b>	<b>66,7677%</b>	<b>47</b>
CHMF	2007	91,9348%	31,5727%	2,5793	33,8816%	10,3630%	2,2563	70,1613%	13
	2008	-85,0376%	36,0676%	-2,6647	393,3503%	120,6165%	3,1694	75,5102%	10
	2009	188,9599%	57,7613%	3,0849	-4,0510%	11,3270%	-1,3087	56,2249%	17

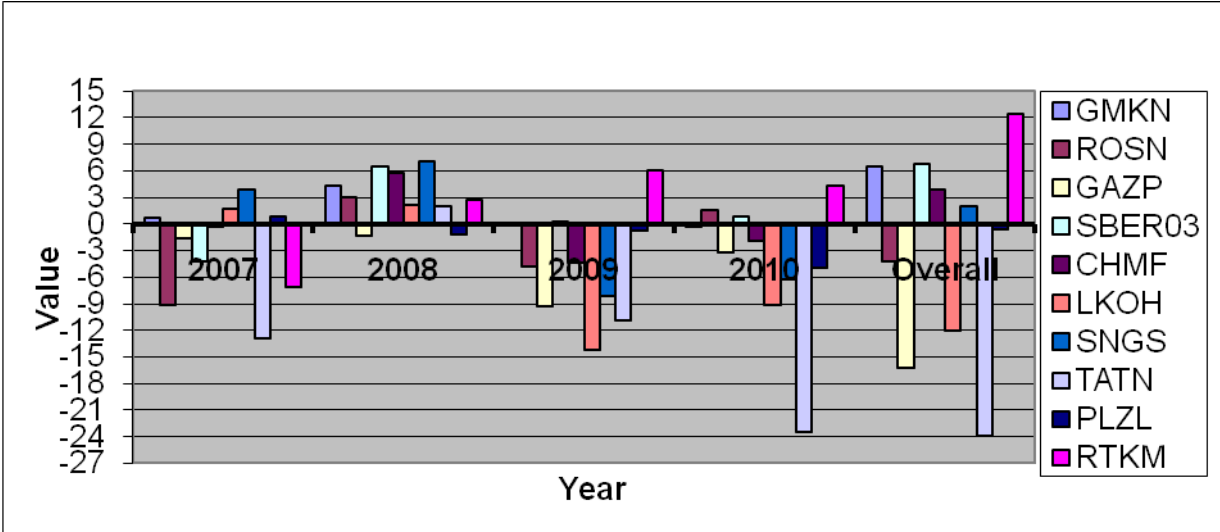
<sup>15</sup> Risk free rates values can be seen in Appendix 2

	2010	70,7225%	18,8168%	3,3200	29,8081%	14,4905%	1,4877	56,0484%	11
	<b>Overall</b>	<b>266,5797%</b>	<b>60,5890%</b>	<b>3,7298</b>	<b>452,9890%</b>	<b>53,8690%</b>	<b>7,6555</b>	<b>64,4444%</b>	<b>51</b>
LKOH	2007	-1,7771%	4,9234%	-2,4936	7,5866%	4,0098%	-0,7266	67,3387%	14
	2008	-53,5782%	25,3972%	-2,5455	5,2147%	14,8799%	-0,3936	49,3878%	9
	2009	66,7159%	21,9161%	2,5526	-43,5455%	4,6493%	-11,6832	51,8072%	19
	2010	-0,5129%	4,3529%	-2,0131	-16,4357%	2,2187%	-11,1260	50,4032%	14
	<b>Overall</b>	<b>10,8477%</b>	<b>30,1329%</b>	<b>-0,9872</b>	<b>-47,1798%</b>	<b>6,7080%</b>	<b>-13,0849</b>	<b>54,7475%</b>	<b>56</b>
SNGS	2007	-19,3080%	5,1256%	-5,8155	-0,2493%	5,4190%	-1,9836	74,1935%	12
	2008	-45,7395%	16,1869%	-3,5097	105,6033%	26,8622%	3,5191	77,1429%	12
	2009	68,8008%	22,4054%	2,5899	-30,4523%	7,3559%	-5,6043	71,0843%	19
	2010	14,0019%	6,4207%	0,8958	-16,4760%	4,6387%	-5,3304	79,8387%	17
	<b>Overall</b>	<b>17,7552%</b>	<b>33,4977%</b>	<b>-0,6818</b>	<b>58,4257%</b>	<b>13,2387%</b>	<b>1,3469</b>	<b>75,5556%</b>	<b>60</b>
TATN	2007	32,6878%	11,0662%	2,0050	-37,6774%	4,4226%	-10,8934	74,1935%	18
	2008	-64,2626%	30,6464%	-2,4582	5,4112%	13,6650%	-0,4142	52,2449%	11
	2009	150,0448%	49,1700%	2,8325	-60,1702%	8,8892%	-7,9808	77,5100%	23
	2010	3,1207%	3,8268%	-1,3404	-32,6743%	1,6548%	-24,7313	50,0000%	22
	<b>Overall</b>	<b>121,5907%</b>	<b>54,5482%</b>	<b>1,4849</b>	<b>-125,1107%</b>	<b>7,4177%</b>	<b>-22,3391</b>	<b>63,5354%</b>	<b>74</b>
PLZL	2007	-6,0825%	9,2492%	-1,7929	4,2165%	6,9627%	-0,9024	79,4355%	12
	2008	-34,1596%	32,0253%	-1,4124	-44,9569%	21,2938%	-2,6312	52,6531%	8
	2009	102,1684%	26,7687%	3,4143	98,8434%	32,5104%	2,7090	56,2249%	15
	2010	18,1122%	8,7518%	1,1269	-10,9171%	5,0894%	-3,7661	65,3226%	14
	<b>Overall</b>	<b>80,0384%</b>	<b>40,7670%</b>	<b>0,9676</b>	<b>47,1860%</b>	<b>20,0558%</b>	<b>0,3287</b>	<b>63,4343%</b>	<b>49</b>
RTKM	2007	45,4005%	10,7438%	3,2484	-2,4497%	3,3429%	-3,8738	34,2742%	9
	2008	-9,2062%	12,4784%	-1,6250	26,6534%	14,6766%	1,0617	43,2653%	16
	2009	-46,0000%	24,1680%	-2,3491	144,9939%	35,7422%	3,7553	54,6185%	7
	2010	6,7000%	11,7834%	-0,1315	56,5868%	11,5305%	4,1921	68,1452%	16
	<b>Overall</b>	<b>-3,1056%</b>	<b>22,2547%</b>	<b>-1,9636</b>	<b>225,7844%</b>	<b>17,7754%</b>	<b>10,4184</b>	<b>50,1010%</b>	<b>48</b>

Let's make the first screen of analysis for 2 SMA strategy, and compare only total values of return and risk. It will help us to drop off markets which showed its negative results. We can see that strategy proved to be efficient according to total values only in 5 markets from 10: GMKN, SBER03, SNGS, RTKM, CHMF. Values of return were high enough and readings of risk were lower if we compare with buy and hold strategy. Concerning PLZL market the strategy showed its lower profitability, but at the same time lower risk in comparison with buy and hold strategy, so for reasonable comparison we can take into consideration Sharpe ratio, which was lower in 2 SMA case, which indicates that buy and hold strategy was more superior. Within 3 markets, such as TATN, LKOH, GAZP, the

strategy was completely unprofitable and readings of returns were negative, while buy and hold strategy at the same time produced better performance. And in 1 market, such as ROSN, the value of return was positive but too low, the readings of Sharpe ratio was inadequate, so buy and hold strategy was not beaten in this case. For additional visual support take a view at the following diagram, where you can spot the differences in Sharpe ratios between 2 SMA strategy and holding strategy within indicated period:

**Figure 20: Differences in Sharpe ratio between 2 SMA strategy and holding strategy**



Therefore, we can drop off such markets as TATN, LKOH, GAZP, ROSN, PLZL and choose for further analysis such markets as GMKN, SBER03, SNGS, RTKM, CHMF.

Now, let's turn us to second screen of analysis and compare separate years in these chosen 5 markets. Concerning GMKN, we can see that results were rather stable and positive from year to year. In 2007, holding strategy brought higher return, and higher risk than in 2 SMA case. But Sharpe was higher for 2 SMA strategy. GMKN lost -68,8474% in 2008 with buy and hold strategy, but it gained 27,2220% with 2 SMA strategy due to ability to go short. At the same time standard deviation was lower in 2 SMA strategy. In 2009 and 2010 values of returns were positive enough in both strategies, but Sharpe was better for holding strategy, however the difference was rather small. Therefore, grounding on stability from year to year and moreover that such strategy preserves capital and do not let annual negative outcomes come in, which is an important trait of reliable trading system, 2 SMA strategy is considered efficient for the second screen of analysis in GMKN market.

SBER03 also provided us with results which were similar to GMKN market. In 2007 2 SMA strategy lost to buy and hold strategy, but still preserved the capital. In the remaining years, timing strategy proved its efficiency and beat holding strategy according to its values of Sharpe, risk and return. The only case when return was lower, while other parameters were favorable in comparison with holding strategy was year 2009. Thus, the conclusion can be made in favor of 2 SMA strategy.

SNGS didn't show its stability as it was in 2 previous cases. While the stock brought us with 105,6033% of return in 2008, it showed completely unprofitability during other years. However, this return was able to cover all expenses. We can also notice that strategy was able to preserve capital much more better in 2007 with loss of -0,2493% than holding strategy, which lost -19,3080%. But in years 2009 and 2010 timing strategy lost -30,4523% and -16,4760% and was fully beaten by holding strategy. Such instability and heavily losses during 2 years imposes a question in reasonable efficiency of timing strategy in this market. Therefore, 2 SMA strategy is not efficient in this case.

If we consider RTKM market, we can view that results were positive, stable enough and more superior for 2 SMA strategy. The only year which brought us with negative outcome was year 2007 with return of -2,4497%, which in principal rather low. Taking into consideration these facts, we can claim that 2 SMA strategy is efficient in this market.

The last CHMF case showed results which were good enough and stable. The maximum annual loss was -4,0510% (2008) for timing strategy, while it was -85,0376% (2009) for holding strategy and such fact tell us about ability to adequately control risks with respect to 2 SMA strategy. The maximum gain for timing strategy was achieved in year 2008 with return of 393,3503% and beat holding strategy. However, holding strategy was more superior during 3 years, which points the fact that CHMF market showed worse performance in dynamics. Therefore 2 SMA strategy was not efficient in this case.

Therefore, holding strategy was beaten only in 3 cases out of 10. These are stocks: GMKN, SBER03, RTKM, which in fact indicates that overall effectiveness is quite low for this strategy. To support this decision, let's carry out a test of significance of differences in Sharpe ratios between these two strategies. This hypothesis test will be performed on overall mean value of differences in Sharpe ratios within all ten stocks and including all years, which provides us with a sample of 40 observations. In this test, since we have a sample consisting of more than 30 observations, I can rely on properties of central limit theorem, according to which as the number of discrete events increases, the function begin to resemble a normal (Lauvsnes, spring 2010). This test will show us whether this mean is significantly different

from zero or not. This test is one-sided, since we are interested whether testing value is higher than zero or not. You can view the results of such performance in the table below:

*Table 12: Test of Significance for 2 SMA<sup>16</sup>*

<b><i>Hypothesis Test (One-Sample)</i></b>	<b>2 SMA strategy</b>
<b>Sample Size</b>	40
<b>Sample Mean</b>	-2,136
<b>Sample Std Dev</b>	6,432
<b>Hypothesized Mean</b>	0
<b>Alternative Hypothesis</b>	> 0
<b>Standard Error of Mean</b>	1,016960765
<b>Degrees of Freedom</b>	39
<b>t-Test Statistic</b>	-2,1003
<b>p-Value</b>	0,9789
<b>Null Hypoth. at 10% Significance</b>	Don't Reject
<b>Null Hypoth. at 5% Significance</b>	Don't Reject
<b>Null Hypoth. at 1% Significance</b>	Don't Reject

Therefore, high p-value tells us that we can not reject null hypothesis and this is evident at all levels of significance. However, we see that mean value is even negative, therefore it can be a case that it is significantly different from zero in negative direction. But it should not bother us, since it will also indicate that overall effectiveness of trading strategy is low. So, test of significance confirm the point of view that overall effectiveness of this system is low.

Now, let's turn our analysis to finding out problems with this timing strategy. It is obvious that for continuous trending system as in our case the major problem is the failure to recognize when the market is not trending and its inability to turn itself off incurring losses during such periods. In order to understand periods when markets are trending and when they are not trending, let's find relative strength for 10 stocks or comparing each stock's performance with overall market. MICEX index was chosen to reflect the performance of that market. For additional visual support take an eye on the graph after table below.

<sup>16</sup> Results are provided with use of StatTools 1.1 for Excel.

Table 13: Relative strength<sup>17</sup> for holding strategy in comparison with MICEX index

Year	2007		2008		2009		2010	
Item	RS	Rank	RS	Rank	RS	Rank	RS	Rank
<b>MICEX</b>	Weak trend	-	Strong trend	-	Strong trend	-	Medium trend	-
GMKN	3,5735	<b>2</b>	1,0198	4	1,0204	5	3,1245	<b>2</b>
SBER03	1,0969	5	1,1468	<b>2</b>	2,2836	<b>1</b>	1,1985	<b>3</b>
SNGS	-0,9578	10	0,6775	8	0,5951	7	0,8318	5
RTKM	2,2521	<b>3</b>	0,1364	10	-0,3979	10	0,3980	6
CHMF	4,5605	<b>1</b>	1,2596	<b>1</b>	1,6344	<b>2</b>	4,2012	<b>1</b>
PLZL	-0,3017	9	0,5060	9	0,8837	6	1,0759	4
TATN	1,6215	4	0,9519	5	1,2978	<b>3</b>	0,1854	7
LKOH	-0,0882	8	0,7936	6	0,5771	8	-0,0305	8
GAZP	0,9725	6	1,0277	<b>3</b>	0,5543	9	-0,0305	9
ROSN	0,1016	7	0,7599	7	1,0437	4	-1,1555	10

Table 14: Dynamics of annual returns for MICEX index from 2007-2010 (including)<sup>18</sup>

Item	2007	2008	2009	2010
MICEX	20,1590%	-67,5105%	115,6138%	16,8337%

Figure 21: Dynamics of MICEX index from 2007-2010 (including)

(FINAM Company, 2011)



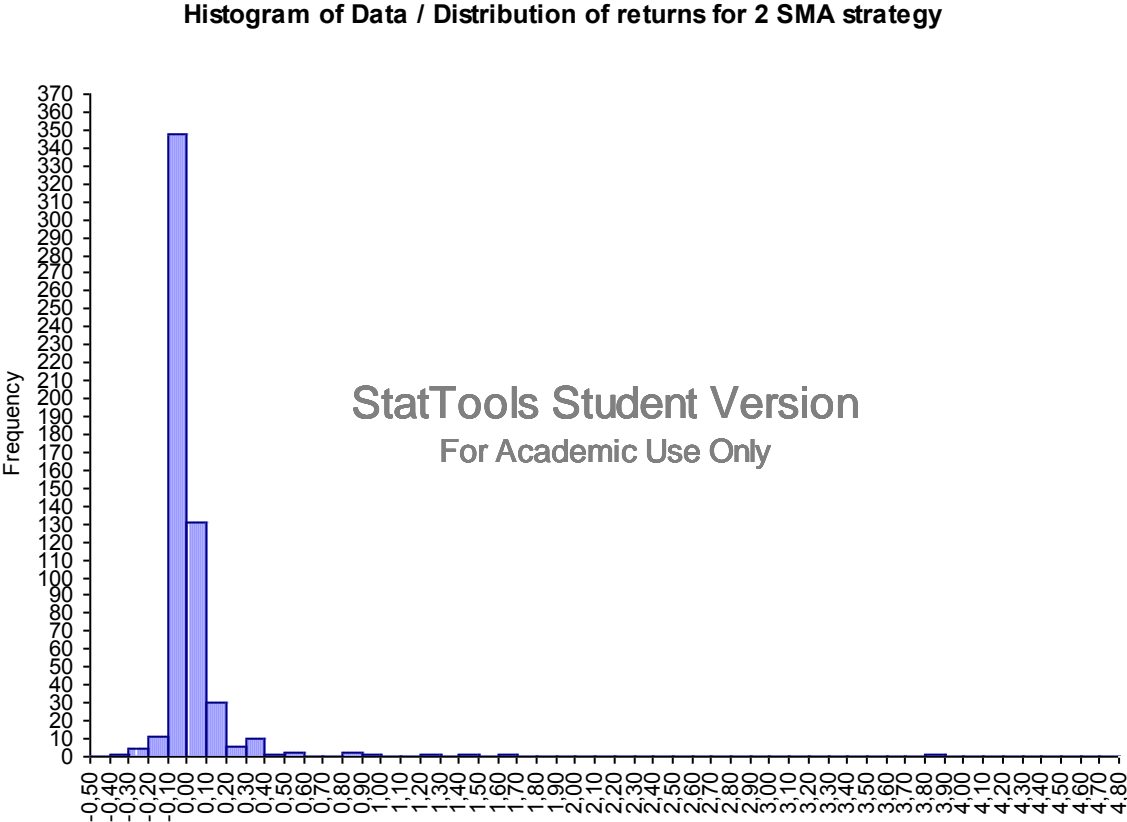
<sup>17</sup> Do not confuse with relative strength index

<sup>18</sup> Data gathered from www.finam.ru. Returns's calculations are based on closing prices.

It can be stated that overall market was not in a strong trend for year 2007. This can be evident from ADX readings which were quite low and for most of its time were below 20. The market was in a strong trend for year 2008 and subsequent recovery also was enough powerful during year 2009. Then, the market started to slow down during the first half of 2010 but still was in trend and then race on during the second half. If we take RS readings for year 2007, we will see that GAZP, ROSN, LKOH, PLZL, SNGS were outsiders, meaning that they had a period of range market, SNGS even had negative market. And this means that it is hard for trend following systems to earn on such markets. This is supported by low or negative values which were earned with these stocks during this year within 2 SMA strategy. At the same time such stocks as CHMF, GMKN, RTKM, TATN, SBER03 were leaders. While 2 SMA strategy earned more than overall market did on CHMF, GMKN, since these markets were in the best trending mode, it is failed to earn on RTKM and TATN, and gained little in SBER03 case. Year 2008 brought a strong negative trend which was favorable for trend-following system to be profitable. We can see from summary table 11 of results that CHMF, SBER03, SNGS, GMKN, RTKM earned a positive return with premium in comparision with risk free rate, meaning that trend-following system was effective in this case. Other stocks had negative or rather small readings, even with some contradictions: while GAZP was in the leaders according to RS, 2 SMA strategy was unable to capture this big negative movement. And RTKM did not fall a lot, but timing strategy performed profitably. During year 2009, which was in a strong recovery period after financial crisis, we can notice that according to RS such stocks as SBER03, CHMF, TATN, ROSN, GMKN, were in a racy period. PLZL in principle was in a strong trend with 6-th place. And according to 2 SMA strategy it was highly profitable to trade with SBER03, GMKN, PLZL, RTKM. But RTKM again in contradiction, since it fell and had negative correlation with market, but in this case it fell by 46% a rather serious value, so perhaps such falling was captured by 2 SMA strategy. Year 2010 was in a medium trend, and we can see that such stocks as CHMF, GMKN, SBER03, PLZL were stronger than overall market. From summary table 11 for 2 SMA strategy, we can note that GMKN, SBER03, CHMF, RTKM are leaders with high results. RTKM was weaker than market, but again in a contradiction, since 2 SMA strategy brought high results. Therefore, from year to year we can see that timing strategy worked well with the most trending stocks such as GMKN, SBER03. CHMF also was in the leaders, but timing strategy failed to catch these strong movements during 3 years out of 4. RTKM behaved very unpredictable if we compare its RS, but still was profitable with 2 SMA strategy. Moreover, there were other contradictions, when some stocks possessed themselves as very strong, while

2 SMA strategy was not able to catch these strong movements. This in principal leads us to second serious problem with 2 SMA strategy – possibility of failure for SMA’s standardized periods to catch strong movements. But before discussion this problem, see the overall performance of 2 SMA strategy within the following histogram and table below:

**Figure 22: Histogram of data for 2 SMA strategy<sup>19</sup>**



**Table 15: Distribution of returns for 2 SMA strategy<sup>20</sup>**

<b>Distribution of returns for 2 SMA strategy</b>						
<i>Histogram</i>	<b>Bin Min</b>	<b>Bin Max</b>	<b>Bin Midpoint</b>	<b>Freq.</b>	<b>Rel. Freq.</b>	<b>Rank</b>
<b>Bin #2</b>	-0,4000	-0,3000	-0,3500	1	0,0018	9
<b>Bin #3</b>	-0,3000	-0,2000	-0,2500	5	0,0091	7
<b>Bin #4</b>	-0,2000	-0,1000	-0,1500	11	0,0199	4
<b>Bin #5</b>	-0,1000	0,0000	-0,0500	348	0,6304	<b>1</b>

<sup>19</sup> Results are provided with use of StatTools 1.1 for Excel.

<sup>20</sup> Results are provided with use of StatTools 1.1 for Excel.



<b>Bin #6</b>	0,0000	0,1000	0,0500	131	0,2373	<b>2</b>
<b>Bin #7</b>	0,1000	0,2000	0,1500	30	0,0543	<b>3</b>
<b>Bin #8</b>	0,2000	0,3000	0,2500	6	0,0109	<b>6</b>
<b>Bin #9</b>	0,3000	0,4000	0,3500	10	0,0181	<b>5</b>
<b>Bin #10</b>	0,4000	0,5000	0,4500	1	0,0018	<b>9</b>
<b>Bin #11</b>	0,5000	0,6000	0,5500	2	0,0036	<b>8</b>
<b>Bin #14</b>	0,8000	0,9000	0,8500	2	0,0036	<b>8</b>
<b>Bin #15</b>	0,9000	1,0000	0,9500	1	0,0018	<b>9</b>
<b>Bin #18</b>	1,2000	1,3000	1,2500	1	0,0018	<b>9</b>
<b>Bin #20</b>	1,4000	1,5000	1,4500	1	0,0018	<b>9</b>
<b>Bin #22</b>	1,6000	1,7000	1,6500	1	0,0018	<b>9</b>
<b>Bin #44</b>	3,8000	3,9000	3,8500	1	0,0018	<b>9</b>

This system is purely mechanical, which means that you act only when you get signal, which in turn increases your trading discipline, brings you with consistent results and minimizes human emotion and participation. When I mean last two terms, I emphasize the fact that you do not have to spend all your time on viewing trading process. You can program your trading platform to execute these signals and make corrections from time to time. This system is simple for implementation which brings you with perfect understanding of it and eliminates contradictions in your decisions. Since the system obliges you to follow its signals, then it can guarantee you the participation in the direction of every important trend. Risk control was useful in the sense of trailing stops (dynamic stop points which were enabled if longer SMA was halfway penetrated by price bars) which allowed profits to run and in the sense of stop losses, since in many cases you exited in advance in favorable location, while subsequent reverse crossover took place in unfavorable location. Furthermore, this system decreases risk, which is evident from table 11 of summary results, since you are not in the market all the time as in case with holding strategy.

After consideration of positive issues, let's turn to negative sides of this strategy. The measure of a good system is not only in its ability to make money in trending markets, but of more importance in its ability to preserve capital during nontrending periods. This histogram gives us a view that: 1) losses were not focused within a definite interval, and we can see that 63,04% of trades were within 0 and -10%, almost 2% were within -10% and -20%, almost 1%

were within -20% and -30%, and 0,18% were within -30% and -40%. Such spread tells us about instability of established risk control. 2) moreover, it is notable that the largest positive share of trades or 23,73% were lied within 0 to 10%, only 5,43% were within 10% and 20%, and 1,81% within 30% and 40%. This indicates that strategy poorly captured the beginning/end of big movements, since majority of returns were rather small, while we know from theory that successful moving averages crossovers strategy gets large profits during trending periods when crossovers are few and far between while at the same time withstanding the inevitable small losses during sideways whipsaw periods when crossovers are abundant. It means that the problem concerned with optimization issues for SMA's periods. Since standardized periods for SMA were used in all these markets, this could lead to inability of timing strategy to quickly capture strong movements. It should be mentioned here that there were accidents when big movements were missed due to risk control, since you exited a trade earlier, while movement continued. Also, one more reason of negative trades was that there were accidents when you traded against a major tide, since you adhered to mechanical trading signals and eliminated overview of weekly charts. 3) We also see from the histogram and summary table the fact that there were too many trades or 552 altogether and this can lead to higher comission costs, which decreases net returns.

So, summarizing of what was said during the discussion, we can point out main advantages and disadvantages of this system.

Advantages of 2 simple moving averages crossovers strategy:

1. Human emotion and participation are minimized.
2. System is simple for implementation
3. Greater discipline is achieved
4. Goog consistency is possible
5. Participation is virtually guaranteed in the direction of every important trend
6. Profits are allowed to run. Trailing stops are very useful in this case.
7. Losses are partly minimized due to additional filter for risk control

Disadvantages of 2 simple moving averages crossovers strategy:

1. System is trend-following only, thus flexibility decreases.
2. It is unprofitable when markets are not trending and there are long periods of time when markets are range trending, therefore, not suitable for trending approach.
3. Overall effectiveness is rather low, and the system is efficient only in 3 cases out of 10.

4. Partial inability of standardized periods for SMA to quickly capture the beginning/end of big movements, therefore optimization process is required.
5. Accidents are detected when trades are made against a major trend
6. Too much number of trades are done. Therefore, higher commission costs are imposed.
7. Accidents are detected, when you miss the continuation of big movement due to additional filter for risk control.

#### 4. Analysis of results: multifaceted strategy versus holding strategy

The criteria for judging the effectiveness for this kind of timing strategy was the same as for 2 SMA crossovers strategy.

Multifaceted strategy was implemented and tested on historical data and following results were established versus holding strategy in the table below:

*Table 16: Summary results of Multifaceted strategy versus Holding strategy*

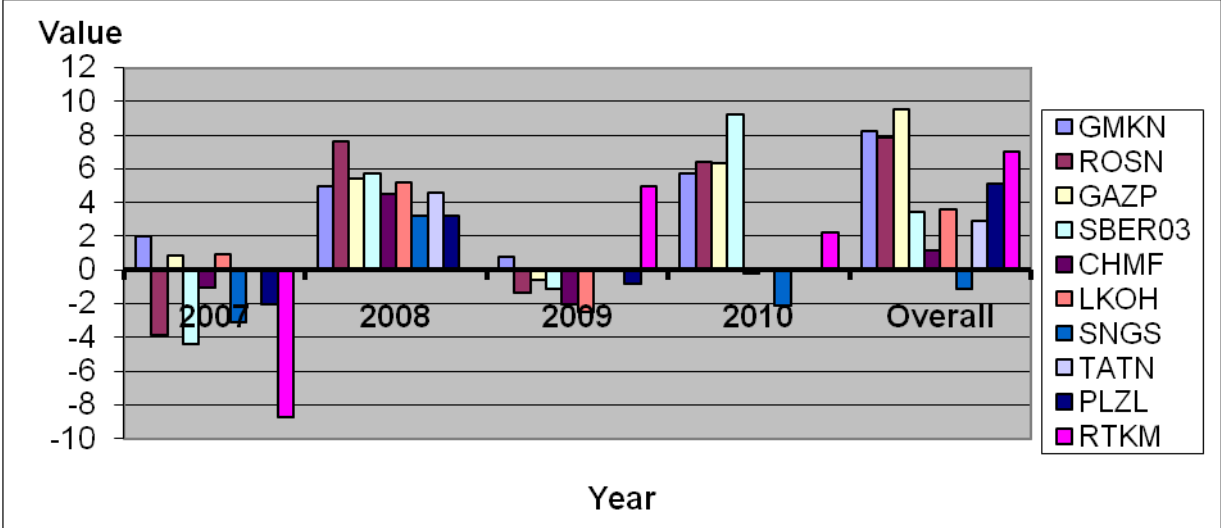
Ticker	Period	Holding strategy			Multifaceted strategy				
		Net Return	Risk	Sharpe ratio	Net Return	Risk	Sharpe ratio	% in Market	# of trades
GMKN	2007	72,0373%	24,1175%	2,5516	59,1193%	10,7140%	4,5379	67,3387%	3
	2008	-68,8474%	30,4682%	-2,6230	131,5268%	52,0421%	2,3146	38,3673%	3
	2009	117,9683%	44,9359%	2,3855	128,1227%	36,7787%	3,1907	75,1004%	5
	2010	52,5962%	12,5063%	3,5459	66,8415%	6,3254%	9,2629	56,4516%	2
	<b>Overall</b>	<b>173,7543%</b>	<b>43,9035%</b>	<b>3,0330</b>	<b>385,6103%</b>	<b>30,5178%</b>	<b>11,3054</b>	<b>59,3939%</b>	<b>13</b>
ROSN	2007	2,0480%	4,4073%	-1,9177	-7,2182%	3,0498%	-5,8096	53,6290%	5
	2008	-51,3041%	25,8970%	-2,4086	98,8828%	16,8664%	5,2063	72,6531%	5
	2009	120,6706%	38,5340%	2,8520	42,2109%	20,7729%	1,5134	66,6667%	5
	2010	-19,4516%	6,6492%	-4,1662	19,6327%	5,0129%	2,2707	54,8387%	8
	<b>Overall</b>	<b>51,9629%</b>	<b>41,8004%</b>	<b>0,2720</b>	<b>153,5082%</b>	<b>13,8674%</b>	<b>8,1424</b>	<b>61,9192%</b>	<b>23</b>
GAZP	2007	19,6037%	9,6168%	0,9466	23,4782%	7,2893%	1,7805	44,7581%	3
	2008	-69,3782%	25,0166%	-3,2158	64,8407%	24,4656%	2,1977	60,4082%	5
	2009	64,0885%	22,4499%	2,3749	47,9220%	20,5169%	1,8107	55,8233%	4
	2010	-0,5141%	6,0919%	-1,4387	34,6821%	5,4037%	4,8914	43,5484%	6
	<b>Overall</b>	<b>13,7999%</b>	<b>31,0984%</b>	<b>-0,8616</b>	<b>170,9230%</b>	<b>15,0657%</b>	<b>8,6507</b>	<b>51,1111%</b>	<b>18</b>
SBER03	2007	22,1118%	<b>7,0795%</b>	1,6402	-2,3958%	4,7285%	-2,7273	36,6935%	4
	2008	-77,4178%	24,1255%	-3,6679	224,9829%	105,4655%	2,0283	62,8571%	3
	2009	264,0122%	88,9798%	2,8460	96,9371%	50,5866%	1,7033	41,7671%	2
	2010	20,1753%	11,4873%	1,0381	44,8369%	3,5741%	10,2367	44,3548%	5
	<b>Overall</b>	<b>228,8816%</b>	<b>66,7201%</b>	<b>2,8221</b>	<b>364,3611%</b>	<b>51,9722%</b>	<b>6,2296</b>	<b>46,3636%</b>	<b>14</b>

CHMF	2007	91,9348%	31,5727%	2,5793	53,8391%	27,6432%	1,5678	43,1452%	4
	2008	-85,0376%	36,0676%	-2,6647	456,0429%	237,1423%	1,8764	62,0408%	4
	2009	188,9599%	57,7613%	3,0849	24,5622%	13,4007%	1,0290	20,8835%	3
	2010	70,7225%	18,8168%	3,3200	57,1266%	15,6666%	3,1198	32,6613%	5
	<b>Overall</b>	<b>266,5797%</b>	<b>60,5890%</b>	<b>3,7298</b>	<b>591,5709%</b>	<b>112,9277%</b>	<b>4,8790</b>	<b>39,5960%</b>	<b>16</b>
LKOH	2007	-1,7771%	4,9234%	-2,4936	3,1449%	4,7403%	-1,5516	31,8548%	4
	2008	-53,5782%	25,3972%	-2,5455	53,3320%	15,7365%	2,6855	53,4694%	4
	2009	66,7159%	21,9161%	2,5526	11,3636%	15,6819%	0,0377	64,6586%	5
	2010	-0,5129%	4,3529%	-2,0131	2,1118%	3,2664%	-1,8792	30,2419%	5
	<b>Overall</b>	<b>10,8477%</b>	<b>30,1329%</b>	<b>-0,9872</b>	<b>69,9523%</b>	<b>11,3164%</b>	<b>2,5943</b>	<b>45,0505%</b>	<b>18</b>
SNGS	2007	-19,3080%	5,1256%	-5,8155	-5,6055%	1,8041%	-8,9273	12,5000%	3
	2008	-45,7395%	16,1869%	-3,5097	5,4201%	19,7619%	-0,2860	31,0204%	3
	2009	68,8008%	22,4054%	2,5899	20,0631%	0,0000%	-	22,4900%	1
	2010	14,0019%	6,4207%	0,8958	0,1166%	6,7278%	-1,2089	29,4355%	2
	<b>Overall</b>	<b>17,7552%</b>	<b>33,4977%</b>	<b>-0,6818</b>	<b>19,9943%</b>	<b>11,6009%</b>	<b>-1,7757</b>	<b>23,8384%</b>	<b>9</b>
TATN	2007	32,6878%	11,0662%	2,0050	-9,0084%	0,0000%	-	12,0968%	1
	2008	-64,2626%	30,6464%	-2,4582	55,2199%	20,9054%	2,1118	26,1224%	2
	2009	150,0448%	49,1700%	2,8325	90,9076%	28,7603%	2,7863	44,5783%	4
	2010	3,1207%	3,8268%	-1,3404	3,9660%	0,0000%	-	6,0484%	1
	<b>Overall</b>	<b>121,5907%</b>	<b>54,5482%</b>	<b>1,4849</b>	<b>141,0852%</b>	<b>22,6879%</b>	<b>4,4293</b>	<b>22,2222%</b>	<b>8</b>
PLZL	2007	-6,0825%	9,2492%	-1,7929	0,5699%	2,6171%	-3,7944	9,2742%	2
	2008	-34,1596%	32,0253%	-1,4124	80,4280%	38,5094%	1,8010	62,0408%	3
	2009	102,1684%	26,7687%	3,4143	61,9920%	19,9393%	2,5688	47,3896%	6
	2010	18,1122%	8,7518%	1,1269	23,7571%	14,3351%	1,0818	61,2903%	6
	<b>Overall</b>	<b>80,0384%</b>	<b>40,7670%</b>	<b>0,9676</b>	<b>166,7470%</b>	<b>20,6420%</b>	<b>6,1115</b>	<b>44,9495%</b>	<b>17</b>
RTKM	2007	45,4005%	10,7438%	3,2484	-12,1603%	4,1507%	-5,4594	44,3548%	5
	2008	-9,2062%	12,4784%	-1,6250	17,5610%	0,0000%	-	7,3469%	1
	2009	-46,0000%	24,1680%	-2,3491	118,2057%	41,0161%	2,6193	43,3735%	4
	2010	6,7000%	11,7834%	-0,1315	42,2742%	15,9818%	2,1289	47,9839%	3
	<b>Overall</b>	<b>-3,1056%</b>	<b>22,2547%</b>	<b>-1,9636</b>	<b>165,8806%</b>	<b>24,7089%</b>	<b>5,0705</b>	<b>35,8586%</b>	<b>13</b>

Let's start with first screen of our analysis and compare total values of each stock for multifaceted strategy against holding strategy. It is notable that the strategy proved to be efficient in 9 markets from 10 in comparison with holding strategy. It was evident from return and risk readings as well as from Sharpe ratios. We should drop off SNGS market, since the difference in returns was not substantial and Sharpe ratio was even negative, and comission costs which were not included in net returns must be taken in our mind. But what we can say for sure in favor of this market is that standard deviation was much lower - almost 3 times lower. For additional visual support take a view of the following diagram, where you can spot

the differences in Sharpe ratios between multifaceted strategy and holding strategy within indicated period:

**Figure 23: Differences in Sharpe ratio between multifaceted strategy and holding strategy**



Now, let's compare each year of 9 stocks for second screen of analysis. We see from table above that such stocks as GMKN, GAZP, CHMF, LKOH, PLZL did't let annual negative returns to come in, while ROSN, SBER03, SNGS, TATN, RTKM had one annual negative return for overall period. Thus, total results proved to be stable from year to year. What was more evident that all annual negative returns were made only in 2007 and we know that market was the weakest during that year in comparison with remaining testing period according to table with RS readings. This table was established in previous part of discussion, where such stocks as ROSN, SBER03, SNGS, TATN were not in the leaders according to RS rank and only RTKM was 3-rd. Also, in 8 cases from 10, specifically in GMKN, PLZL, TATN, SNGS, LKOH, SBER03, GAZP, ROSN, the year 2010 was the poorest according to positive returns, and we acknowledged from previous discussion that this year was not a strong trending time for overall market. Now, concerning individual stocks, we can see that timing strategy in GMKN market proved to be efficient and this is evident from all years. If there were any doubts, when for instance return was better in one strategy, but risk was lower in another, then Sharpe ratios were compared. Such stocks as RTKM, LKOH, GAZP showed superior performance for timing strategy against holding strategy during three years. Implementation of timing strategy in PLZL, TATN, SBER03, ROSN markets allowed to beat holding strategy during two years and in CHMF market only during one year. Therefore,

stable dynamics of results and superior performance for GMKN, GAZP, LKOH, RTKM, PLZL, TATN, SBER03, ROSN proved to claim that multifaceted strategy was efficient in these markets. However, we can not say that it was efficient for CHMF, even that total values were higher for timing strategy. To confirm this point of view, concerning overall effectiveness of this system, let's conduct a test of significance, as we did in case with 2 SMA strategy. In this test, since we have a sample consisting of more than 30 observations, I can rely on properties of central limit theorem, according to which as the number of discrete events increases, the function begin to resemble a normal (Lauvsnes, spring 2010). You can spot the results in the table below:

*Table 17: Test of Significance for Multifaceted strategy<sup>21</sup>*

<b>Hypothesis Test (One-Sample)</b>	<b>Multifaceted strategy</b>
<b>Sample Size</b>	36
<b>Sample Mean</b>	1,392
<b>Sample Std Dev</b>	3,938
<b>Hypothesized Mean</b>	0
<b>Alternative Hypothesis</b>	> 0
<b>Standard Error of Mean</b>	0,656277645
<b>Degrees of Freedom</b>	35
<b>t-Test Statistic</b>	2,1207
<b>p-Value</b>	0,0206
<b>Null Hypoth. at 10% Significance</b>	Reject
<b>Null Hypoth. at 5% Significance</b>	Reject
<b>Null Hypoth. at 1% Significance</b>	Don't Reject

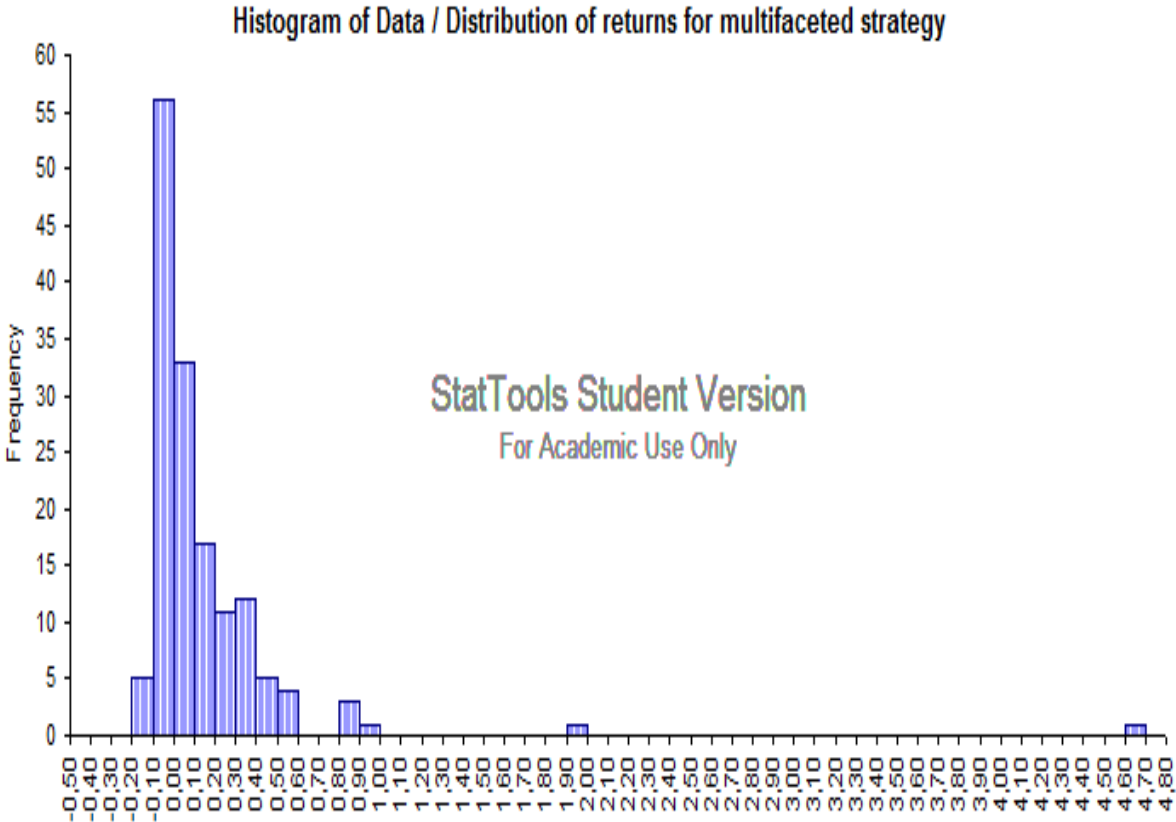
As you can see from this table, low p-value rejects null hypothesis, indicating that our result is significantly different from zero. But we should remember that with ten stocks and four years, a statistically significant difference may pop up as a coincidence, just because there are many (36) cases. Therefore, we should try to decrease the chance of making type 1 error, when we reject the null, while in reality it is true. But we also should not forget about making type 2 error, when it is more likely to incorrectly not reject. So, there should be a kind

<sup>21</sup> Results are provided with use of StatTools 1.1 for Excel.

of trade off between these two types of errors. In practice, up to certain level, type 1 errors are usually considered more serious and hence a smaller size of test is usually chosen. It implies that 5% of significance is most common. It tells to reject the null hypothesis, which confirms the point of view that overall effectiveness of this system is rather high.

Now, let continue to overview overall performance of this system and establish the histogram, which enables to help us in understanding the main limitations and advantages of this system. Thus, the distribution of returns is presented below:

**Figure 24: Histogram of data for Multifaceted strategy<sup>22</sup>**



**Table 18: Distribution of returns for Multifaceted strategy<sup>23</sup>**

<b>Distribution of returns for Multifaceted strategy</b>						
<i><b>Histogram</b></i>	<b>Bin Min</b>	<b>Bin Max</b>	<b>Bin Midpoint</b>	<b>Freq.</b>	<b>Rel. Freq.</b>	<b>Rank</b>
<b>Bin #4</b>	-0,2000	-0,1000	-0,1500	5	0,0336	6
<b>Bin #5</b>	-0,1000	0,0000	-0,0500	56	0,3758	1

<sup>22</sup> Results are provided with use of StatTools 1.1 for Excel.  
<sup>23</sup> Results are provided with use of StatTools 1.1 for Excel.

<b>Bin #6</b>	0,0000	0,1000	0,0500	33	0,2215	<b>2</b>
<b>Bin #7</b>	0,1000	0,2000	0,1500	17	0,1141	<b>3</b>
<b>Bin #8</b>	0,2000	0,3000	0,2500	11	0,0738	5
<b>Bin #9</b>	0,3000	0,4000	0,3500	12	0,0805	4
<b>Bin #10</b>	0,4000	0,5000	0,4500	5	0,0336	6
<b>Bin #11</b>	0,5000	0,6000	0,5500	4	0,0268	7
<b>Bin #14</b>	0,8000	0,9000	0,8500	3	0,0201	8
<b>Bin #15</b>	0,9000	1,0000	0,9500	1	0,0067	9
<b>Bin #25</b>	1,9000	2,0000	1,9500	1	0,0067	9
<b>Bin #52</b>	4,6000	4,7000	4,6500	1	0,0067	9

Thus, one of the main advantages of this system is that multifaceted strategy allows us to cut the left tail of distribution, and by doing so, eliminates too negative returns and at the same time decreases the relative share of them. It is evident from table above, that 37,58% of trades are located within interval from 0% to -10% and only 3,36% are located within border from -10% to -20% afterwards we have no more negative returns. This can be explained by more rational and superior risk control policy. In addition it is notable that the system increases the relative share of positive returns, especially returns which are equal or above 10%. While it is only 22,15% of returns within interval from 0% to 10%, all remaining share or 36,81% is attributed to returns which equal or higher to 10%. It may mean that detection of every important tide is highly probable due to overview of weekly charts and daily charts with powerful technical gauges and in this case is more superior in comparison with 2 SMA strategy.

Second, is that overall number of trades decreased substantially which means that imposed commission costs are much lower in comparison with 2 SMA strategy, while % of time in the market for multifaceted strategy was not downgraded significantly, which helped to be during many important movements and earn relatively high returns.

As with 2 SMA strategy, human emotion and participation are minimized here, but perhaps due to complexity of this system the desired effect is lower. Good discipline is also achieved, since you have to follow mechanical signals.



Futhermore, according to my observations the MACD proved to be most effective in wide-swinging trading markets as theory suggests, but produced false signals during narrow-swinging markets.

Now, let's switch to negative aspects. This system is complex, therefore sometimes there were difficulties in accepting decisions, especially in the question which MACD to use, when readings of some trend indicators were vague, while other indicators confirmed necessary trend. This can also lead to more subjective results than in 2 SMA strategy's case. It was also witnessed that RSI and Stochastics gauges were not optimized, because there was inabilities to satisfy the conditions of their application. Therefore during particular range market movements (when weekly ADX was below 20), there were only few accidents of using them. So it is impossible to judge these indicators as well as Bollinger Bands, since there were only 2 usings of it. Moreover, there were problems with risk control, when you have to exit the market due to stop loss, even if it was relatively small, but the movement was still confirmed by indicators and was continued. In addition optimization process is also desired for MACD and ADX gauges, even though they proved to behave rather stable but still sometimes gave whipsawed signals. There were also observations when daily MACD determined reverse of daily chart and strong movement was followed by that, however weekly ADX was weak at the moment of MACD signal, which created inability of its using. So, there is a trade off – a risky participation in the first wave of movement with ability to earn substantial rates of return, or waiting for weekly confirmation of ADX and more reliably get on board with second wave, but earn less return as system suggests. Moreover, there were unprofitable periods for MACD during narrow-swinging trading markets.

However, the main failure of this strategy was inability to check whether it would work during horizontal markets due to poorly optimized parameters such as RSI and Stochastics. MACD and SMA were always used when ADX gave its signal, so these gauges were tested during weak, medium and strong trends, and proved to behave rather stable, but this combination was never tested versus range-following markets, since it was a job for RSI and Stochastics. It indicates that system is still trend-following.

Now, let's summarize previous discussion and establish main advantages and disadvantages of this system:

Advantages of multifaceted strategy:

1. Human emotion and participation are minimized
2. Good discipline is achieved
3. Participation is virtually guaranteed in the direction of every important trend

4. Losses are minimized much better than in 2 SMA case due to better risk control.
5. Better ability to capture the beginning/end of big movements in comparison with 2 SMA strategy
6. Overall effectiveness is high enough, since the strategy proved to be efficient in 8 markets out of 10.
7. Less trades are done, imposing less commission costs.

Disadvantages of multifaceted strategy:

1. System is more complex for implementation, therefore decisions sometimes in contradiction.
2. Less consistency is possible in comparison with 2 SMA crossovers strategy due to complexity of this system.
3. Partial inability of standardized periods for MACD to be more precise. From time to time they confirm wrong movements. But it is less evident than with 2 SMA crossovers strategy.
4. RSI and Stochastics are not optimized, therefore inability to trade profitably during range-trading markets.
5. Risk control is not enough optimized, therefore accidents of missing big movements are detected, while you exit a trade earlier due to established stop losses, even if losses are relatively small at the moment of exit.
6. System is still trend-following.
7. Accidents are detected when daily MACD spotted trend's reverse on daily chart and strong movement started, while weekly ADX was very weak in order to satisfy the condition of MACD using.

### **Conclusion**

First of all the purpose of a science to be objective as much as possible, therefore technical indicators were chosen as basis for modelling trading strategies, since according to theory they concerned to be objective methods of measurement. It should be noted that it does not necessary make them more advantageous or prosperous in using, but results of higher consistency may be demonstrated.

There are a lot of different reasonable combinations which can be formed from technical indicators/oscillators, but not all of them can be successfully implemented. This research thoroughly investigated theory concerning technical analysis from which we were also acknowledged that liquidity is crucial demand for its prosperous using, and afterwards we

tested two possible combinations on the most liquid Russian stocks. Concerning 2 SMA strategy, we can state that overall efficiency of this system was rather low, which can be confirmed by analysis part. It can be concluded that there were 2 main reasons of its failure:

- Different markets are not enough sensible to standardized periods of simple moving averages. Therefore optimization process for these periods is strictly required;
- Simple moving average crossovers is strongly a trend-following strategy but it is also assumed to be a continuous strategy, therefore it participates almost in every movement, even during weak markets, imposing inevitable and multiple losses. Reasonable question arises here: will you have enough deposit's funds to cover all these losses, before gaining in strong movements?

Regarding multifaceted strategy we can conclude that overall effectiveness was rather high and it was confirmed during analysis discussion. However, a caution should be demonstrated here. First of all, test of significance can lead us to mislead results and threat to internal validity, since if we apply 1% size of the test, thereby reducing the chance to falsely reject the hypothesis, but at the same time increasing to incorrectly not reject - we will not reject the null hypothesis. Furthermore, assumption of normally distributed returns may lead to distorted results, since there may be not enough number of returns obtained from this strategy per year to satisfy the properties of central limit theorem, which can also be a threat to internal validity. Moreover, the higher complexity of this system in comparison with 2 SMA strategy can create a threat to reliability issue, since it may be not easy for another researcher to replicate the original research and come up with same results.

The very serious problem was inability to check whether oscillators, such as RSI and Stochastics would work during weak range-trading markets. Therefore, the periods for these indicators require optimization process. However, the decision of choosing MACD was not accidental due to its flexibility issues that in theory it can be gainfully implemented during trending and range-trading periods. Therefore, it helped not only during strong trends but also during weak trends, when ADX readings were still high enough. Unfortunately, I did not find the previous empirical evidence regarding successful implementation of MACD alone.

Rather high performance of this system on chosen stocks does not necessarily indicate that its results may be successfully extrapolated on other stocks. However, it is more probable that it can be successfully implemented on remaining stocks with high liquidity, than on stocks with low liquidity issues.

Thus, when we are speaking that system is efficient, it implies that we can model and perform trading strategy based on technical analysis and earn abnormal return against performance of holding strategy, which in fact indicates that Russian stock market is not efficient and you can use past stock prices in your analysis to adequately estimate the current situation and trade gainfully. Although the strategy seems to be profitable, it is possible that a more complete accounting of the costs (including commission costs and the impact of bid-ask spreads) will reveal that the strategy is less profitable but still can be efficient. Hence evaluating investment systems will not always provide unambiguous answers to their potential usefulness.

“Technical analysis is much more than “tea leaf reading” or “crystal ball gazing,” descriptions sometimes used by those who simply do not know any better. But neither is it the “Holy Grail,” promising instant riches to practitioners. Technical analysis is simply one approach to market forecasting based on a study of the past, human psychology, and the law of probabilities. It is certainly not infallible. But it is a technique that works more often than not, has stood the test of time in the real world of trading...” (Murphy, 1986, p. xviii). However, very complex but critical question is whether there is reason to believe that what worked in the past should continue to work in the future.

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## Appendixes

### Appendix 1: Stocks included in MICEX index<sup>24</sup>

No	Ticker	Security	FreeFloat Factor	Weight Factor	Issue Size Outstanding	Issue Size Index	Capitalization	Weight
1	GAZP	Gazprom	0.4600	0.4949	23,673,512,900	5,389,369,905	5,050,980,712,344	16.32%
2	LKOH	LUKOIL	0.8500	0.7541	850,563,255	545,198,288	1,671,356,796,075	15.21%
3	SBER	Sberbank	0.3900	1	21,586,948,000	8,418,909,720	2,217,627,168,040	12.28%
4	GMKN	NorNickel GMK	0.4800	1	190,627,747	91,501,318	1,418,748,913,325	9.67%
5	ROSN	Rosneft	0.1500	1	10,598,177,817	1,589,726,672	2,726,911,152,314	5.81%
6	NOTK	NOVATEK	0.3600	1	3,036,306,000	1,093,070,160	989,835,756,000	5.06%
7	TATN	Tatneft-3	0.6700	1	2,178,690,700	1,459,722,769	379,048,607,986	3.61%
8	SNGS	Surgut	0.2100	1	35,725,994,705	7,502,458,888	1,193,248,223,147	3.56%
9	MTSI	MTS	0.5000	1	1,993,326,138	996,663,069	496,916,272,942	3.53%
10	CHMF	Severstal - ao	0.4000	1	1,007,701,355	403,080,542	545,680,360,746	3.10%
11	URKA	Uralkaliy	0.3400	1	2,124,390,000	722,292,600	488,737,163,400	2.36%
12	HYDR	RusGidro 038D, RusGidro	0.3800	1	288,695,430,802	109,704,263,7 04	435,930,100,511	2.35%
13	PLZL	Polus Zoloto	0.5000	1	190,627,747	95,313,873	327,643,346,434	2.33%
14	VTBR	VTB	0.1400	1	10,460,541,337, 338	1,464,475,787, 227	1,069,067,324,676	2.12%
15	NLMK	NLMK ao	0.1500	1	5,993,227,240	898,984,086	815,558,362,819	1.74%
16	FEES	FSK EES	0.2200	1	1,233,561,333,5 52	271,383,493,3 81	534,132,057,428	1.67%
17	SNGSP	Surgut- pref	0.7000	1	7,701,998,235	5,391,398,764	137,010,846,602	1.36%
18	PMTL	Polymetal	0.4600	1	399,375,000	183,712,500	204,080,625,000	1.33%
19	MRKH	Holding MRSK ao	0.3400	1	41,041,753,984	13,954,196,35 4	224,908,811,832	1.09%
20	SBERP	Sberbank (pref)	0.9200	1	1,000,000,000	920,000,000	71,400,000,000	0.93%
21	TRNFP	Transneft (pref)	0.9800	1	1,554,875	1,523,777	61,395,949,738	0.85%
22	MAGN	MMK	0.1200	1	11,174,330,000	1,340,919,600	386,631,818,000	0.66%
23	IRAO	INTER RAO EES 001D ao, INTER RAO EES ao	0.2800	1	2,893,027,370,2 29	810,047,663,6 64	133,368,561,768	0.53%
24	RASP	Raspadska ya	0.2000	1	780,799,808	156,159,961	179,943,123,752	0.51%
25	SIBN	Gazprom neft	0.0500	1	4,741,299,639	237,064,981	648,277,899,640	0.46%

<sup>24</sup> <http://www.micex.com/marketdata/indices/shares/composite#&index=MICEXINDEXCF>



26	URSI	UralSvyazinform	0.4900	1	32,298,782,020	15,826,403,189	51,807,246,360	0.36%
27	MSNG	MosEnrg	0.2000	1	39,749,359,700	7,949,871,940	122,507,526,595	0.35%
28	RTKM	Rostelecom	0.1900	1	728,696,320	138,452,300	121,692,285,440	0.33%
29	AFLT	Aeroflot	0.2300	1	1,110,616,299	255,441,748	86,661,389,811	0.28%
30	OGKC	OGK-3	0.2500	1	47,487,999,252	11,871,999,813	73,131,518,848	0.26%

## Appendix 2: Risk free rates

(Central Bank of Russia, 2011)<sup>25</sup>

Item	2007	2008	2009	2010
Risk free rate	10,5000%	11,0714%	10,7727%	8,2500%

<sup>25</sup> Rates are taken as average discount rates per year