

**T.C. KOCAELİ ÜNİVERSİTESİ
SOSYAL BİLİMLER ENSTİTÜSÜ
İŞLETME ANABİLİM DALI
MUHASEBE VE FİNANSMAN BİLİM DALI**

**AN APPLICATION ON INTERNATIONAL PORTFOLIO
DIVERSIFICATION**

MASTER THESIS

NONA SHARADZE

KOCAELI, 2019

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ASSOC. PROF. HAKAN KAPUCU

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ABSTRACT

In this work, fundamental and technical analysis models are used to evaluate an International Index Portfolio. The index portfolios are diversified by Black-Litterman model. The key point in Black-Litterman model is estimating individual investor's views. In this work, Capital Asset Pricing Model and Technical Analysis Techniques estimate the investor's views. This work aims to determine, if using CAPM derived investor's views in the Black-Litterman model is preferred technique or using technical analysis derived investor's view. For this purpose, 10 international indices monthly portfolio performances are examined. The research is done separately every month from January until December in 2018 year; accordingly, 12 separated portfolios are evaluated. This work consists of introduction, the main text, conclusion and appendix. The main text is divided into four parts. First part is an introduction to the portfolio theory, which reviews the many concepts and theories for portfolio management and investment analysis. Second part gives detailed explanation about Black-Litterman Model and defines how to combine the mathematical model with personal investor's views in portfolio optimization process. Third part is an introduction of technical analysis and its techniques such as Elliot Wave Principle, Fibonacci Sequences, Volume, Trend, Volatility Indicators and Patterns. Finally, those techniques and methodologies evaluated in the fourth part.

Keywords: Fundamental Analysis, Technical Analysis, Black-Litterman Model, Technical Analysis Indicators, Technical Analysis Patterns, Elliot Wave Principle, Fibonacci Sequences.

ÖZET

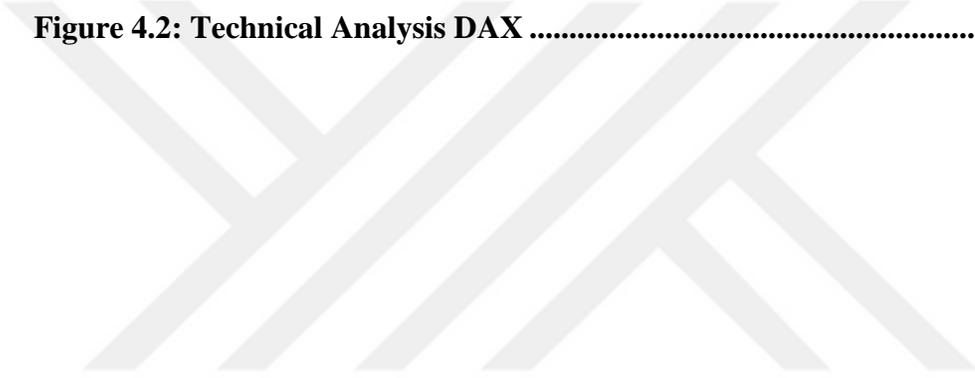
Bu çalışmada Uluslararası Endeks Portföyünü değerlendirmek için temel ve teknik analiz modelleri kullanılmıştır. Endeks portföyleri, Black-Litterman modeli ile çeşitlendirilmiştir. Black-Litterman modelindeki asıl amacı, bireysel yatırımcının görüşlerini tahmin etmektir. Bu çalışmada, yatırımcıların görüşleri, Sermaye Varlığı Fiyatlandırma Modeli ve Teknik Analiz Teknikleri ile tahmin edilmiştir. Bu çalışma, Black-Litterman modelinde, Sermaye Varlığı Fiyatlandırma modelinden türetilen bireysel yatırımcının görüşlerini yoksa teknik analizden türetilmiş bireysel yatırımcının görüşlerini mi tercih edilen bir tekniktir belirlemeyi amaçlamaktadır. Bu amaçla 10 uluslararası endeks aylık portföy performansı incelenmiştir. Dolayısıyla 12 adet portföy değerlendirilmiştir. Bu çalışma, giriş ve sonuç bölümü hariç dört bölümden oluşmaktadır. Birinci bölümde, portföy teorisine giriş, yatırım analizi ve portföy yönetiminin temel kavramları ve teorilerine yer verilmiştir. İkinci bölümde ise, Black-Litterman Modeli açıklanmakta ve portföy optimizasyon yönteminde yatırımcının bireysel görüşlerinin matematiksel modelleme yoluyla nasıl portfoye seçimine uyarlanabileceğine ilişkin detaylı bilgiler sunulmuştur. Üçüncü bölümde, teknik analize giriş ve teknik analiz araçlarından Elliot Dalga Kuramı ve Fibonacci Serisi ile teknik analiz göstergeleri tanıtılmıştır. Dördüncü ve son bölümde ise, çalışmanın uygulaması yer almaktadır.

Anahtar Kelimeleri: Temel Analiz, Teknik Analiz, Black-Litterman Model, Elliot Dalga Teorisi, Fibonacci Serisi, Finansal Piyasalar.

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ABBREVIATIONS

ABI - Absolute Breadth Index	49
APT- Arbitrage Pricing Model	17
B-L- Black-Litterman Model	26
CAPM- Capital Asset Pricing Model	13
CCI- Commodity Channel Index.....	50
CML- Capital Market Line.....	14
EMA- Exponential Moving Average	48
EMH- Efficient Markets Hypothesis.....	19
IDC- Indeference Curve	11
MA- Moving Average	48
MACD- Moving Average Convergence Divergence	49
MFI- Money Flow Index.....	52
NVI- Negative Volume Index	52
OBV- ON Balance Volume	52
P/E- Price Earnings Retio.....	20
PVI- Positive Volume Index	52
RSI- Relative Strength Index	49
SMA- Simple Moving Average	48
SML- Security Marekt Line.....	16
VAR- Variance of security	7

INTRODUCTION

One of the major concerns in financial literature is to find out the best investment portfolio. Typically, the fundamental and technical analyses are used for the investment decision-making process. Fundamental analysis considers two main methods in portfolio selection, heuristic and quantitative. In heuristic method, asset allocation is made with investor's feeling and views about future performance of the investment and quantitative approaches are done by applying mathematical models. Harry Markowitz provided the main quantitative model of portfolio selection in 1952, which is the foundation of modern portfolio theory. Markowitz developed a quantitative method of asset allocation in portfolio by considering Expected Return and Risk of an investment. Previously, an optimal portfolio was thought as the one, which maximizes just expected return. In his work on portfolio diversification, he developed the Mean-Variance Model, which helps investors to select and construct the most efficient portfolio. This classic Mean-Variance optimal portfolio selection became the foundation of *Modern Portfolio Theory*. Assuming that the investor is risk averse, the best asset allocation is the one that provides the highest return while having minimum risk. Black Fisher and Litterman Robert provided first model that combined heuristic approach to the quantitative approach of portfolio selection. This model uses the mathematical model of portfolio selection such as Markowitz Mean- Variance and Capital Asset Pricing Models and assembling it with investor's personal views.

A technical analysis considers that security prices are determined by the supply of and demand for securities. Technical analysts rely heavily upon the usage of charts. Technical analysts look market prices of security, record historical financial data on charts, study those charts in search of patterns that they find meaningful and use the patterns to predict future prices. One of the widely used techniques in technical analysis is Elliot Wave Principle. Under the theory of the Elliot Wave Principle, every market has a law of its own. Every decision made in market produces meaningful information

and it is itself production of meaningful information. Every price movement in the market reflects a structural progression. This progression is formed is unfolded in waves. Sometimes market appears to reflect outside event, but most of times it follows its own rules and folds every market movement into wave formation. For this concept, the waves are patterns that show directional movement of prices. Typically, they believe that past patterns of security prices will repeat in the future and therefore those patterns can be useful for predictive purpose.

Fundamental analysis is useful to determine which security to buy, while technical analysis determines when to buy a security. The best way of increasing the profitability in the uncertain and unpredicted market is to find the best combination of fundamental method of market analysis and technical analysis aspects of trading. The combination of both technical and fundamental studies not only increases knowledge but also can boost investor's confidence.



CHAPTER I

1 INTRODUCTION TO PORTFOLIO THEORY

1.1 PORTFOLIO SELECTION

One of the major concerns in financial literature is to find out the best investment portfolio. Fundamentally, there are two methods in portfolio selection, heuristic and quantitative. In heuristic method, asset allocation is made just with investor's feeling and point of views about future performance of the investment that he or she collected from the news and media. On the other hand, portfolio selection process can be done by quantitative approaches with applying mathematical models. Harry Markowitz provided the main quantitative model of Portfolio Selection in 1952, which is genesis of Modern Portfolio Theory. Markowitz developed a quantitative method to help investment managers to find out optimum weight of assets in portfolio by considering Expected Return and Risk of an investment. Previously, an optimal portfolio was thought as the one that maximizes expected return. This classic Mean-Variance optimal portfolio selection became the foundation of Modern Portfolio Theory. Assuming that the investor is risk averse, the best asset allocation is the one that provides the highest return while having minimum risk. (Francis J.K. & K. Dongcheol, 2013, pp. 20-22)

Asset allocation is a complex process for couple of reasons: great number of opportunities to invest in and inability to prognosticate the future. Investment is always a risky concept. Initial Investment is made for certain amount of money, but it is never certain about value of return in future. Furthermore, it is impossible to forecast future financial and economic events with certainty. These problems make it difficult to have optimum and certain asset allocation. (Francis J.K. & K. Dongcheol, 2013, pp. 23-25)

1.1.1 Portfolio Diversification

One of the most important concepts of Markowitz asset allocation model is diversification. This approach indicates effectiveness of diversification in reducing The Portfolio Risk. Increasing the size of portfolio is reason of decreasing the portfolio risk. The principle here relates to minimizing total risk of portfolio, it means that, investors can minimize total risk, by sufficient numbers of securities with zero correlation in the portfolio. Hence, diversification can be effective in reducing total risk; eliminating risk entirely through diversification is not possible. This is because of one component of total risk is market related. The market related risk is referred as symmetric risk. The symmetric risk cannot be diversified and it affects all securities. Large portfolios are highly correlated with the market risk; it means that market related risk increases as proportion of the portfolio risk and the size of portfolio increase. Risk that is called as diversifiable or unsymmetrical risk is unexplained by the market. Thus, the total risk includes two types of risks: symmetric (market related) and Non-symmetrical (unexplained by market) risks. Consequently, well-diversified portfolio is correlated with the market and portfolio analysts are exposed to market uncertainty no matter how many stocks they hold. (Norton E.& F. Reilly , 1995, p. 147)

Markowitz declares that, any investor behavior that does not intend portfolio diversification is not acceptable. This is a rule of investor behavior no matter what future returns are expected or how discount rates are selected. He concludes that Markowitz asset allocation model and the concept of portfolio diversification, actually implies the right kind of diversification for the right reason. He purposes that according to reduce the portfolio variance, it is not enough to invest in many securities. It is important to diversify across securities with low covariance. (Markowitz, 1999, p. 5)

1.1.2 Expected Return of Portfolio

A portfolio is described by the list of individual securities as well as the weighted proportions of each security in the portfolio. If securities in portfolio are described as x_i ,

x_1, \dots, x_n and relatively weight of securities in portfolio is w_1, w_2, \dots, w_n , then, Calculation of the expected return for an aggregate portfolio of the securities is relatively easy. It is simply, the weighted average of the expected returns of individual securities. (Farrell, 1997, pp. 64-65)

$$\text{Average Return- } E(x) = \mu = \frac{1}{n} \sum_{i=1}^n x_i$$

$$\text{Where, } \sum_{i=1}^n w_i = 1$$

Where: w_i - represents security's proportion of the portfolio, $E(x)$ represents the expected return of the security; **the Portfolio Expected Return R_p** is calculated as follow: (Farrell, 1997, p. 65)

$$\text{Expected Return of Portfolio } R_p = w_1 E(x_1) + w_2 E(x_2) = \sum_{i=1}^n w_i E(x_i)$$

Thus, **the Portfolio Expected Return R_p** is the weighted average of the securities expected returns in the portfolio.

1.1.3 Portfolio Risk

Although there is a difference in the specific definitions of risk and uncertainty, most of the financial literatures use these two terms interchangeably, in fact one way to define risk is as the uncertainty of future outcomes. The second main accept in portfolio management is uncertainty of future outcome of securities. So far, assessing the risk that may be associated with earning the return is also important. The variance and standard deviation are statistical measures for the uncertainty or **Risk of the Expected Return**. Standard deviation is square root of variance. The standard deviation also measures the variability of the distribution and it is set out in terms of return. (Fettahoğlu, 2016, p. 205)

$$\text{Variance of Return} - \text{var}(R) = \sigma^2 = \frac{1}{n} \sum_{i=1}^n (X_i - \mu)^2$$

$$\text{Standard Deviation of Return} - S = \sigma = \sqrt{\text{Var}(R)}$$

Thus, standard deviation and variance solely measure the riskiness of each security in portfolio; in this case, it is also important to consider riskiness of a security within the context of an overall portfolio of securities. In other words, there is need to define relationship of a security to other existing securities in the portfolio and its contribution the overall risk of a portfolio. **Covariance** is a statistical model that measures the riskiness of a security relative to others in portfolio securities. Thus, the way securities are related to each other affects the overall risk of portfolio. If covariance of portfolio takes negative value it means that, the deviation of securities is merely opposite and otherwise if it is positive value then deviation is the same direction. (Fettahoğlu, 2016, p. 207)

$$\text{Covariance} - cov(i, j) = \frac{1}{n} \sum_{i,j=1}^n (X_i - \mu_i)(x_j - \mu_j)$$

The covariance is difficult to clarify, so standardize the covariance by statistical measurement “**Correlation Coefficient**” is therefore useful. Calculation of correlation coefficient is simple; covariance of securities is divided by the standard deviation of each security. It is scaled to a range of -1 to +1. (Fettahoğlu, 2016, p. 105)

$$\text{Correlation Coefficient} - \rho_{i,j} = \frac{cov(i,j)}{\sigma_x \sigma_y}$$

In General, negative correlation is desired in portfolio. If correlation coefficient is -1, the two securities are perfectly negatively correlated and this indicates that because the two securities move opposite to each other. Such securities have a great power of risk reduction in a set of portfolio. So far, the variance or risk of portfolio is not as simple as weighted average of the variances of individual securities in the portfolio, it is also necessary to consider the relationship between each security in the portfolio, as it is measured by covariance of return. Using: $VAR (R_i)$ - Variance of each security, $COV (R_i R_j)$ -covariance of portfolio to represent covariance between two securities, w_i - proportion that each security in the portfolio, The calculation of portfolio variance

$VAR(R_p)$ is as follow: (Reilly, Investment Analysis and Portfolio Management, 1989, p. 242)

$$VAR(R_p) = w_i^2 VAR(R_i) + w_j^2 VAR(R_j) + 2 w_i w_j Cov(R_i R_j)$$

$$\text{Whereas: } Cov(R_i R_j) = \rho_{ij} \sigma_x \sigma_y$$

In such case, the higher correlation between two securities shows higher covariance and as a result higher risk of the overall portfolio. Conversely, the lower correlation shows lower risk of portfolio. (Reilly, Investment Analysis and Portfolio Management, 1989, p. 243)

$$\text{Variance of Portfolio } VAR(R_p) = w_i^2 VAR(R_i) + w_j^2 VAR(R_j) + 2 w_i w_j \rho_{ij} \sigma_x \sigma_y$$

Although, there are numerous potential measure of risk, variance and stranded deviation of risk is widely recognized risk measurement technique and it has been used in most of the theoretical asset allocation models. (Reilly, Investment Analysis and Portfolio Management, 1989, p. 243)

1.2 TRADITIONAL PORTFOLIO THEORY

Markowitz Mean -Variance model became fundament of modern portfolio theory. Priors of Markowitz believed that the best asset allocation provides a portfolio that maximizes expected returns. Methodology review before Markowitz Theory can be presented as below:

Economist Adam Smith studied, two main economic decisions: First, how to choose a right way to allocate consumption among commodities and services, Second, how to invest among various assets. He declared that a consumer would choose goods and services that offer the greatest marginal utility relative to price. (Constantinides G.& A.Mallirias , 1995, p. 2)

In 20th, Neoclassical Economists developed a theory of consumer behavior. According to this theory, every consumer's action on the perfect competition market has an important impact on market pricing. Thus, consumer behavior is a certain part of analyzing of market pricing under perfect completion and certainty. Although Portfolio asset allocation and neoclassical economists' decisions are interrelated, they require substantially different methodologies. (Constantinides G.& A.Mallirias , 1995, p. 3)

First, Irving Fisher (1906) described asset returns in terms of a probability distribution. The probabilistic notions of expected return and risk became very important concept in portfolio selection. Marschak (1938) attempted to express preferences for investment by indifference curves in the mean-variance space, but concepts of expected return and risk was not fully integrated. Neumann & Morgenstern (1947) offered the methodological breakthrough of treating axiomatically the theory of choice under uncertainty and it was only a few years later that Markowitz (1952, 1959) and Tobin (1958), used this theory to formulate and solve the portfolio selection problem. Markowitz discredit widely accepted principle that an investor chooses a portfolio by selecting securities that maximize expected returns. (Constantinides G.& A.Mallirias , 1995, p. 7)

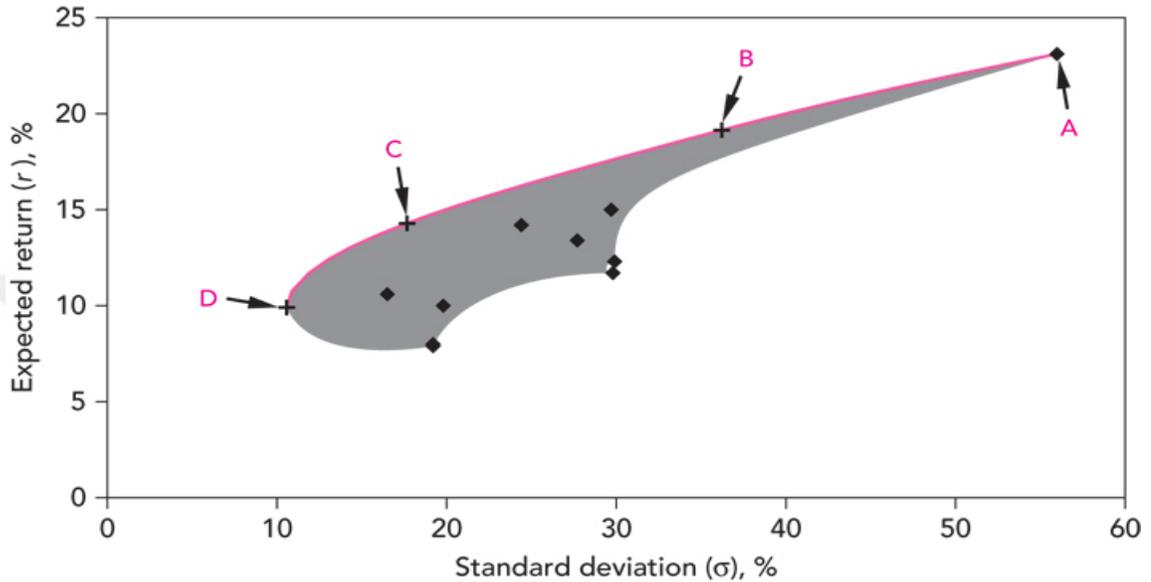
1.3 MODERN PORTFOLIO THEORY

In contemporary history of finance, Markowitz's work plays a significant role in the portfolio management. The Modern Portfolio Theory mainly stands on four main concepts: Risk and Return of portfolio, diversification and concept of risk-aversion. **The expected rate of return:** For the portfolio, investment is the weighted average of the expected rates of return of the individual investments in the portfolio. The weights counted proportionally, as the proportion of the investment's total value. It is very risky, when the portfolio performance and its expected return solely depend on the one asset. Monitoring and measuring risk in portfolio selection is other part of objective function. The financial literature uses definition of Risk and Uncertainty interchangeably, even

though; there is a difference in the specific definitions of **risk** and uncertainty. In reality, if we define the concept of risk, it can be said that, risk is the uncertainty of future outcomes. The best-known measure of risk is the variance, standard deviation of expected return that is used in most of the theoretical Asset Allocation Models. In fact, it is a dispersion of returns round the expected returns, so, simply it is a statistical measure. While all other factors being equal, a larger variance or standard deviation indicates greater dispersion. It means that, more disperse is expected return, the greater the uncertainty of the future returns is. One of the leading concepts in portfolio management is “**Diversification**”, as far as the investment decision-making process is not necessarily just, which securities to buy, but, also it answers the question: how to divide the wealth amongst securities. Diversification declares that “Don’t put all of your eggs in one basket” it leads the portfolio to more constant expected return and acceptable risk. In tradeoff between risk and expected return, if an investor only takes additional risk for additional expected return is called “**Risk Averse**” investor. The modern Portfolio theory assumes that investors are Risk Averse. In other words, between two assets with equal rates of expected return, an investor selects security with the lower level of risk. So far, human investment behavior can be best described, in term of the Risk Aversion concept. (Norton E.& F. Reilly , 1995, pp. 240-245)

The main quantitative model in Modern portfolio theory and Asset allocation model is provided by Harry Markowitz in 1952, which is usually seen as genesis of Modern Portfolio Theory. The fundamental statement of Markowitz approach to portfolio management is that investors are Risk Averse. That means that according to investors’ behavior, they require a higher expected return in order to accept higher risk. In fact, rational investors always choose an efficient portfolio. It means that they select portfolio that maximizes expected return for a given degree of risk or alternatively minimize risk for a given expected returns. Theoretically, the efficient portfolio is identified by proper analysis of each asset’s: expected return, variance and covariance. The covariance is the interrelationship between the returns of each security in the given portfolio. Thus, to operationalize the concept of expected return Markowitz suggested valid premise that all investors want a combination of high returns of low risk. In other

words, investors seek the point of maximum utility, where the highest rate of expected return is suggested for a given risk and the lowest level of risk for a given return. (Reilly, Investment Analysis and Portfolio Management, 1994, pp. 244-250)



Corresponding of risk and expected return is illustrated on the Figure 1.1 Below; the expected return is schemed in the vertical axis and the risk on the horizontal axis. The line ABCD represents the efficient boundary or efficient set of investor's alternatives. The line, which is called an efficient frontier, offers the investors the highest level of return with these degrees of risk and alternatively the lower risk for a given return. (Vaughn D. E. & D. Carroll , 1979, pp. 325-345)

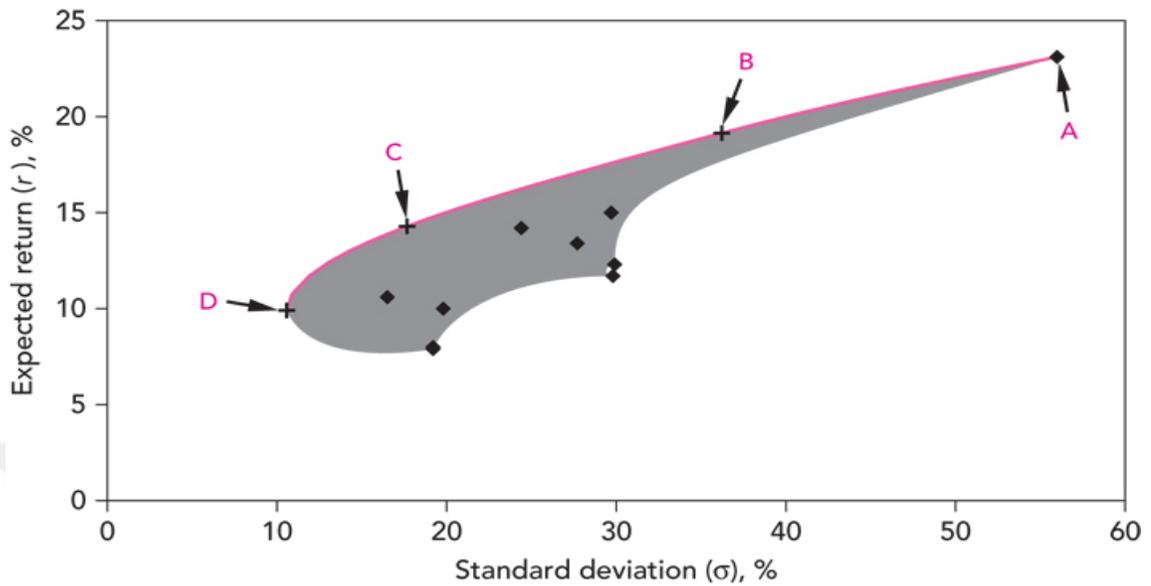


Figure 1.1: Efficient Frontier

Source: Donald E. Vaughn, 1979:325

Investors will select portfolio from efficient frontier according to their Risk Aversion degree. The higher degree risk aversion Investor choses a portfolio with lower risk. At the same time, investor with a higher tolerance for risk selects portfolio with a higher expected return, despite of an associated higher risk of expected return. The selection of portfolio is the process of maximizing the investor's utility. The Risk_Return trade-off is well described by indifference curve. (Elton E.J., M.J. Gruber & S.J. Brown , 2011, p. 150)

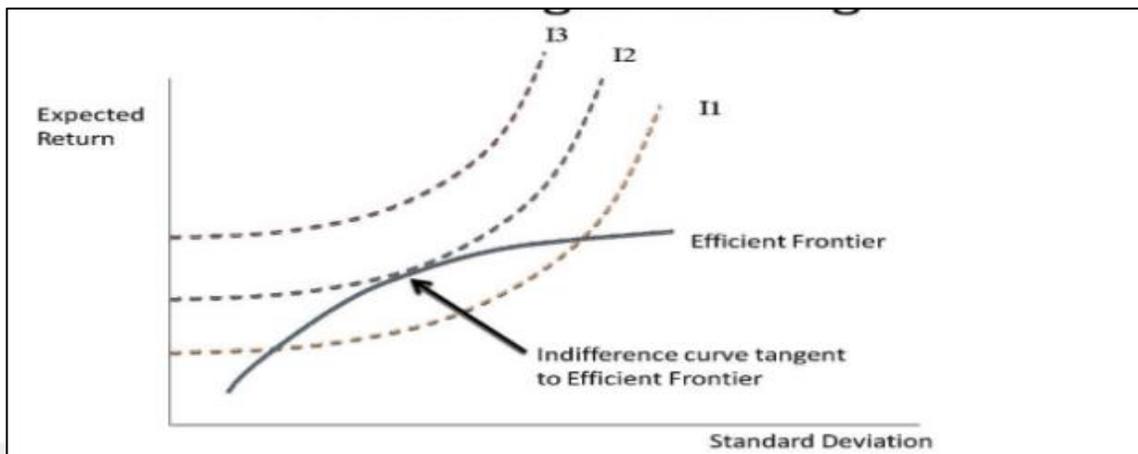


Figure 1.2: Indifference Curve

Source: F.K. Reilly, Edgar. A. Norton, 1995: 147

The indifference curves (IDC) are widely used in the Classical Economic Analysis. They clearly express form of the risk-return trade-off in a mean _variance framework. IDC are presented on Figure 1.2 above and it declares that, along those curves the portfolio analyst is indifferent to the risk-return trade off. The optimal portfolio can be selected, once those indifference curves are known. The tangency of the efficient frontier and indifference curve that is highest in risk-return space is the point where the optimal portfolio exists. Portfolios receive lower value for higher risk and higher utility for higher expected return. In addition, it is considered that, based on the expected return and risk of portfolios each investor can elect a utility rank to contend investment portfolios. (Curley, 1979, pp. 5-10)

Markowitz asset allocation model had a big role in changing the course of investment related notions. Priors of Markowitz deliberated the proper way of constructing an investment portfolio, just by selecting the best securities. It was only the way and the best technique of choosing portfolio and maximizing portfolio expected return. Markowitz demonstrated that the objective of modern portfolio management is to maximize what he called expected utility. The concept of utility is because individuals derive personal satisfaction in different ways and different investors have different

desires. Satisfaction can be synonymous term of the utility. Based on human investment behaviors, each investor prefers combination of investments rely on his or her satisfaction with positive returns relative to his or her distaste for risk. Thus, utility function is as following: (Curley, 1979, pp. 10-13)

$$U = E(R) - \frac{1}{2} A \sigma^2$$

Where: U- Utility Value, A - An Index of the Invertor Risk Aversion.

The coefficient A is zero for Risk Neutral Investor the utility Function, for her/his would be the same as portfolio expected return. Hence, for the more realistic case, as degree of risk aversion increase, the size of A and risk penalty will be greater. (Norton E.& F. Reilly , 1995, pp. 145-164)

Traditionally, weights of individual securities in portfolio were positive or at least no less than zero. It means that selling securities short is restricted, that is called as a non-negativity constraint of individual securities. However, some investors employ short selling as a significant component of the portfolio optimization process as one of the most important investment strategy. Those strategies are the underlying principles for portfolio theory. As a result, investors are allowed to develop a better risk-return combination. (Hagin, 1990, pp. 145-151)

In order to use Markowitz Asset allocation model for portfolio construction, investor must obtain estimates of the returns, variances and covariance of returns for the securities. Thus, for N stock, $2N + [N(N - 1)/2]$ estimates must be obtained. For a two Asset portfolio, five estimates are needed. This number increases by increasing number of Assets, for example, a set of 200 stocks would require 20300 estimates. Hence, the Markowitz Model is the most compressive one; it has found relatively little use in solving practical problems of analyzing large numbers of securities. Mainly because of it requires the large numbers of estimations. (Fettahoğlu, 2016, pp. 250-255)

Markowitz Asset Allocation Model currently plays a dominant role in portfolio management process. However, it has couple of weak points. Firstly, the utility

maximization process of Markowitz is highly sensitive to the input data set. Small change in the estimated returns or volatilities can result drastic changes in the final allocation. Second, mean-variance optimization process results in extreme short sale positions or minus weights. Third, if portfolio weights are plotted between zero and one, majority of securities take the zero weights and only a few will be incorporated in the optimal portfolio. Furthermore, if the parameters estimated correctly, the resulting portfolio weights obviously lead to the highest preference level. (Farrell, 1997, pp. 17-20)

1.4 CAPITAL ASSET PRICING MODEL (CAPM)

Whereas, Markowitz Asset Allocation model is foundation for portfolio analysis, the capital asset pricing model (CAPM) is foundation for **Capital Market Theory**. Solely Sharpe, Linter and Mossion developed the general equilibrium for asset allocation returns. Accordingly, it is often referred as the Sharpe, Linter, and Mossion form of the Capital Asset Pricing model. They take a new concept of risk free investment opportunity, such as short-term governmental securities. As such, it is the pure Risk Free interest rate, this riskless compensation can be thought of as the amount, which the government is willing to pay to rent money. Based on, capital asset pricing model, investors who choose a risk free investment, can expect to be compensated for use of their money, but not for market or company related risk. Other investors, who making for risky investments, logically expect a higher rate of return as compensation for the given risk, Difference between the total return from a risky investment and the risk free rate of return is called “**A Risk Premium**”. The capital asset pricing model provides framework for defining the relationship between Expected Return, Risk and the Risk premium. In CAPM, risk for asset is known as **beta (β)**, which is the market related risk, so far systematic risk. The major application for model is that the expected return of an asset is related to a measure of risk. The precise model and exact manner in which beta and expected rate of return are related is indicated by the capital asset pricing mode (BodieZ., A. Kane & A.J. Marcus, 1998, pp. 228-235) 1

Some of the assumptions behind the capital asset pricing model:

- Investors maximize expected utility and they are Risk Averse.
- Investors select the optimal portfolio accordingly their variance and mean of return.
- Investors have a single time period horizon, which is the same for all investors.
- Investors can borrow and lend at the risk free rate and it is unrestricted.
- All investors can borrow and lend on the same risk free rate.
- Investors are homogenous, that means, their expectations regarding the means, variance and covariance of security returns are homogenous.
- There are no transaction costs, no taxes or any market imperfections.
- Information is freely and instantly available to all investors. (BodieZ., A. Kane & A.J. Marcus, 1998, p. 247)

The CAPM can be portrayed graphically by means of the Capital Market Line (CML). The CML is usually obtained on the assumption that there exists a Risk free asset available for investment. It is assumed that investors can borrow and lend at the riskless rate as much as desire. The risk free rate is referred as (R_f). As a result, all investors have opportunity to obtain portfolio by mixing risk free assets with risky assets and get desired Risk-Return combination. (Farrell, 1997, pp. 54-60)

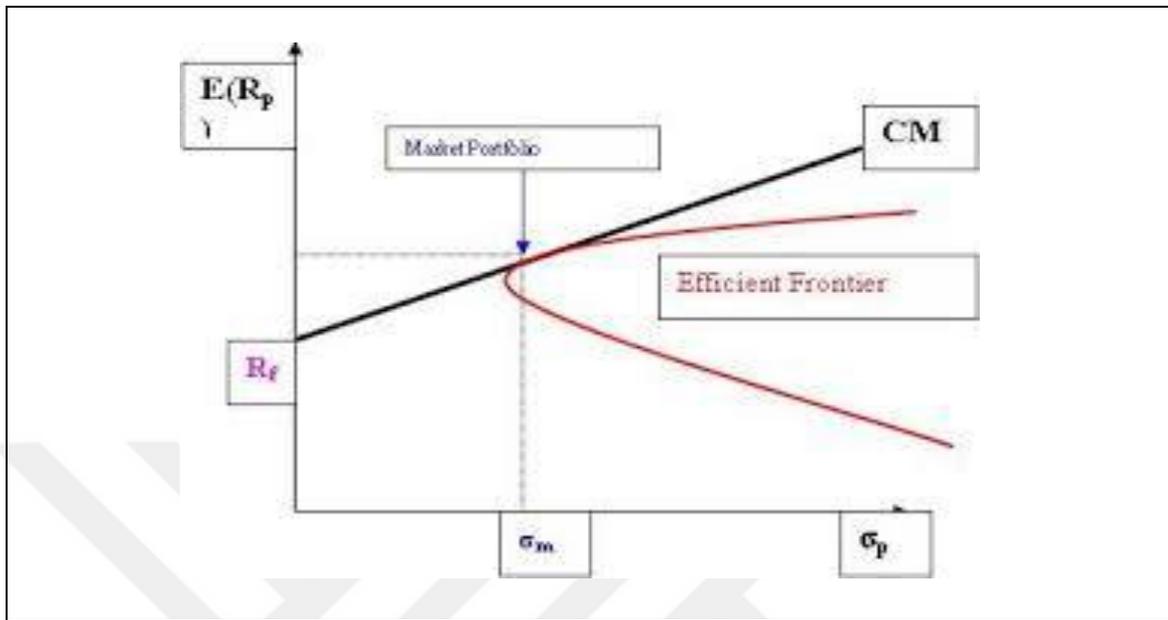


Figure 1.3: Capital Market Line

Source: James L. Farrell Jr, 1997: 54

The capital market line is graphically depicted on Figure 1.3 above, which represents relationship between expected return and risk of portfolio, under framework of capital asset pricing model. The horizontal axis represents the risk and the vertical axis measures the expected return. When risk is zero, the expected return is R_f the riskless rate of interest. The risk of holding the market portfolio resemble with the expected return of the market portfolio $E(R_p)$. The difference between the expected return of the market portfolio $E(R_p)$ and expected riskless rate of return R_f is the risk premium for the market portfolio. The slope of the capital market line can be assumed as the expected reward per unit of risk. (Elton E.J., M.J. Gruber & S.J. Brown , 2011, pp. 279-290)

CML shows the appropriate measure of risk and return relationship for efficient portfolio, but it does not interpret these for inefficient portfolios or individual securities. Sharpe in his work clarifies that analysis can be extended to a related but not identical measure of risk and he takes beta concept for measuring risk that applies to all assets and

portfolios, whether efficient or inefficient. The total risk of asset has two components: systematic and diversified risk. Measure systematic risk of an asset or portfolio can be done as follow: multiply correlation coefficient between the security or portfolio and the market portfolio p_{im} by the standard deviation of the security or portfolio σ_i . The symmetric risk will be equivalent to total risk for perfectly diversified portfolio, because correlation is positive ($p_{im} = +1$). However, the total risk and symmetric risk will not be equivalent for an individual securities or portfolios that are less than perfectly diversified. CAPM can be form as below, by using the definition of the correlation coefficient (Curley, 1979, pp. 458-465)

The CAPM can be referred as:

$$E(R_i) - R_f = \frac{Cov(R_i, R_m)}{var(R_m)} [E(R_m) - (R_f)]$$

It is obvious that coefficient on the right side of this formula is the same as systematic risk- beta (β) of the security. So, that equation can be restated in its more familiar forms as: (Sibel, 2018)

$$E(R_i) = R_f + \beta_i [E(R_m) - (R_f)]$$

It is able to derive the equilibrium relationship for any security or portfolio that can be efficient or inefficient, from the equilibrium relationship for efficient portfolios. This relationship is called the Security Market Line (SML) and is showed on Figure 1.4: Security Market Line below It might be called also the Security Portfolio Market Line, considering that it describes the equilibrium return on all portfolios, as well as all securities (Curley, 1979, pp. 447-450)

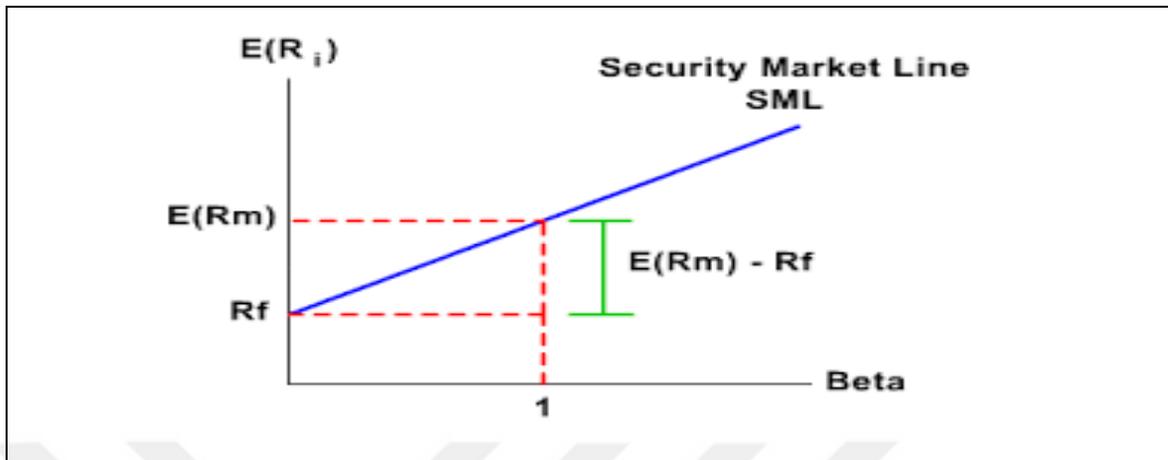


Figure 1.4: Security Market Line

Source: A. J. Curley, 1979: 465

The Security Market Line is analogous in many ways to the capital market line. However, it considers β (beta) as the risk of the market portfolio and declares that the impact of a security on the risk of the market portfolio is given by σ_{im}/σ_m . The security market line clearly shows that return is an increasing function of risk. It means that any investor receives an additional return by accepting an additional diversifiable risk. Thus, only market risk effects return of investment. (Farrell, 1997, pp. 55-66)

1.5 ARBITRAGE PRICING MODEL

The Arbitrage Pricing Model (APT), an alternative asset allocation model, has been developed by Ross, in the early 1970s and initially published in 1976. The arbitrage pricing model has three main assumptions:

- Capital markets are perfectly competitive
- Investors always prefer more wealth to less wealth with certainty
- The stochastic process generating assets returns can be represented as a K factor model.

Despite of other asset allocation models, following assumptions are not required:

- Quadratic utility function
- Normally distributed security return
- A market portfolio that contains all risky assets is mean-variance efficient. (Reilly , Investment Analysis and Portfolio Management, 1979, p. 288)

The rate of return to stock J in any given period t is assumed to be as following formula:

$$R_{j,t} = A_j + \beta_{1,j} I_{1,t} + \beta_{2,j} I_{2,t} + \dots + \beta_{n,j} I_{n,t} + \varepsilon_{j,t}$$

In this equation, I represent the value of any of the indices or factors that affects the rate of return to the stock. The number of factors equal to n. A_j is expected rate of return of stock. The individual betas can be positive or negative. (Robert A. Haugen, 1990, 257)

The residual term $\varepsilon_{j,t}$ will be uncorrelated between companies. Accordingly, the residual variance for any portfolio of individual securities is given as following formula. (Robert , 1990, p. 257)

$$\sigma^2(\varepsilon_p) = \sum_{j=1}^M x_j^2 \sigma^2(\varepsilon_j)$$

Moreover, the variance of portfolio return is given by the following formula.

$$\sigma^2(r_p) = \beta_{1,p}^2 \sigma^2(I_1) + \beta_{2,p}^2 \sigma^2(I_1) + \dots + \beta_{n,p}^2 \sigma^2(I_n) + \sigma^2(\varepsilon_p)$$

The portfolio's beta with respect to any one of the factors is a simple weighted average of the betas of the securities in the portfolio. (Hagin, 1990, p. 258)

$$\beta_{1,p} = \sum_{j=1}^M X_j \beta_{1,j}$$

Empirical tests of APT show inconclusive results. An extensive number of factors may account for the covariance that exists between securities. There are some evidences that those factors affect the prices that investors are willing to pay for securities. In some studies, pricing seems to be consistent across different samples. In others, it is not. The empirical results also appear to be highly dependent on the methodology employed in the tests. (Hagin, 1990, p. 270)

1.6 BEHAVIORAL FINANCE

The Efficient Markets Hypothesis (EMH) is a core of Modern Portfolio theory. The EMH assumes that prices on the market have “Correct Value “and markets are rational. It means that, when agents of market receive new information, they update their beliefs correctly and accordingly make choices that are normally accepted. In contrast, behavioral finance assumes that, in some circumstances, financial markets are informational inefficient and it argues that some financial phenomena can be better understood using the models in which agents are not fully rational. In other words, in some behavioral finance models, agents are failed to update their beliefs correctly. (Thaler , 2005, pp. 1-5)

A core of Behavioral finance is cognitive psychology. It refers to how people think. A huge psychology literature documenting proves that people make systematic errors in the way that they think: Behavioral finance uses this knowledge and argues that agents of market are not fully rational, either because of their overconfident and preferences or mistaken beliefs. (Ritter , 2003, pp. 429-437)

Thus, Behavioral finance picks up where modern portfolio theory leaves off completing the circle. It describes how investors actually behave, rather than how they should behave. It recognizes that we sometimes act in our own best economic interests. Behavioral Finance describes how we might best profit from that knowledge. (Gregory, 2004, pp. 17-20)

1.7 PORTFOLIO ANALYSIS

There are Fundamental and technical approaches of analyzing Portfolio. Roots of Fundamental Analysis rely on studying of economic, social and political issues that affect the security market. Therefore, it is more research based, that studies demand and supply of security, economic policies, political issues and financials as a decision-making criteria. They look for price to earnings ratios known as P/E. It means that, fundamental analysis relates to market through monitoring a security's annual growth rate. In other words, fundamentalists are more concerned with a security's annual performance than the overall market behavior. These investors are looking for long-term profit. Fundamental analysis is hard process of researching and studying it requires time, effort and energy. (Hagin, 1990, pp. 120-125)

Technical analysis focuses on evaluating time, price and market sentiments. A technical analyst or technician, chartists believe that security prices are determined by the supply of and demand for securities. Technical analysts rely heavily upon the usage of charts. Technical analysts look market prices of security, record historical financial data on charts, study those charts in search of patterns that they find meaningful and use the patterns to predict future prices. Typically, they believe that past patterns of security prices will recur in the future and therefore those patterns can be useful for predictive purpose. They just ignore fundamental valuation facts such as the firm's risks and Price/Earnings growth rates. In short, they estimate prices instead of values. (Francis, 1991, pp. 521-522)

Thus, company performance based fundamental analysis is useful to determine which security to buy, while security price performance based technical analysis is used to determine when to buy (Looking for entry and exit price points and volume levels provide clues about where the best entry and exit point are located). The best way of increasing the profitability in the uncertain and unpredicted market is to find the best combination of fundamental method's market analysis and technical analysis aspects of trading. The combination of both technical and fundamental studies not only increases

knowledge but also can boost investor's confidence. Fundamental factors often supplement technical pricing, which increases chances of being right.

1.8 MEASUREMENT OF PORTFOLIO PERFORMANCE

Risk adjusted portfolio performance measures are the widely used techniques. These kinds of measurements adjust portfolio return and its relative risk of a portfolio, accordingly to a given strength of the market in the period of performance evaluation. There are three widespread used risk adjusted performance measures. All of them are based on the Capital Asset Pricing Model (CAPM). The measures are named after those who introduced them. They are the Jensen Index, the Treynor Index and the Sharpe Index. The Jensen and Treynor indices use the Security Market Line (SML) as a benchmark, while The Sharpe Index uses the Capital Market Line (CML) as a benchmark. The Sharpe Index is combined measures of the depth (Excess Return) and Breadth (Excess Return on more than one security) of portfolio performance, while The Jensen and Treynor indices focus on investors' ability to generate excess return and ignore its ability to generate excess return on more than one security. (Robert , 1990, p. 280)

The Treynor Index (1965) The Treynor Index measures the risk premium earned per unit of risk taken. It takes the opportunity to level into account in its performance rankings. The formula is as follow:

$$T_p = \frac{r_p - r_f}{\beta_p}$$

Treynor gives the wrong answer because it measures risk in terms of beta factor. Portfolio Beta is weighted average of securities in the portfolio. There is no propensity for the Treynor Index to grow larger as increase the number of securities in the portfolio, in as much, increases securities in the portfolio does not causes beta to grow. Therefore, the Treynor Index is also insensitive to the breadth dimension of portfolio performance.

This reason brings portfolio managers to the Sharpe Index. (Robert A. Haugen, 1990: 285)

The Sharpe Index (1966) uses capital market line as a benchmark. This index is counted as dividing the risk premium of portfolio by the portfolio's standard deviation. It measures earned risk premium for per unit if risk expose. The equation of Sharpe Index is as following:

$$S_p = \frac{r_p - r_f}{\sigma_{rp}}$$

For determining the quality of portfolio performance by Sharpe Index, it should be compared with the market. If Sharpe Index is higher than market then, it indicated that the one outperformed the market, while a lower Sharpe Index indicated underperformance. (Hagin, 1990, pp. 280-283)

The Jensen Index (1969) this index is actually the difference between the expected rate of return of portfolio and expected return that would be if portfolio were positioned on the security market line. The equation of the Jensen Index is as follow:

$$J_p = r_p - \{r_f + [r_m - r_f]\beta_p\}$$

In this formula;

r_m - Average Rate of Return for the Market Portfolio;

r_f - Risk Free Rate;

β_p - Portfolio Beta.

A positive Jensen index indicates a good performance and it is positioned above the security market line, while a negative Jensen index indicates bad performance and takes a position below the security market line. (Robert A. Haugen, 1990: 290)

CHAPTER II

2 THE BLACK-LITTERMAN MODEL

2.1 INTRODUCTION OF BLACK-LITTERMAN MODEL

The Black-Litterman Model is widely used asset allocation tool. Fisher Black and Robert Litterman developed the so-called Black-Litterman model published by Goldman Sachs & Company in 1991. They developed more diversified portfolio by incorporation of investor's views. This improvement was built upon the traditional Markowitz asset allocation and Capital Asset Pricing Models. Harry Markowitz, known as the father of Modern Portfolio grounded the foundation of the modern portfolio theory. In his work on portfolio diversification, he developed the Mean-Variance Model, which helps investors to select and construct the most efficient portfolio by maximizing the return for the given desired risk or minimizing the risk for a given expected return. Extreme weights in portfolio also input sensitivity makes this model less practically used. (Litterman R.& G. He, 1999, p. 6)

Deficiencies of the Mean-Variance optimization in the real investment situation motivated Black Fisher and Litterman Robert to develop better models on asset allocation. Black and Litterman while analyzing investment portfolios in Goldman Sachs provided a model to combine Heuristic approach to the Quantitative approach in 1990. The first publication on the model was in 1990, and subsequently in 1991, 1992 and proposed model which allowed investors to incorporate their views on optimization process. (Litterman R.& G. He, 1999, p. 8)

The Black Litterman Model is also called Reversal Portfolio Optimization Model. This model requires two sets of data to input. The first set of comes from CAPM equilibrium expected returns and historical variance-covariance; same as it is used in Original Mean-Variance Optimization. The second one and the most significant set used in application of that model is to construct a vector of views on assets' expected rate of return. (Litterman R.& G. He, 1999, p. 10)

2.2 BACKGROUND OF BLACK-LITTERMAN MODEL

One of the papers that shed light on the method is the study of Satchell and Scowcroft (2000). The study used Bayesian procedure and reached the same formula. They presented details of Bayesian portfolio construction procedures, which have become known in the asset management industry as Black–Litterman models and argued that these models are valuable tools for financial management. Satchell & Scowcroft combined judgmental and quantitative views. They intended to explain that this model has considerable importance in investment process management in modern financial institutions. (Satchell, 2000, pp. 3-10)

Another important paper about the Black-Litterman method is the one written by Thomas M. Idzorek (2004). In his study, Idzorek gives detailed explanations and clear examples about the model. He proposes a method to assign confidence on subjective views. He explains his methodology in six steps. These step-by-step instructions enable implementation Black-Litterman model. They provided a method for controlling the final portfolio weights caused by introduced views. They suggested that controlled could be done by the user specified confidence level based on an intuitive 0% to 100% confidence level. Thus, they suggested an intuitive technique for specifying one of most abstract mathematical parameters of the Black-Litterman model. (Thomas, 2004, pp. 10-15)

Another study that derived the Black-Litterman formula in Bayesian techniques is the study of Attilio Meucci (2009). He has started with different assumptions and used Bayesian arguments to reach the original formula. As a second contribution, Meucci changed the initial assumptions and modified the method to the extent to which the final formula directly gives the estimation of realized returns instead of expected returns. (Meucci , 2009, pp. 429-437)

2.3 MATHEMATICS OF MODEL

The strength of Black-Litterman Model is that it gives opportunity of combining different models. Originally, in this model CAPM is used to compute prior set and blends outputs of CAPM with subjective investor's views to reach the posterior outputs. In other words, the Black-Litterman Model uses CAPM as a reference point and adding investor's views component to each final optimal portfolio composition. (Satchell, 2000, p. 4)

In order to understand the used Black-Litterman Model following notations should be considered:

w- Weight Vector

Σ - Covariance Matrix

δ/λ - Risk Aversion Parameter

Q- Investor's Views Vector

Π - Implied Equilibrium Excess Return Vector

P- Link Matrix (that identifies assets involved in investor's view)

Ω - Uncertainty of Investor's Views

r_f - Risk Free Rate.

To obtain Black-Litterman formula, following utility function (U) is maximized:

$$U = w^T \Pi - \left(\frac{\lambda}{2}\right) w^T \Sigma w$$

Setting this derivative equal to zero, following equation is obtained:

$$\frac{dU}{dw} = \Pi - \lambda \Sigma w = 0$$

Black-Litterman Formula:

$$\Pi = [(\tau\Sigma)^{-1} + P^T \Omega^{-1} P]^{-1} [(\tau\Sigma)^{-1} \Pi + P^T \Omega^{-1} Q]$$

In the reverse optimization process the Implied Excess Equilibrium Return Π in the Black-Litterman Model is derived by using market capitalization weights (w_{MKT}) and formula is represented below: (Thomas, 2004, p. 5)

$$\Pi = \lambda \Sigma w_{MKT}.$$

The risk aversion coefficient can also be written as:

$$\lambda = \frac{E(r_m) - r_f}{\sigma_m^2}$$

The Optimal weights are derived by following formula:

$$w = (\delta\Sigma)^{-1} E(r)$$

Thus, the portfolio optimization process starts with market capitalization weights, taking Ω , Q , Σ and Π into account. Finally, the resulting posterior portfolio is the summation of the initial market capitalization weighted portfolio plus the view portfolio. (Hakan Kapucu, 2011)

2.4 EXPRESSING THE VIEW CONCEPT

In the B-L model, absolute or relative investor's views can be expressed. B-L model considers absolute and relative views of portfolio. The absolute view is written as "asset A will have a return of X" and relative view such as "asset A will outperform asset B by X percent". Let assume that investor believe that asset A is going to exceed the return on asset B by x% (Thomas, 2004, p. 14)

$$r_A > r_B \text{ by } x_1\%$$

Or

$$r_B > r_C \text{ by } x_2\%$$

In the Black-Litterman Formula, investors express their views as a views vector Q , with dimension n by 1 , where n is number of view. (Thomas, 2004, p. 14)

$$Q = \begin{matrix} x_1 \\ x_2 \end{matrix}, n=2$$

Matrix (Q) is integrated with Link Matrix (P), which is matrix with n numbers of view and j numbers of observed assets. If the numbers of views are (k):

$$P = \begin{matrix} p_{1,1} & \dots & 0 & p_{1,n} \\ \vdots & & \ddots & \vdots \\ p_{k,1} & \dots & & p_{k,n} \end{matrix}$$

The Link Matrix (P) is filled as following rule: For the absolute views terms the respective cell of each positive view is filled by 1 and rest of other cells by 0 as far as investor has not view about those assets. For the relative views terms the respective cell of each positive view is filled by 1 and each negative view by -1 but the other cells by 0 as far as investor has not view about those assets. (Thomas, 2004, p. 15)

$$P = \begin{matrix} 1 & -1 & 0 \\ -1 & 0 & 1 \end{matrix} n=2, j=3$$

Considering risk in Black-Litterman model, uncertainty, can represent through the Variance-Covariance matrix Σ , On the other hand, the confidence of expectations can be represented as Σ^{-1} . The uncertainty of investor's views is referred by term of Omega (Ω) if the number of views (k) is n , therefore, the View vector (Q) will be $n \times 1$ column vector. The uncertainty of views is normally distributed Error Term Vector (ϵ) with a mean of 0 and a covariance matrix Ω . Therefore, a view has the form of $q + \epsilon$. (Thomas, 2004, p. 18)

$$q + \epsilon = \begin{matrix} q_1 \\ \vdots \\ q_k \end{matrix} + \begin{matrix} \epsilon_1 \\ \vdots \\ \epsilon_k \end{matrix}$$

The variances of error terms (ω) constitute Ω , where Ω is a diagonal variance-covariance matrix. Since views expressed on different assets are assumed independent of

one another, the off-diagonal elements of Ω are 0. The variances of error terms (ω) *indicate* the uncertainty associated with these views.

$$\Omega = \begin{pmatrix} \omega_1 & 0 & 0 \\ 0 & \ddots & 0 \\ 0 & 0 & \omega_k \end{pmatrix}$$

Black and Litterman suggest that: (Thomas, 2004, p. 19)

$$\Omega = P (\tau \Sigma) P^T$$

Where, τ is scalar and is equal to 1.

2.5 THE BAYESIAN THEOREM

The Bayesian Theorem is used to describe conditional probability also called posterior distribution, given the prior distribution and sample data. The main idea behind the theorem is to integrate additional information into calculation process. In Black-Litterman model, the Bayes' theorem incorporates investor's views into the model. The Black-Litterman Model we it is obvious that the model generates posterior implied equilibrium expected returns by integration of the investors views into the prior expected return using Bayesian method. (Satchell, 2000, p. 10)

CHAPTER III

3 TECHNICAL ANALYSIS

3.1 CONCEPT OF TECHNICAL ANALYSIS

The word technical comes from the Greek *technikos*, relating to skillful and art. Technical analysis is study of any market in order to forecast future price movement and trends, by using price and volume information. There is a third important element in technical analysis that is called the Market Psychology, but is not part of the formal definition of technical analysis. Technical analysis works only because traders believe it works and act accordingly, that is the key factor of causing the price action predicted. There are three main concepts to be considered: Market Action Discounts Everything, Prices Move in Trends, History Repeats Itself. The validity of technical analysis theory is the concept that price changes are not random, so far the markets has predictable trends. Moreover, technical analysis theory declares that, based on past and *current* price and volume activities, it is possible to forecast the expected duration of a trend. A Trend line is primary tool to define, when a new trend starts, when the old trend finished and when a trend has reversed. This Trend Line is construing on charts, as a result, Technical analysis sometimes is called as *chart* analysis. Technical analysis applies the geometrical tools and pattern recognition techniques to determine trend movement on charts. They plot information of price and volume on chart to make its visual imagination. It is a well-known fact that the mind can take the most information visually. (Stevens, 2002, pp. 36-50)

Published Market Data and economic theory is roots of Technical Analysis. Market data includes prices, volume and technical indicators information for securities.

Market data indicates the forces of supply and demand of securities in the market. This is the basic information to make trading or investing decisions. The basic assumptions of Technical Analysis are following:

- Stock prices are determined according to the supply and demand.
- Stock prices move in trend.
- Reversals in trend are caused by shifts in demand and supply
- Shifts in demand and supply can be detected in charts.
- Chart Patterns tend to repeat. (Jones, 1999, pp. 424-425)

Thus, the technical analysis is also an intellectual process than a technique. Technical analysis means using of charts, technical trading rules and indicators. Price and volume is the primary information for technical analysis and the chart is the most important for displaying this information. Forces of supply and demand result in particular pattern of price behavior that is shown up by the trend. Technicians try to identify trends and patterns that provide particular trading signals.

Charles Dow originated the oldest and most famous technical tool. He is founder of Dow Jones Company and editor of The Wall Street Journal. This tool of technical analysis is called the Dow Theory. Dow Theory is a technique for detecting long-term trends in the aggregate stock market. It is used to depict trends in the market as a whole or in individual securities. Charles Dow was one of the first to write about the fact that stock market prices tend to move in trends (Willis , (2001, pp. 40-45)

The theory is based on the existence of three types of price movements: primary moves-last several years. Intermediate moves-last several weeks or months and occur as the interruptions within the primary moves. Minor moves- last day to day and occur randomly around the primary and secondary moves. (Hagin, 1990, pp. 137-149)

3.2 CHARTS

Chart is the foundation of technical analysis, as far as, the chart with its patterns and indicators are the best instrument of trading. A graphical interpretation, a visual picture of price movement truly is worth a thousand words. The stock charts became popular in the late 19th century. It started with Charles H. Dow writings in the Wall Street Journal. This became known as the Dow Theory. This theory indicates that markets moved in measurable trends and these trends could be interpreted and forecasted accordingly the price movement and those price movements can be recorded on charts. (Madlem P. W., 1999, pp. 27-30)

Technical analysis is founded on the idea that history tends to repeat itself, in other words, studying the past behaviors of prices and price patterns of a security give possibility to investors to develop a reasonable forecast about what the security price is likely to be in the future. Technical analysts believe that all-important information is conveyed in the market price and those price movements can be expressed on graphical format, which is known as a stock charts. (Madlem P. W., 1999, pp. 30-34)

There are four different types of charts: a line chart, a bar chart, a figure and point cart and candlestick chart.

A line chart represents the security's closing price on each day. Dates are displayed along the bottom side while, prices are plotted on other side of chart, as shown in below

Figure 3.1 typically, a security's closing prices are used for line charts. The line chart's strength comes from its simplicity. It provides easy to understand view of a security price movement. (Steven, 2003, p. 15)

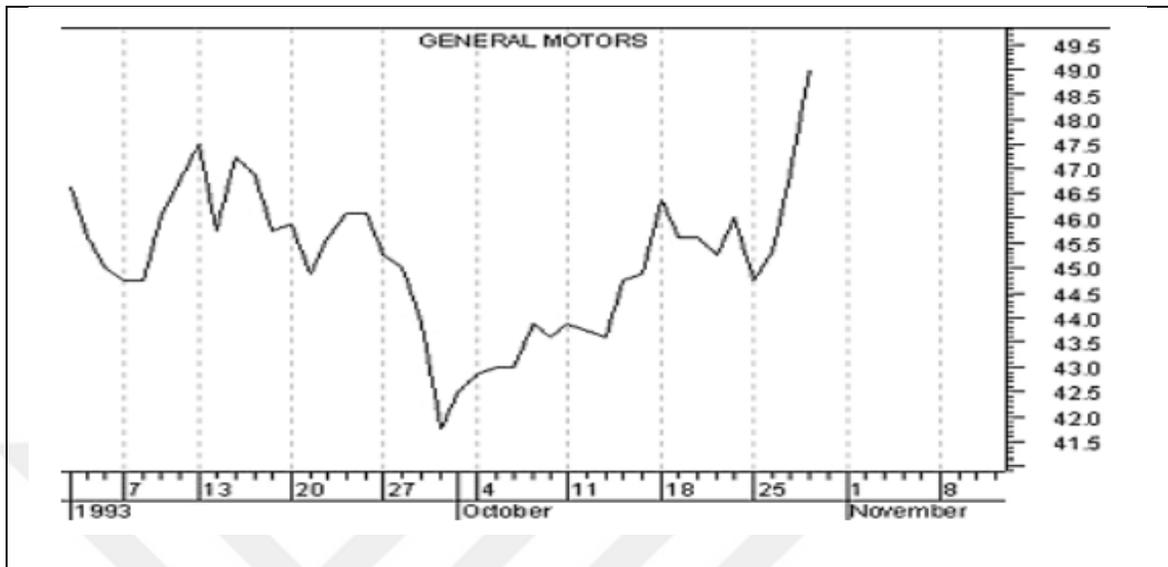


Figure 3.1: The Line Chart

Source: Achilles Steven 2003:15

A bar chart is the most popular security charts. Bars on these charts represent stock's open, low, high and closing prices. As illustrated in the Figure 3.2. They are shown as vertical bars, top of any vertical bar is the highest price of the security during a trading period, and according bottom of the bar represents the lowest price. "Ticks" represent open and closing prices. A tick that is displayed on the right side of the bar distinguishes a closing price of security, while a tick on the left side of the bar represents an opening price of security. (Steven, 2003, p. 18)

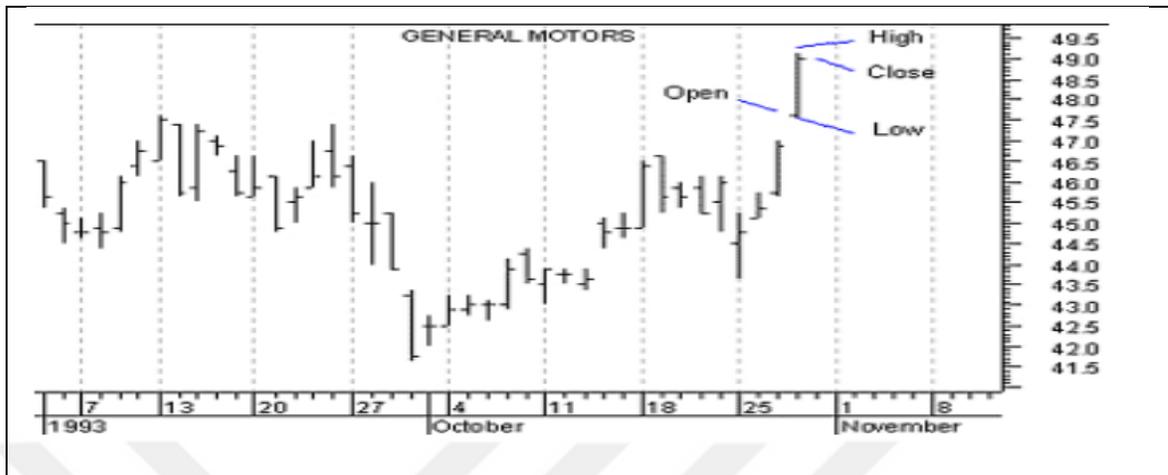


Figure 3.2: The Bar Chart

Source: Achellis Steven 2003:17

Another popular device used by technicians is **the point and figure charts**. Unlike other chart types the point and figure charts considers only significant prices changes, regardless of the time. It highlight just exit and enter points. The analysts determine which significant price changes will be recorded and when a price reversal will be recorded. (Reilly, Investment Analysis and Portfolio Management, 1989, p. 658)

The candlestick chart (Figure 3.3) is one of the most popular and widely used techniques that represent price action in a more striking way. In candlestick charts, the “real body” is the wider area between the open and close prices. The “shadow” is the vertical line from the real body up to the price high and down to the price low. A long shadow indicates the inability for prices to maintain their highs or lows and is thus a warning of trouble. When the real body is colored as red, it means that close is lower than the open and usually it is green when the close is higher than the open. A red body denotes, therefore, a “down” day and a green body indicates an “up” day. A large body indicates strength in the direction of the trend and a small body indicates indecision and a potential reversal, especially after a meaningful prior trend. (Jones, 1999, pp. 428-429)



Figure 3.3: The Candlestick Chart

Source: Achellis Steven 2003:18

3.3 CANDLESTICK CHART PATTERNS

The candlestick chart can be used for analyzing patterns, trend lines, support and resistance, yet it has a set of unique patterns of its own. These patterns are mostly short term of only one to five bars. They are generally tools, not a system. There are bullish, bearish and reversal patterns. The Japanese Candlestick Patterns are illustrated below: (Steven, 2003, pp. 102-120)

Long-White Line	Hammer	Piercing Line	Bullish Engulfing Lines	Morning Star	Bullish Doji Star

Table 3.1: Bullish Patterns

Source: Achellis Steven 2003:20

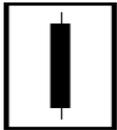
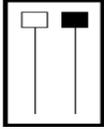
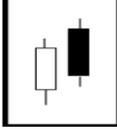
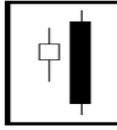
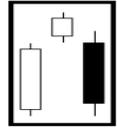
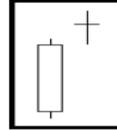
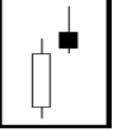
Long-Black Line	Hanging Man	Piercing Line	Bearish Engulfing Line	Evening Star	Bearish Doji Star	Shooting Star
						

Table 3.2: Bearish Patterns

Source: Achelis Steven 2003:21

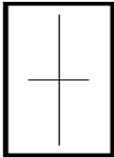
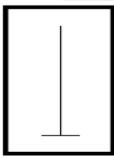
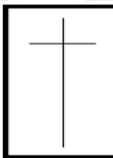
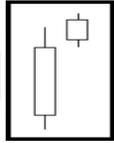
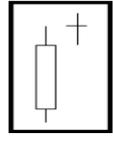
Long-Legged Doji	Dragon-Fly Doji	Gravestone Doji	Star	Doji Star
				

Table 3.3: Reversal Patterns

Source: Achelis Steven 2003:22

- **Long white line** is a bullish pattern and occurs when opening prices of current Candlestick is higher than closing prices of previous candlestick. **Long black line** is a bearish pattern and occurs when opening prices of current Candlestick is lower than closing prices of previous candlestick. (Steven, 2003, p. 107)
- **A doji** pattern formation illustrates a case when the opening and closing prices are the same. Therefore, it shows a horizontal line and expressing identical open and close prices during a specific period of trading range. It indicates that market is in equilibrium and that is caused by indecision in the market. There are some types of Doji pattern:

Bullish Doji Star- in this pattern formation a doji expresses indecision on the market and a star formation illustrates a reverse. Thus, this pattern defines an indecisive period on the market. **Bearish Doji Star-** also identifies an indecisive period on the market. **Long-Legged Doji-** identifies a reversal pattern that illustrates a case when the opening and closing prices are the same but the range between the high and low prices are large. **Dragon-Fly Doji-** also identifies a reversal pattern that illustrates a case when the opening and closing prices are the same but the low is significantly lower than the open, high and closing prices. **Gravestone Doji-** also identifies a reversal pattern that illustrates a case when the open, close and low are the same, but the high is significantly higher than the open, low and closing prices. (Steven, 2003, p. 105)

- **Stars** – indicate trend reversals with a small real body. This formation contains two candlesticks that start after a much larger real body candlestick, where the real body does not overlap the star pattern. However, the shadows may overlap it. There are some types of star pattern: **The Evening Star-** is a bearish pattern. Three candlesticks pattern occur at market top. The middle candlestick is known as a star in each of those patterns that lies outside of the range and the real body of this pattern does not overlap the previous bar's body at all. **The Morning Star** is the opposite formation of the evening star. It occurs at market bottom. **Shooting Star-** This pattern suggests a minor reversal when it appears after a rally. This formation has a long shadow above its body and very short or nonexistent shadow below body. The real body of this formation occurs in the lower end of the trading range. (Steven, 2003, p. 110)

- **Hanging Man and Hammer** have a small real body and a long lower shadow. The hanging man is a bearish pattern that occurs after a significant uptrend. The Hammer is a bullish pattern that occurs after a significant downtrend. The real body of the hammer and the hanging man patterns are located at the upper end of trading bar. The hanging man formation occurs at a peak. Otherwise if it occurs and hammer at a trough. (Gallahe , 2018)

- **An engulfing Pattern** is a two bar pattern, it occurs when the second body engulfs the first body. This pattern recognizes a significant trend reversal and signal is

much stronger when the first body is very small and the second body is very large. There are some types of star pattern: **The Bearish Engulfing** pattern is formatted when a small white body candlestick is followed by a black body candlestick that engulfs the white body. This pattern indicates a market top in an uptrend market. **The Bullish Engulfing** pattern is formatted when a small dark body candlestick is followed by a white body candlestick that engulfs the dark body. This pattern indicates that a downward trend is reversing. (Steven, 2003, p. 102)

The Piercing Line- is a bullish pattern. The first candle is a long black bar and the second candle is a long white bar. The second candlestick opens lower than the first one's low, but it closes more than halfway above the first candlestick's real body. **The Dark cloud cover**- is a bearish pattern. The pattern is more significant if the second candle's body is below the center of the previous candle's body. (Stevens, 2002, p. 120)

Thus, the pattern should always be used with other evidence before action is taken. Being more often a reversal pattern, however, candlestick patterns are often useful in determining support and resistance levels on their own.

3.4 BASIC CONCEPTS OF TREND ANALYSIS

3.4.1 Concept of Price

Technical analysts assume that price is determined by the supply and demand of security. They believe that prices are nonrandom and it includes all information. Price changes because of supply and demand. Technical analysts do not worry about reason of price changing, because they believe that is influenced by investor's behavior and emotions. The fear and greed are two main factors that reflect on investor's decision. Investors watch price, price changes and previous price history accordingly they can be very optimistic or very pessimistic. Thus, the seller may be more anxious, while the buyer may have more money to invest, whatever the reason, the price will change and

reflect this change in supply or demand. So, the interaction of supply and demand determine price. In other words, the supply and demand are affected by investors' emotions that can be characterized as Fear, pessimism, hope, overconfidence and greed. Emotions or psychology of market participants are called as Market Sentiments. Investors react emotionally to the market and these reactions affect the market and security price. Thus, investor psychology is both influenced by and an influencer of market activity. (BauerRichard J, 1998, p. 300)

3.4.2 Trend Classifications and Varieties

A **trend** is a directional movement of prices that remains long enough to be identified and be playable. The trend is a direction rather than a straight line. Technical analysts use the trend to determine: when trend is changing, when trend has changed, when to enter a position, when to exit a position and when the analysis is wrong and the position must be closed. The most basic Trend Identification Technique is trend identification by **Peaks and troughs**. The basic of this method is to look for peaks and troughs within a series of price. If within the series of price oscillations, prices reach higher peaks and higher troughs it indicates the “**Uptrend**” and “**Downtrend**” occurs when prices reach lower troughs and lower peaks. A sideways or “**Flat Trend**” occurs when prices trade in a range without significant underlying upward or downward movement. In other words, if the peaks tend to be higher than the earlier peaks and the troughs tend to be higher than the previous troughs, the trend must be upward. If peaks and troughs are lower than previously, the trend must be downward. If the peaks and troughs are scattered, the trend is random and if the peaks and troughs occur at the same relative levels, the trend must be a trading range. A trend is a period in which a price moves in an irregular but persistent direction. Trends exist in all lengths, from long term trends that occur over decades to short term trends that occur minute-to-minute. The number of trend lengths is large, but the methods of determining when a trend begins and ends are the same regardless of length. (BauerRichard J, 1998, pp. 307-310)

Trends might also be described according to the time span. They are primary, intermediate and short-term trends. below

Figure 3.4 describes Time Span of Trends. *The primary trend* generally lasts between 9 months and 2 years. The countercyclical trends within a primary are known as the *intermediate* price movements. They last from 6 weeks to 9 months, sometimes even longer. The *Short-Term Trends* usually last 3 to 6 weeks, sometimes shorter and sometimes longer. They interrupt the course of the intermediate cycle, just as the intermediate term trend interrupts primary price movements. Short-term trends are usually influenced by random news events and are far more difficult to identify rather than intermediate or primary counterparts. (Pring , 2014, pp. 5-10)

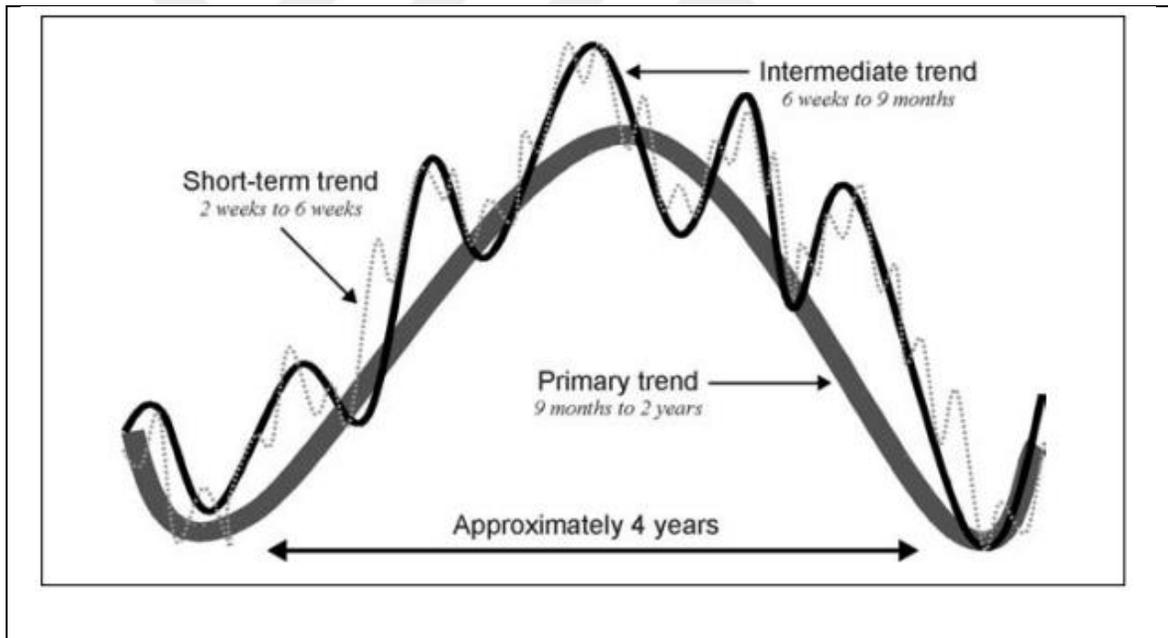


Figure 3.4: The Market Cycle Model

Source: Martin J. Pring, 2014:5

A trend rarely follows a line without including a number of smaller trends. The smaller countertrends are called “**retracements**”. Retracements are always corrections to the principal trend. The retracement is a smaller trend itself and runs counter to the

principal trend. A retracement, in a healthy trend, can also present an opportunity to the trend-follower who missed a chance at the earlier stages of the trend. The general rule is that a strong uptrend requires retracements of only one-third of the previous uptrend. Variations of retracements that occur after a breakout are called “**pullbacks**” or “**throwbacks**” depending on whether the breakout was downward or upward. Throwback occurs when the price retraces quickly back from the upward breakout zone and opposite of it, the quick retracement from a downward breakout is called a pullback. (Pring , 2014, p. 15)

3.4.3 Trendline

The difficulty of Technical analysis is to determine the signs, which indicate that a trend change is occurring. One of the oldest and easiest methods of determining the trend of prices is a “Trendline”. The simplicity in Trend lines is that it can be drawn with just a ruler and the use of one’s eyes rather than a fancy mathematical formula, as it shown on the

Figure 3.5 below the lines are generally drawn between lows (support) when the price is rising and between tops (resistance) when the price is declining. The lines that connect the lows or highs are extended into the future so that the analyst can estimate when the trend line’s break points. The purpose of the trendline is to provide a signal of a change in trend. (Shannon, 2008, pp. 29-35)

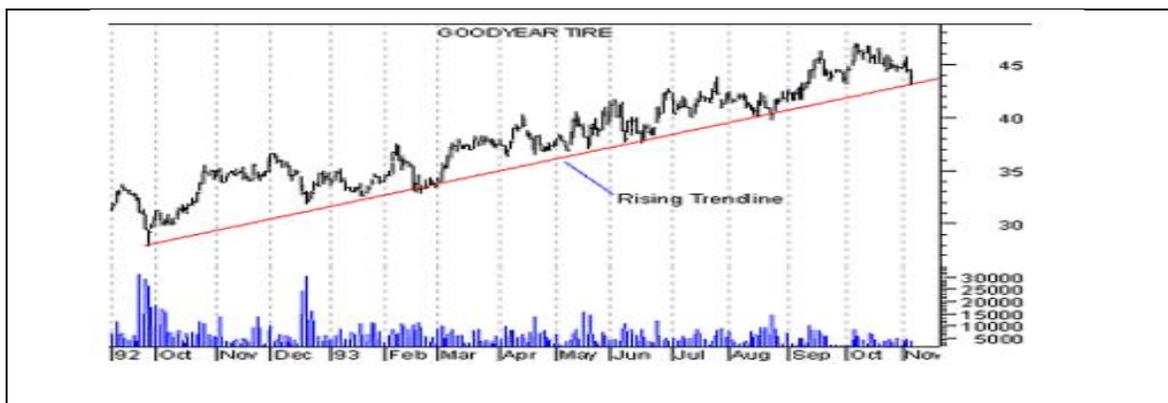


Figure 3.5: The Trendline

Source: Brian Shannon, 2008: 29

3.4.4 Trendline Breakout

Breakout Trading is as old as technical analysis and one of the most successful techniques. A breakout occurs when a price “breaks out” through a prior support or resistance level. The trendline breakout gives signal of a significant changing in supply and demand and it indicates that a new price trend is beginning. Alone, for this reason, it can be said that a breakout is an extremely important signal for the technical analysts. After trend breakout occurs it means that an opposite direction of a previous trend is starting and it suggests that the trend is reversing and that a position should be closed and possibly reversed. The point at which a breakout occurs is extremely important, because false breakouts are common. Thus, there is always the tradeoff between risk and reward. As a result, penetration of previous trendline or resistance or support zone/level is first requirement for breakout. The next requirement is confirmation of the penetration if it is a real breakout. Technical analysis suggests waiting for two bars close beyond the breakout level for confirmation. This increases the risk that some part of the move subsequent to the breakout will be missed, but on the other hand, it increases the possibility that the breakout is real. (Brian, 2008, p. 35)



Figure 3.6: The Trendline Breakout

Source: Achelis Steven, 2003: 40

3.4.5 Support and Resistance Levels

Technicians, generally rely on charts to be able to predict direction of prices future movements. They seek to identify certain signals in a chart by visually identifying support and resistance levels. **A support level** is the level of price or a price range at which technicians expect significant increase in demand for a security, in other words, the point at which buyers will support the price and prevent additional declines. At the support level, buyers become as powerful and force to stop a price decline. **A resistance level** is a level of price or a price range, at which technicians expect significant increase in the supply of a security, in other words, an upper bound of price where sellers provide a resistance level for any further rise in price. A resistance level is the level at which sellers are powerful and stop the price advance. The concept of support and resistance presumes that they represent a remembered psychological barrier for prices and prices will also stop at these recorded levels or zones in the future. (Jones, 1999, pp. 428-430)

When more than one resistance level occurs at the same price, a resistance level becomes a resistance zone. The zones maintain throughout time and become as barrier level for future price action. In addition, there is one more significant function of those support and resistance zones, they not only maintain through time, but also once they are broken through, they will switch functions. In other words, previous support level will become a new resistance level and previous resistance level will become a new support level, as it shown on Figure 3.7and Figure 3.8 (Donald E, 1991: 590-610)



Figure 3.7: Resistance and Support Levels

Source: Achelis Steven, 2003: 27

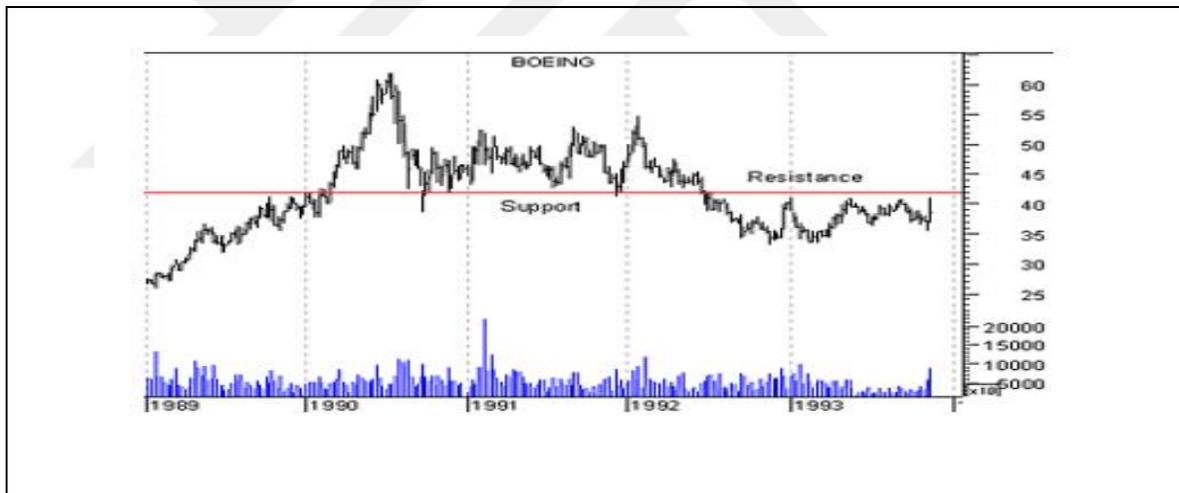


Figure 3.8: Resistance and Support Levels

Source: Achelis Steven, 2003: 29

3.4.6 Trend Channels

Sometimes, prices move in a “channel”. Prices tend to “bounce” off this rising upper channel line as if supply were present at these moving intervals and rising at the same rate as demand. Indeed, when the upper channel line is no longer parallel but beginning to close on the underlying trend line, we know that supply is getting just a

little more anxious and that the price is likely approaching a reversal point. The same channel rules apply in downtrends. (Pistoiese, 1994, pp. 80-99)

3.4.7 Trading Volume and Its Usage

Volume is the secondary confirmation of trend. Increased trading volume often occurs with a breakout. The volume of trading usually increases and remains higher average during an uptrend. A large increased volume provides a strong buy signal. There is a lower probability to sustain uptrend if volume is not increased. Technical analysis assumes that best time to buy a security is after a high volume breakout is made to the upside of a bottom formation. Volume is usually lower than average during a downtrend, also, volume usually decreases inside triangles. (Pistoiese, 1994, pp. 72-80)

Volume is useful indicator for identifying turning points in a market. When the market moves in one direction and there is a significant increase in volume, it declares changing in the balance of power. Therefore, the change in balance of power is signal of turning point in the market. Yet, increasing volume is not always identified with reversal in the market and increasing volume does not always mean the market is turning; but often times. (Shannon, 2008, pp. 70-71)

3.5 TECHNICAL ANALYSIS PATTERNS FORMATION

3.5.1 Double Top and Double Bottom Formation

Foundation of technical analysis is chart. There can be identified some patterns on the charts that can be used for predicting future price movements. Appearance of certain patterns on the chart following by a breakout gives a profitable buy or sells signals. There are large numbers of such patterns. Obviously, those patterns are much easier to

identify when they are already formatted rather than at the time they are actually occurring. The appearance of certain patterns following by a breakout gives a profitable buy or sell signal. (Jones, 1999, p. 433)

A double formation is about the simplest of the classic formations. It is also one of the least reliable and least profitable patterns. **A double top** consists of only three reversal points: two peaks separated by a trough. For it to be a true double top, the initial price must enter the pattern from below the trough price and the exit signal must occur on the breakout below the trough low price. The two peaks must be at or close to the same price level. **A double top** formation occurs when the price of a stock that has peaked once rises again to the same approximate level after a decline and peaks again. The trading volume generated in making the first top will usually be greater than that generated in making the second top. Once the decline the second top goes 5 percent below the valley floor between the tops, there usually follows a further decline of intermediate or long-term duration. Double tops occur because stockowner has a good memory. They remember the price they could have gotten had they sold at the first peak. Once the price returns to that same level, they feel that they are being given a second chance to sell at the historical top price and many of them offer their shares for sale. When the sellers become too anxious an offer more shares than the buyers want, the price is driven down again, because the supply exceeds the demand. **A Double Bottom** pattern has the same characteristics as the top but is upside down. (Pistolese, 1994, pp. 17-19)

3.5.2 Rounding Top and Rounding Bottom formation

A Rounding Top formation is a gradual curve, which reverses an upward trend and converts it into a downward. This gradual reverses usually occurs over a period of several months or longer. A rounding top represents a long struggle between the demand for and supply of a stock. **A Rounding Bottom** is a curve that changes direction of

downtrend and converts it into an uptrend. This curve represents a situation where the demand is larger than the supply. (Pistolese, 1994, pp. 23-42)

3.5.3 Head and Shoulders Formation

Technical analysts have described numerous patterns that they believe will indicate the direction of future price movements. Consider a pattern called “head and shoulders” formation. Head and Shoulders Top (HST) is a formation, which is supposed to signal that the security’s prices has reached a top and will decline in the future. HST can be broken down into four phrases:

1. Left shoulder: heavy buying period pushes up prices to new peak, from where prices begin fall down
2. Head: the heavy buying raises prices to a new high and then begins the price to fall back below the top of the left shoulder.
3. Right Shoulder: lifts the price but fails to push prices as high as top of the head before a decline begins.
4. Confirmation or Breakout: prices fall below the neckline that is the line drawn tangent to the bottoms of the left and right shoulders and between the three peaks. This breakout is supposed to be preceding a price drop and is a signal to sell. (Francis, 1991, pp. 521-522)

Head and Shoulders formation come in a variety of shapes and sizes. Those formations can be tall and short, horizontal or slanted and have shoulder on each side. A head and shoulders formation occurs at the end of a long rise in the price of a stock. The formation of head is usually accompanied by an increase in trading volume. The explanation of a head and shoulders formation in terms of buyers’ and sellers’ hopes and fears are as follow. As the price of the stock goes up, the level of buyer interest tends to increase. More and more buyers place their orders to buy, which drives prices up with higher volume than usual. Finally, when most of buyers have obtained their shares and only a few buyers are left who are willing to buy at the high current price, they become

outnumbered by sellers(at the top of the head) the supply of stock available at that prices exceeds the buyers; interests and prices are driven down(to the right side of head). After the prices have declined, more buyers decide to buy and they begin to drive the price up to form the right shoulder. As the price approaches the previous high, current holders of the stock, fearful that price may not return to previous high, become anxious to sell their shares and are willing to accept prices lower than the preceding peak. When the prices fails to regain its old high, the sells gradually become more fearful that price will go lower and a self-fulfilling prophecy is in operation the neckline is broken. After this breakthrough of the neckline has occurred, there is a good chance that the price of the stock will go into long-term decline. The same characteristics apply to an inverted head and shoulders formation as to the upright formation with one major exception. When the breakout occurs from the neckline, it should be accomplish by a large increase in volume. Whereas an increasing in volume as not necessary to validate the breakout from the upright head and shoulders formation. (Jenkins, 1991, pp. 100-105)

3.5.4 Triangle Formation

A symmetrical triangle does not have an upward or downward slant but has a horizontal axis. Symmetrical triangles are formed hen price fluctuation result in two consecutive descending tops and two consecutive ascending bottoms. Drawing lines through the tops and bottoms defines the boundaries of indecision. The breakout is often accomplished by an increasing in volume. The symmetrical triangle is called a continuation formation because most of the time the breakout will be in the same direction (up or down) as the price was headed prior to the triangle creation. When the prices break out in the opposite direction, the triangle serves as a reversal formation. If the price works, its way out through the apex the triangle loses its significance. (Clifford , 1994, pp. 59-60)

A descending (downward) triangle formation develops when downward slanting line can be drawn through two or more succeeding price peaks and a horizontal line can be drawn through the bottom of two or more intervening price dips. The second peak must be lower than a previous peak and next peak must be lower than second peak. Bottoms though must be at approximately the same price level. It usually develops in several weeks or months. At some point before reaching the apex of the triangle, the price will usually break down through the floor of the triangle. When price close 5 percent or more below the bottom line, a sell signal has been given. In this case, the volume usually increases. (Clifford , 1994, p. 30)

An ascending triangle formation is another means of reversing a downtrend. It develops when an ascending line can be drawn through two or more ascending bottoms and a horizontal line can be drawn through the top of two or more intervening price rises. At some point, before reaching the apex, the price should break through the roof of the formation. When it occurs, the buy signal has been given.

3.5.5 Rectangle Formation

It is one of the simplest of patterns, consisting of a resistance line above and a support line below. Each resistance or support line must also be a trend line, which means that it must touch roughly the same price reversal at least twice. This added requirement is what separates it from a double top or bottom formation, which only requires that three price reversals occur. Prices are bounded by and oscillate between the two lines, and eventually exit, or break out, in one direction or the other. The pattern can have a slight tilt upward or downward, but the trend lines defining the support and resistance zones are always parallel. It appears similar to a horizontal channel. It often has false or premature breakouts, neither of which is predictive of the eventual breakout direction. Within the formation, prices do not necessarily always reach the two zones but may fall short (a “shortfall” or “partial decline”). Sometimes this is a warning as to the direction of the eventual breakout.

Sometime after a long decline, a stock will make three or more bottoms at approximately the same price and make three or more intervening tops at approximately the same price thus establishing what can be called a trading range, within which the price may fluctuate from several months to several years. If the price eventually breaks out of the upside of this range, this formation is called a trading range bottom. If this break occurs on a large increase in volume and uptrend becomes established and a significant price rise usually develops. (Clifford , 1994, p. 55)

3.6 TECHNICAL ANALYSIS INDICATORS

Technical indicators are mathematical calculations based on security's past and current price or volume activity. Technical analysis assesses this information to determine historical performance and predict future prices. The purpose of using those technical indicators is identifying the trading opportunities. Also, those indicators identify enter and exit trading signals. Numerous types of indicators exist, including, trend, momentum, volatility and volume indicators. The most important for technical analysts is to avoid redundancy, which is applying the same types of indicators to one chart. They should select indicators that complement each other without providing redundant results. (Fischer , 1991, pp. 590-600)

3.6.1 Trend Indicators

A Moving Average (MA) is one of the most popular and successful trend indicators in technical analysis. It is a useful tool in determination of trend. Therefore, it identifies the direction of trend, changing direction of trend and gives opportunity of profiting from trends. It can be said that the moving average is one of the oldest and useful trading indicator in technical analysis. Technical analysts use moving averages in four basic ways. First, moving average is used as a measure of trend. Second, the

moving average will often act as support or resistance level. Third, the moving average is an indicator of price extreme as far as, the moving average is a mean of prices and any reversion from the mean approaches to moving average. Whereas, a deviation from the moving average is a measure of how much prices have risen or fallen ahead of their usual central tendency. Fourth, moving average gives the specific buy and sells signals, when prices cross a moving average. Breakouts above and below this moving average is considered to be important trading signals. (BodieZ., A. Kane & A.J. Marcus, 1998, p. 430)

The length of the moving average can be different and it depends on the trading objectives. For shorter trading strategies short-term moving average is used while for longer trading strategies, the long-term moving average is used. The 50-day and 200-day MAs are widely used moving averages. The two basic and commonly used moving averages are **the Simple Moving Average (SMA)** and **the Exponential Moving Average (EMA)**. The Simple Moving Average is the simple average of a security over a defined number of times. The Exponential Moving Average gives greater weight to more recent prices. Thus, Calculation of the moving average is different accordingly its type. (Shannon, 2008, pp. 54-90)

Moving Average Convergence Divergence (MACD) otherwise known as MACD is a commonly used and effective indicator developed by Gerald Appel. It is a trend following momentum indicator that uses moving average or exponential moving average. Basically, the MACD is calculated by 12-day EMA and 26-day EMA. The crossover methods are the most commonly used MACD indicator. MACD crossovers give powerful Bullish and bearish trading signals. A bullish signal is generated when the MACD is a positive value, as the shorter period EMA crosses the longer period EMA. Similarly is generated a bearish signal. Crossovers are more reliable when they conform to the prevailing trend. If the MACD crosses above its signal line following a brief correction within a longer-term uptrend, it qualifies as bullish confirmation. If the MACD crosses below its signal line following a brief move higher within a longer-term

downtrend, traders would consider that a bearish confirmation. (Gallahe , 2018, pp. 92-97)

The Relative Strength Index (RSI) is a momentum indicator. An American technical analyst J.Welles Wilder developed RSI indicator. It attempts to determine the Overbought and Oversold level of the market. It is scaled between 0 to 100 values. According to this indicator, the market is considered overbought when it takes a value above 70 and it is oversold when it is dropped below 30. Thus, it indicates if the market has topped or bottomed. The most popular RSIs are 9day-RSI and 25day-RSIs. Traditionally, if RSI takes a value of 70 or above it, which indicated that, the market is overbought; it might be primed for a trend reversal or corrective pullback in price. An RSI reading of 30 or below indicates an oversold or undervalued condition. (Francis, 1991, pp. 532-537)

Absolute Breadth Index (ABI) is the momentum indicator that was developed by Norman G. Fosback. The ABI ignores the direction of prices. Moreover, observes how much volatility activity and change occurred on the New York Stock Exchange. The Absolute Breadth Index is calculated by taking the absolute value of the difference between NYSE Advancing Issues and NYSE Declining Issues. It takes the absolute value of -100 that is read as 100 and the absolute value of +100 that is also read as 100. If the ABI shows above 40% it is bullish signal while, below 15% is bearish signal. (BodieZ., A. Kane & A.J. Marcus, 1998, pp. 410-430)

• **The Commodity Channel Index (CCI)** measures the variation of a security and it is a indicator that declares overbought/oversold of commodities. Donald Lambert developed the CCI. It is effective technique for any type of commodities. CCI usually takes value between 100. Value above +100 implies overbought condition, while valued below -100 implies an oversold condition. High values show that prices are unusually higher compared to average prices whereas low values indicate that prices are unusually low. There are two basic methods to represent the CCI: (Murphy, 1999, p. 237)

3.6.2 Volatility Indicator

Standard Deviation is a statistical measure of volatility. Standard Deviation is typically used as a component of other indicators, rather than as a standalone indicator. High Standard Deviation values occur when prices change dramatically. Similarly, low Standard Deviation values occur when prices are stable. Many analysts feel that major tops are accompanied with high volatility as investors struggle with both euphoria and fear. Major bottoms are expected to be calmer as investors have few expectations of profits. (Fettahoğlu, 2016, p. 250)

▼ **The Bollinger Bands** are a highly popular technique. Financial analyst John Bollinger developed it in the 1980s. It is a good indicator to measure overbought and oversold conditions in the market. Bollinger Bands are a set of three lines: the centerline is referred as trend, an upper line represents resistance level and a lower line defined as a support level. The bands expand when the price of the stocks are volatile. Bollinger Bands detect the turning points in the market. It gives a buy signal when the price drops and hits the lower band and sell signal when price touch the upper band. The market is overbought when prices move closer to the upper band and the market is oversold when prices moves closer to the lower band. (Murphy, 1999, pp. 209-210)

Trading oscillators are based on trading strategy the idea that a stock's prices oscillates between overbought and oversold levels. When the stock price reaches oversold or overbought level, it is an indication that the price will soon change direction. A stock is overbought when the price is too high relatively to where it will be in the near future. The term overbought refers to a belief that many buyers have been buying the stock and the increase in demand has driven the price of stock upward. The increased demand will not continue thus price will fall below its current level and it is the point at which a trader wants to enter into a short position. (Murphy, 1999, pp. 246-249)

A stock is oversold when more people have been selling the stock than will be selling in the near future. The overselling leads to a relatively low price of stock and trader will want to purchase the stock at the oversold, relatively low price. As the oversold position corrects itself, the price will rise, leading to a profitable trading strategy. (BauerRichard J, 1998, pp. 105-120)

The Stochastic Oscillator indicator measures the relationship between the asset's closing price and its price range. The Stochastic Oscillator contains two lines. The main line is called "%K". The second line, called "%D", that is a moving average of %K. The %K line is usually displayed as a solid line and the %D line is usually displayed as a dotted line. The main signal that is formed by this oscillator is when the %K line crosses the %D line. A bullish signal is formed when the %K breaks through the %D in an upward direction. A bearish signal is formed when the %K falls through the %D in a downward direction. (BauerRichard J, 1998, pp. 110-120)

3.6.3 Volume Indicators

As value measure a relative worth of the marker movement, it becomes an important indicator in technical analysis. Volume is the number of securities traded in the market during a specific period. Each interaction between sellers and buyers provides price of transaction. The volume for the day is five, If only five transactions occur in a day. If the market makes a strong price movement, then can be confirmed by the volume for that period. Higher volume during the price move determines higher strength of this movement. (Petti R & N.L.Jacob, 1988, p. 210)

Negative Volume Index (NVI) is a volume indicator. It is a bull market indicator. The Negative Volume Index (NVI) defines the days where the volume decreases according to the previous day. The concept of this indicator is that the "smart money" takes positions on days when volume decreases. It gives a buy signal whenever the NVI crosses above its 1year (255 trading day) moving average. The NVI identifies the profitable opportunities. **Positive Volume Index (PVI)** defines days where the volume increased according to the previous day. The concept of this indicator is that the "crowd" takes positions on days when volume increases. The PVI identifies bull market, when the PVI is above its moving average and bear market, when the PVI is below its moving average. (Steven, 2003, p. 245)

Money Flow Index (MFI) is a momentum indicator that accounts volume and measures the strength of money flowing in and out of a commodity. MFI is related to the Relative Strength Index. This indicator is scaled between 100 and the interpretation of the Money Flow Index is as follows: The market tops occur when the MFI is above 80 and the market bottoms occur when the MFI is below 20. In addition, it looks for divergence between the indicator and the price action, looks for if the price trends higher and the MFI trends lower or vice versa. (Gallahe , 2018, p. 134)

ON Balance Volume (OBV) is a momentum indicator. It relates volume to price change. According to OBV the buy and sell signals are defined according to OBV trend and its breakout. Normally it is a sell signal when OBV makes a downside breakout and it is a buy signal when, OBV makes an upside breakout. (Korkmaz Ali & Ceylan Turhan, 1998, p. 54)

3.7 ELLIOT WAVE PRINCIPLE

R.N. Elliott, in his 1938 book, *The Wave Principle* and again in a series of articles published in 1939 by *Financial World* magazine, pointed out that the stock market unfolds according to a basic rhythm or patterns. Under the theory of the Elliot Wave Principle, every market has a law of its own. Every decision made in market produces meaningful information and it is itself production of meaningful information. Every price movement in the market is reflected by a structural progression. This progression is formed is unfolded in waves. Sometimes market appears to reflect outside event, but most of times it follows its own rules and folds every market movement into wave formation. For this concept, the waves are patterns that show directional movement of prices. (Gann, 2005, p. 50)

Waves in the Elliot Wave Theory have two main functions. It is their actionary and reactionary features. Those action or reaction modes are defined by its relative direction. An actionary mode is also called a trend wave and it tends to move in the same direction of the large degree, at the same time it is a part of this large degree. Opposite of this, a reactionary wave that is also called countertrend wave is any wave

that tends to move in the opposite direction of trend. The basic pattern is structured by five waves, wave 1, 2, 3, 4, 5 (Figure 3.9) between those waves, the wave 1, 3, 5 are directional movement and wave 2, 4 are countertrend interruptions (Gann, 2005, p. 55)

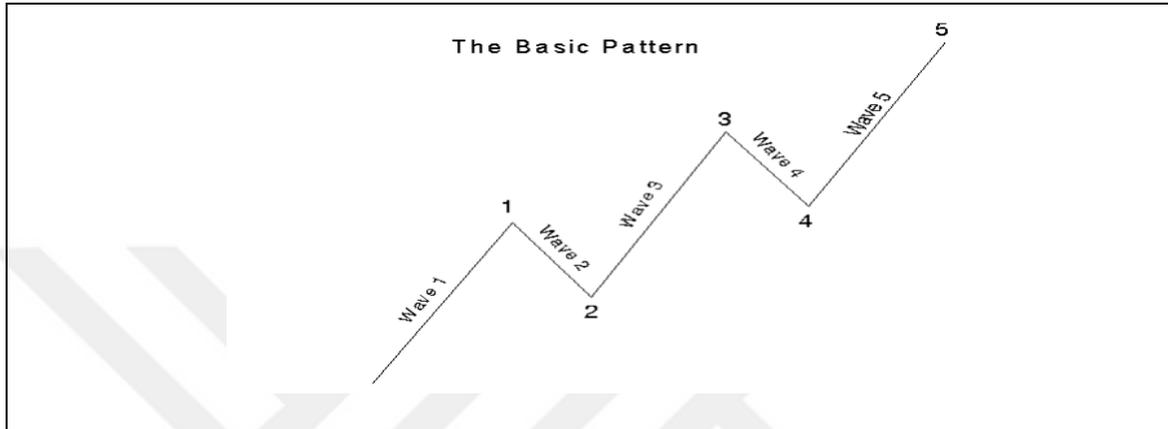


Figure 3.9: The Five-Wave Pattern

Source: A.J. Frost R. Pretcher, 2006:8

Under the wave principle those patterns occur naturally according to a basic rhythm. This rhythm completes two basic phrases: **The Motive (Impulse) Phase and The Corrective Phase**. Numbers denotes the motive phase and letters denote corrective phase. Motive waves move as trend in the same direction and consists five subwaves, while corrective waves consists three subwaves and moves against the trend. Under the Elliot wave principle, one cycle completes eight waves that is made up of two distinct phases. Elliot designed Nine Degrees of Waves' Cycle, which is referred on the Table 3.4: Nine Degrees of Wavesabove (Jenkins, 1991, p. 58)

One Complete Cycle = Impulse (motive) waves + Correction waves

Grand-Supercycle	[I] [II] [III] [IV] [V]	[A] [B] [C]
Supercycle	(I) (II) (III) (IV) (V)	(A) (B) (C)
Cycle	I II III IV V	A B C
Primary	I II III IV V	A B C
Intermediate	[1] [2] [3] [4] [5]	[a] [b] [c]
Minor	(1) (2) (3) (4) (5)	(a) (b) (c)
Minute	1 2 3 4 5	a b c
Minuette	1 2 3 4 5	a b c

Table 3.4: Nine Degrees of Waves

Source: (A.J. Frost R. Pletcher, 2006: 10)

The Wave Principle states that waves in any degree subdivide and re-subdivide into waves of minor degree and are components of waves of higher degree. Numbers of waves at each degree can be illustrated as below on the below

Figure 3.10 (Jenkins, 1991, p. 59)

Number of Waves at Each Degree:

The Largest Waves $1+1=2$;

The Largest Subdivisions $5+3=8$;

Next Subdivisions $21+13=34$;

Next Subdivisions $89+55=144$ (Frost A.J & R. Pretche, 2006, pp. 10-12)

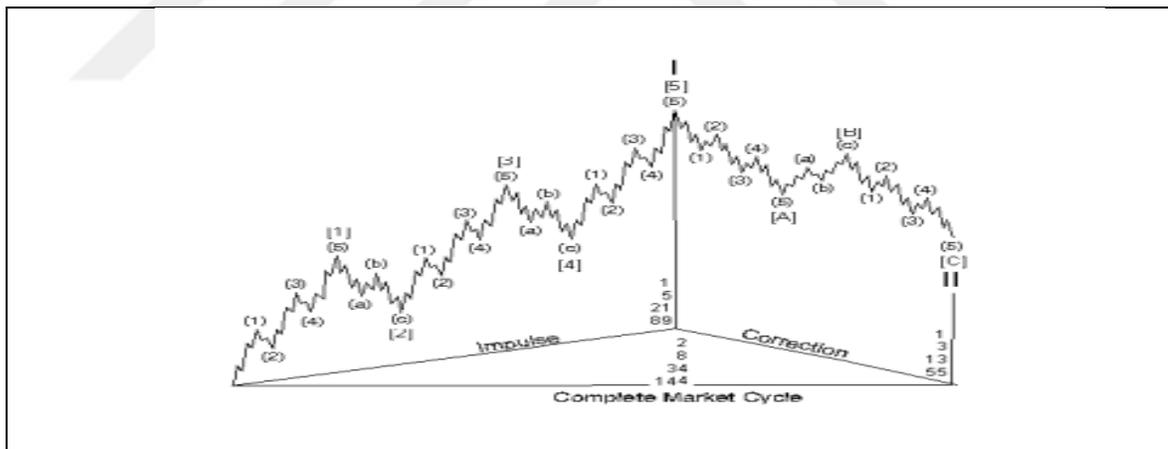


Figure 3.10: Complete Market Cycle

Source: A.J. Frost R. Pletcher, 206

Those waves are basically different according to their roles and construction. Motive waves do not always move upward and corrective waves do not always move downward. The mode of a wave is determined not by its absolute direction but primarily by its relative direction. Motive waves powerfully impel the market, while Corrective waves commit a partial retracement or in other words correction of the progress achieved by motive wave. (Bickford , 2007, pp. 86-87)

Variability of forms and difficulty to identify degrees make Elliot Wave Principle an intellectual challenge. The main reason of difficulties is that wave degree is not relied on the specific price or time length. They depend on form, which is a function of both price and time. The degree of a form is determined by its size and position related to component waves. (Frost A.J & R. Pretche, 2006, p. 16)

3.7.1 Motive Waves

Motive waves obtain five subwaves and always move the same direction of trend's larger degree. Motive waves are straightforward and easy to recognize. The main purpose of a motive wave is to make progress and assure formation of rules. Within motive waves: (Poser, 1998, pp. 8-10)

- Wave 2, never retraces more than 100% of wave 1;
- Wave 4, never retraces more than 100% of wave 3;
- Wave 3, always travels beyond the end of wave 1;
- Wave 3 is often the longest and never the shortest among the three actionary waves 1 and 5 of a motive wave; and this rule is done, as long as wave 3 undergoes a greater percentage movement than either wave 1 or 5;
- Wave 3 is the most commonly extended wave;
- If the wave1 and wave3 are about equal length, the fifth wave will be prolonged and wave 4 may not overlap wave 1. (Poser, 1998, pp. 13-15)

There are two types of motive waves: **Impulses and Diagonal Triangles**. The most common motive wave is an impulse. It also called guideline and work as a ruler because it governs all waves to which it applies. The impulse formation includes: extensions, truncations, alternations, equality, channeling, personality and ratio relationships. For example:

Extension is prolonged impulses with numbers of subdivisions. The most of the impulse waves contains an extension just only in one of the three actionary subwaves. These subdivisions of extended by the same width of waves, as it is illustrated on the

Figure 3.11 below.

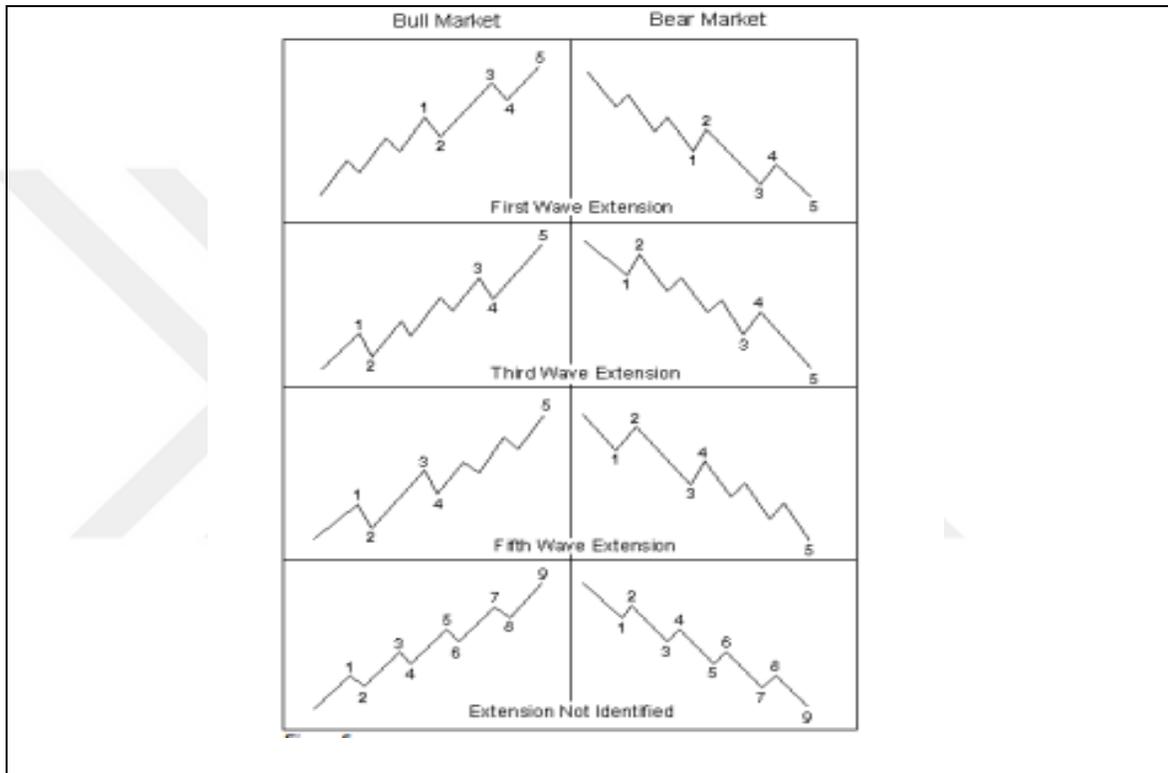


Figure 3.11: Bull and Bear Market Extension

Source: A.J. Frost R. Pletcher, 2006: 12

Truncation or in other words, as Elliott called “failure” which occurs when the fifth wave does not move beyond the end of the third. A truncation is usually confirmed when the fifth wave necessary contains the five subwaves. (Figure 3.12)

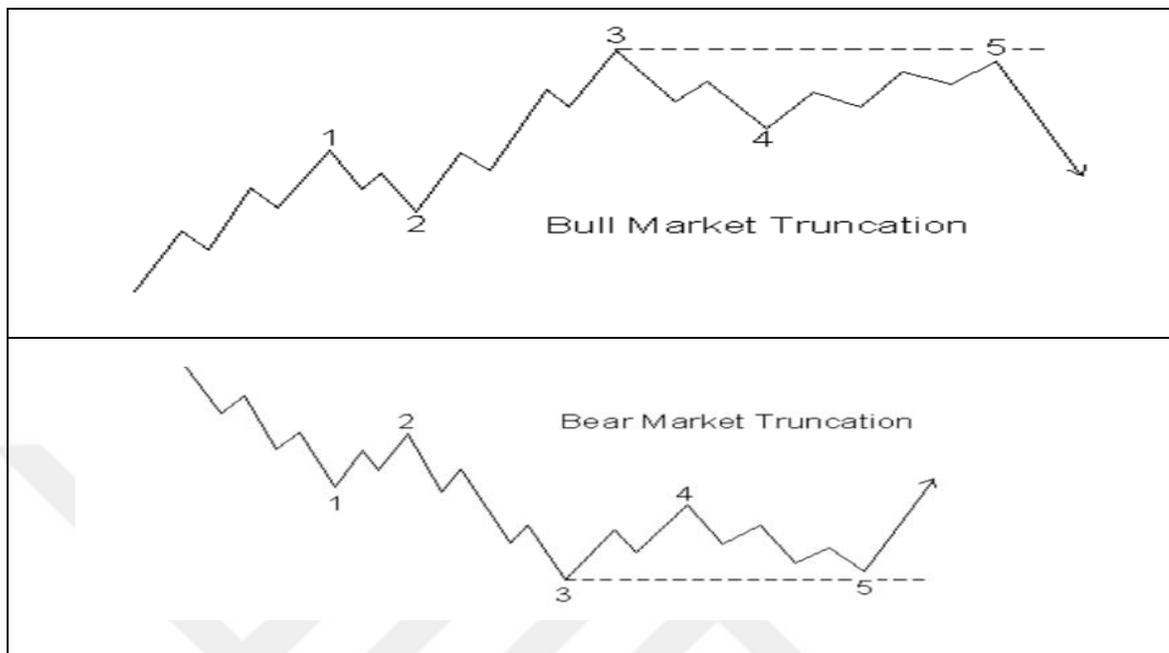


Figure 3.12: Bull and Bear Market Truncation

Source: A.J. Frost R. Pletcher, 2006: 14

A diagonal triangle is a motive pattern however not an impulse, because it has corrective characteristic. Diagonal triangles are part of the impulse waves at specific locations in the wave structure. In diagonal triangles, third sub-wave is never the shortest and wave four usually moves into the price territory of wave one. **An ending diagonal** (Figure 3.13) is a special type of triangles that occurs usually in the fifth wave position and they take 3-3-3-3-3 shape, when diagonal triangles occur in the 5 or C wave.

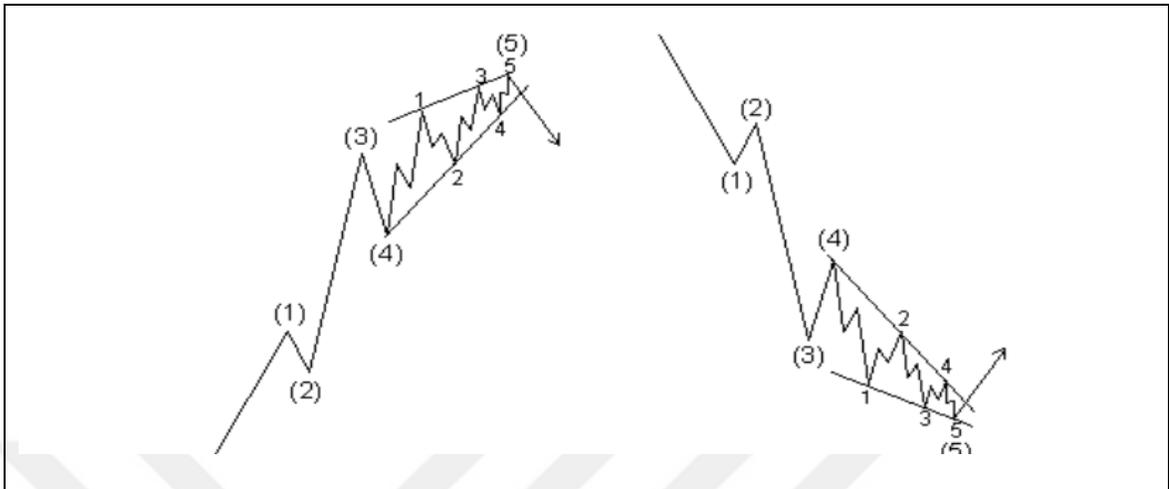


Figure 3.13: Diagonal Triangle

Source: A.J. Frost R. Pletcher, 2006: 16

If diagonal triangle occurs in the wave A position of zigzags, it takes 5-3-5-3-5 shape. The ending diagonal in this position normally carries the continuation function in wave structure.

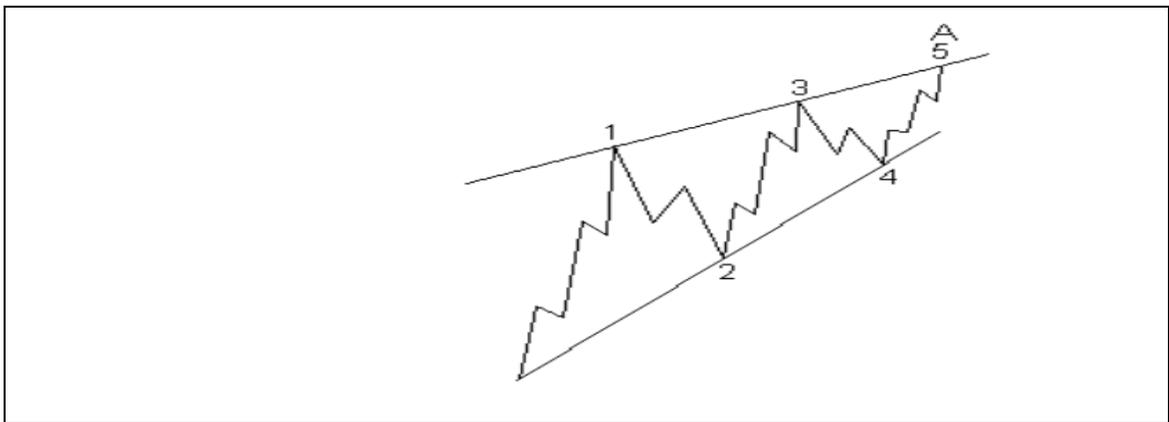


Figure 3.14: The Five Wave Pattern

Source: A.J. Frost R. Pletcher, 2006: 17

3.7.2 Corrective Waves

Corrective waves are less clearly identifiable than motive waves. It is difficult to fit corrective waves into recognizable patterns until they are completed. However, single and the most important rule of corrective waves is that corrections are never fives. Only motive waves are fives. Corrective processes come in two styles: Sharpe corrections and sideways corrections. There are four main categories corrective patterns: (Murphy, 1999, pp. 324-326)

- Zigzags (5-3-5) includes three types: single, double and triple;
- Flats (3-3-5) includes three types: regular, expanded and running;
- Triangles (3-3-3-3) includes four types: three of the contracting variety (ascending, descending and symmetrical) and one of the expanding variety (reverse symmetrical);
- Double threes and triple threes that are combined structures. (Murphy, 1999, p. 328)

Zigzags in a bull market are a simple three wave reversing pattern labeled A-B-C. The sub-wave sequence is 5-3-5 and the top of wave B is noticeably lower than the start of wave A. In a bear market a zigzag correction takes place in the opposite direction. There can be a double zigzag or triple zigzag formatted, in this case they are separated by “an intervening three”, as it is shown on the Figure 2.15. The entire pattern is counted as “W-X-Y (-X-Z)” (Figure 3.15) the letter “W” now denotes the first corrective pattern in a double or triple correction, Y the second and Z the third of a triple. (Williams, 1999, pp. 15-20)

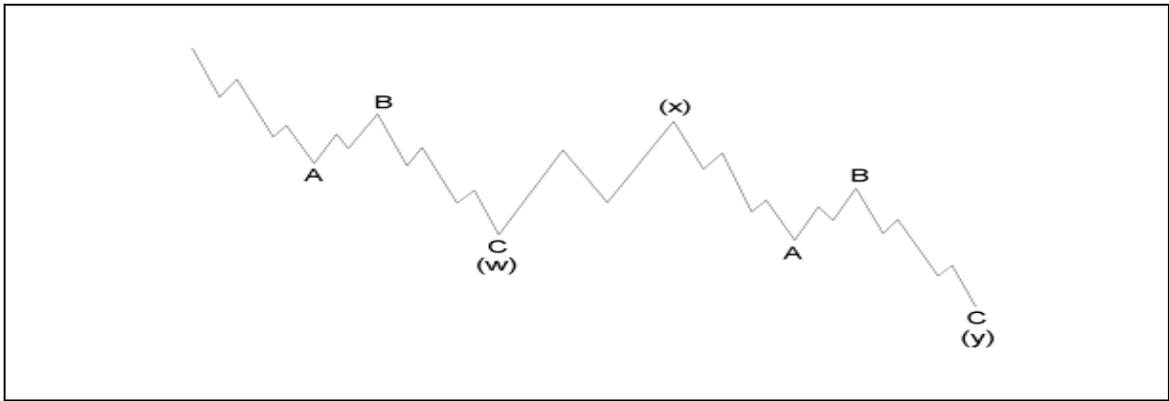


Figure 3.15: Zigzags

Source: A.J. Frost R. Pletcher, 2006:20

Flats subwave sequence is 3-3-5. (Figure 3.16) The first actionary wave A folds into three five waves, unlikely the zigzag formation. Wave B begins near the start of wave A and has a lack of counter trend pressure. Wave C moves slightly beyond the end of wave A but not as significantly as in zigzag formation. (Williams, 1999, p. 21)

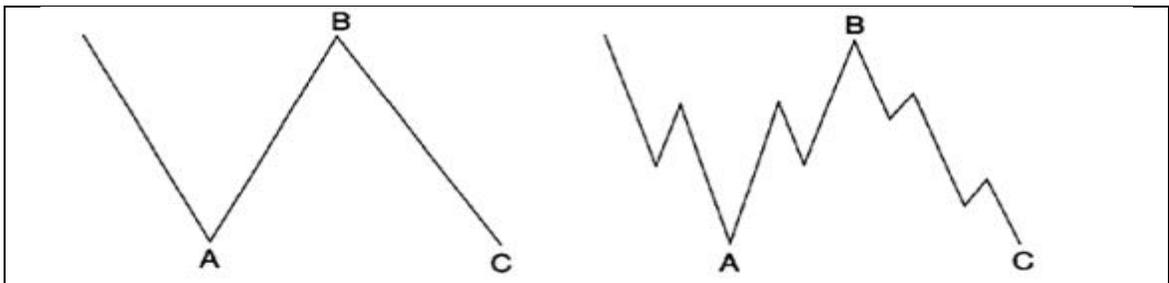


Figure 3.16: Flats

Source: A.J. Frost R. Pletcher, 2006: 25

Triangles show a balance of forces. Triangles contain five overlapping waves that subdivide 3-3-3-3-3 and are labeled a-b-c-d-e. (Figure 3.17) There are two varieties of triangles: contracting and expanding. Within the contracting triangles, there are three

type triangles: symmetrical, ascending and descending. There are no variations on the expanding triangle. (Williams, 1999, pp. 22-23)

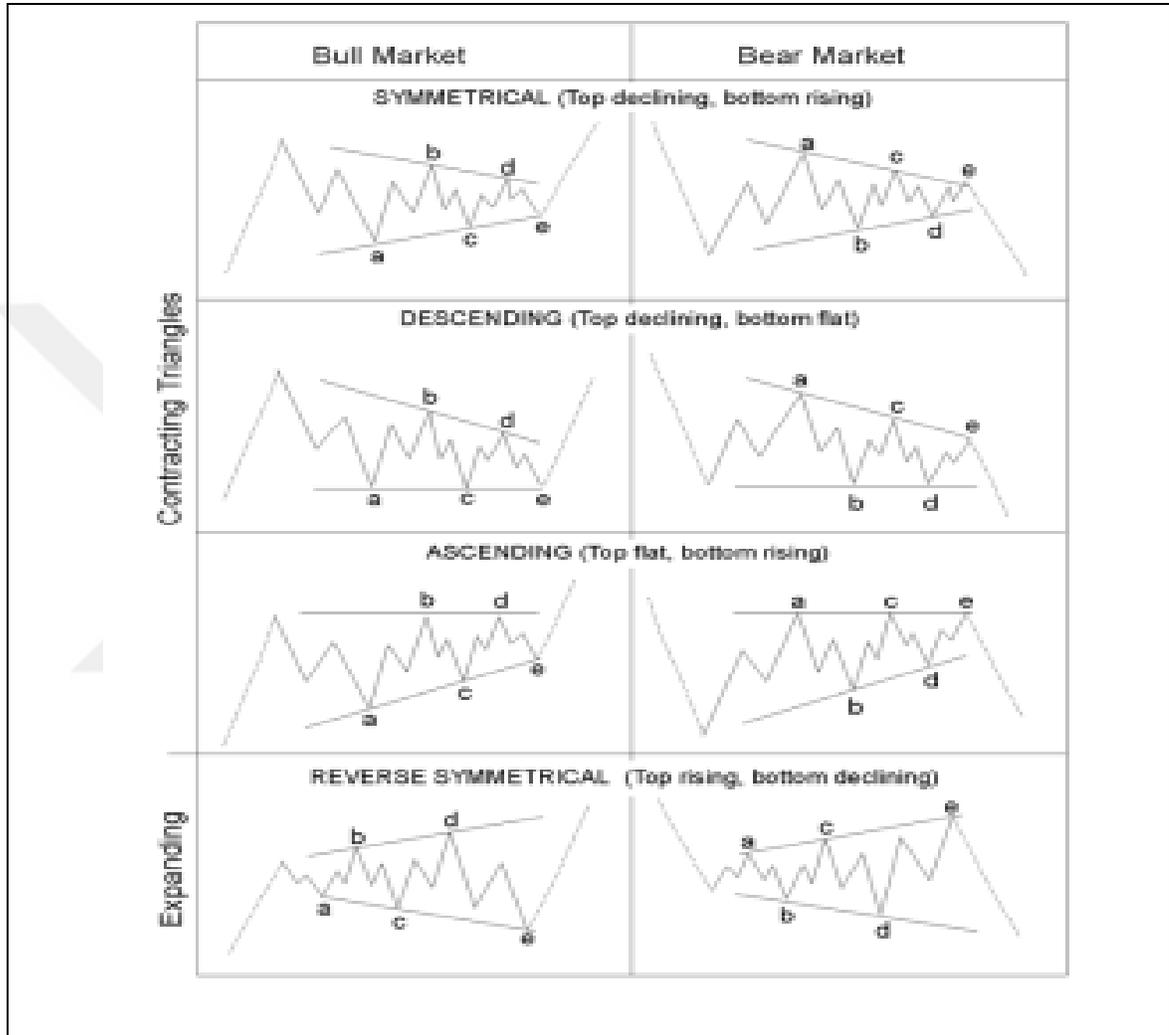


Figure 3.17: Triangles

Source: A.J. Frost R. Pletcher, 2006: 27

“Double Threes” and “Triple Threes” are patterns called corrective combinations. **Corrective Combinations** (Figure 3.18 and Figure 3.19) are a kind of correction, which combines various types of zigzags, flats and triangles. Characteristic of double threes and triple threes is that its horizontal formation. In other words, their occurrence extends

a sideways action and appears to be the flat correction. Each simple corrective pattern is labeled W, Y and Z. For example, a flat followed by a triangle is a more typical type of double three. Flat followed by a zigzag is another example (figure 2.19). (Williams, 1999, p. 25)

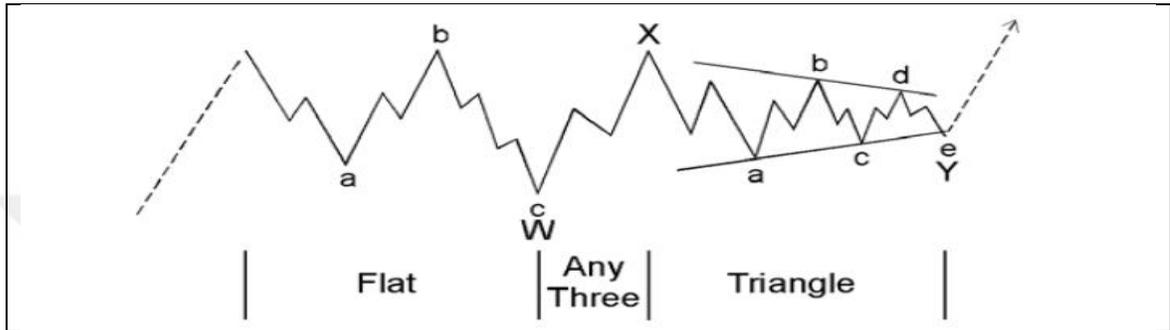


Figure 3.18: Corrective Combinations (Flat/Triangle)

Source: A.J. Frost R. Pletcher, 2006: 40

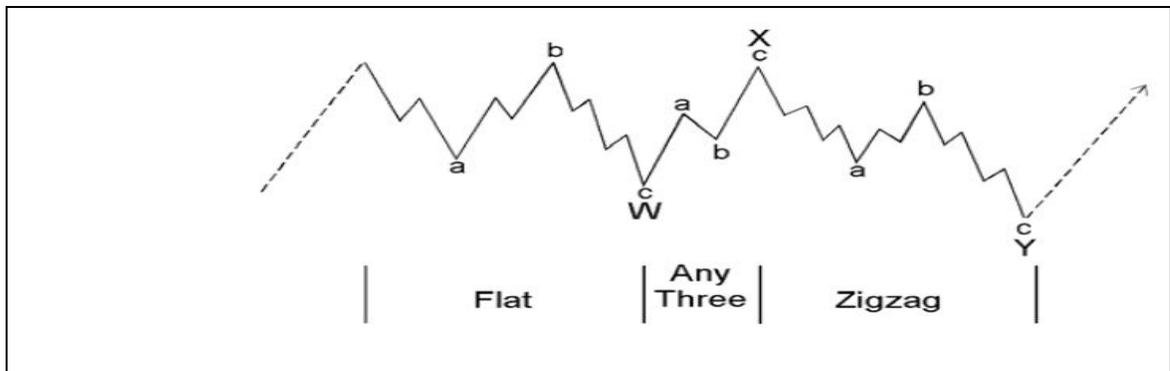


Figure 3.19: Corrective Combination (Flat/ Zigzag)

Source: A.J. Frost R. Pletcher, 2006: 40

Thus, we can summarize their labels as follows:

- The actionary waves are labeled as 1, 3, 5, A, C, E, W, Y and Z.
- The reactionary waves are labeled as 2, 4, B, D and X.

3.8 FIBONACCI SEQUENCES

Leonardo Fibonacci figured out the relationship that is well known as the Fibonacci Numbers, while studying the Great Pyramid of Gizeh in Egypt. The Fibonacci Numbers is a simple sequence, in which each number is the sum of the two previous numbers: 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 610...etc. These numbers have an interesting and verity numbers of interrelationship. For example: Any given number in the sequence is about 1.618 times the preceding number. Any given number is approximately 0.618 times the following number. (Murphy, 1999, p. 337)

There are five popular Fibonacci studies: Fibonacci Ratios, Fibonacci Arcs, Fibonacci Fans, Fibonacci Retracements and Fibonacci Time Zones. **Fibonacci Ratios** are the most popular techniques in Fibonacci studies that are used for trading purpose. Those ratios are mathematical ratios derived from the Fibonacci sequence. They can be illustrated as bellow: **Ratios: 0.14; 0.25; 0.38; 0.5; 0.618. Multiples: 1; 1.618; 2.618; 4.23; 6.85.** Fibonacci rations are best fitted for short term trading. Fibonacci Rules for Waves are as follow: (Williams, 1999, pp. 115-120)

- Wave 2 is always related to wave 1. Wave 2 equals either, 50% of wave 1 or 62% of wave 1. (Figure 3.20)

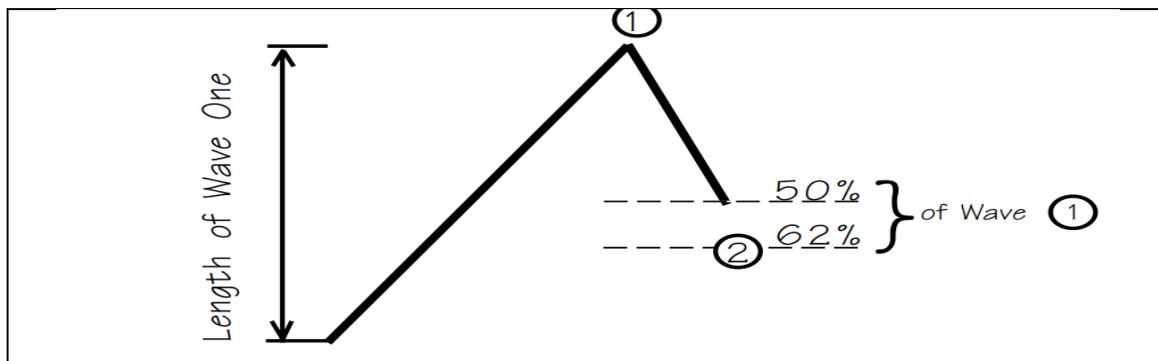


Figure 3.20: Length of Waves 2

Source: B. Williams, 1999: 32

Wave 3 related to the wave 1 is either equal to 1.62 times length of wave 1, or 2.62 times length of wave 1, or 4.25 times length of wave 1. The most common multipliers are 1.62 and 2.62. However if the wave 3th is the extended wave, then 2.62 and 4.25 ratios are more common. (Figure 3.21) (Williams, 1999, p. 127)

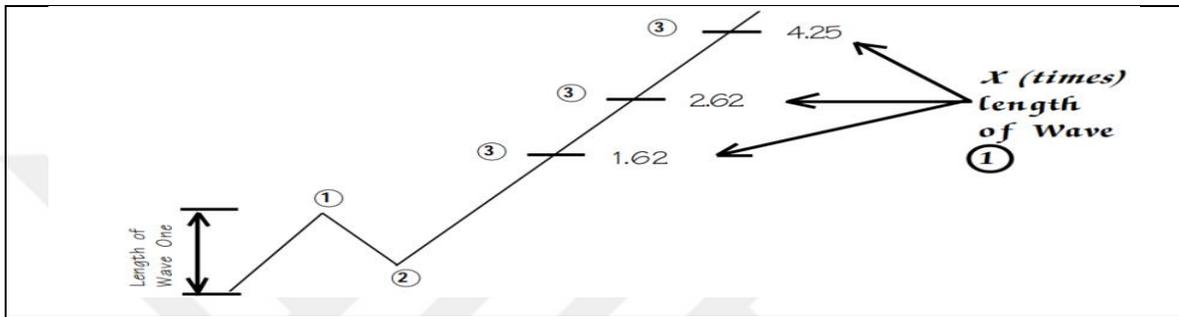


Figure 3.21: Length of Waves 3

Source: B. Williams, 1999: 40

- Wave 4 related to wave 3, either equals to 24% of wave 3, or 38% of wave 3, or 50% of wave 3. (Figure 3.22) (Trading Techniques, 1999, p. 39)

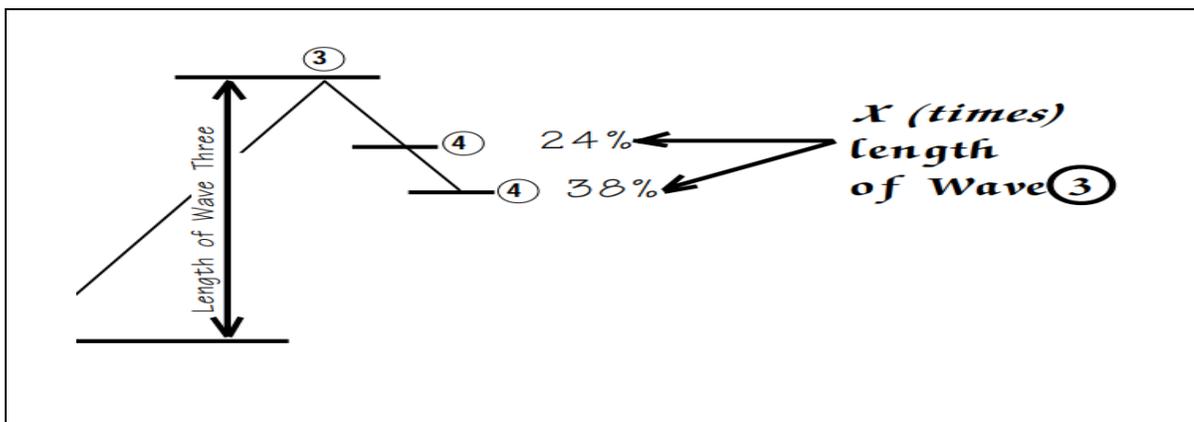


Figure 3.22: Length of Wave 4

Source: B. Williams, 1999: 43

Wave 5 (Figure 3.23) has two different types of relationships:

1) If wave 3 is greater than 1.62 or extended, then wave 5 equals either to wave 1, or 1.62 times to wave 1 or 2.62time to wave 1.

2) If the wave 3 is less than 1.62, then the wave 5 either equals to 0.62 times length of beginning of wave1 to top of wave3 or length of beginning of wave one to top of wave three or 1.62 times length of beginning of wave one to top of wave three. (Trading Techniques, 1999, p. 45)

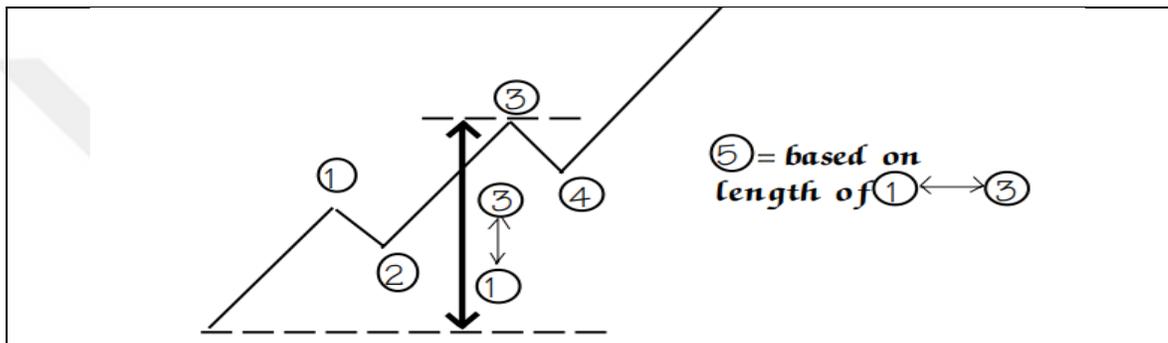


Figure 3.23: Length of Waves 5

Source: B. Williams, 1999: 45

Fibonacci Retracements are drawn as a trendline between two extreme points of trough and opposing peak. A series of nine horizontal lines are drawn intersecting the trendline at the Fibonacci levels of 0.0%, 23.6%, 38.2%, 50%, 61.8%, 100%, 161.8%, 261.8%, and 423.6%. After a significant price move (either up or down), prices will often retrace from the original move. As prices retrace, support and resistance levels often occur at or near the Fibonacci Retracement levels. Generally, prices are expected to be retraced near the Fibonacci levels of 23 and 38%. Correction of price is expected to be till 50% and 61, 8% of Fibonacci Numbers. (Kennedy, 1996, p. 549)

CHAPTER IV

4 APPLICATION ON INTERNATIONAL PORTFOLIO

4.1 PURPOSE AND IMPORTANCE OF RESEARCH

In this work, fundamental and technical analysis models are used to evaluate an International Index Portfolio. The Black-Litterman model diversifies the index portfolios. The key point in Black-Litterman model is estimating individual investor's views. In this work, Capital Asset Pricing Model and Technical Analysis Techniques estimate the investors' views. This work aims to determine, profitable methodology of portfolio selection process. For the purpose, two methodologies were constructed, first, using Capital Asset Pricing Model in the B-L formula to calculate personal investor's views, select optimized portfolio, calculate Black-Litterman portfolio returns and finally estimate portfolio performances and second methodology is to use Technical Analysis Model to calculate personal investor's views, select optimized portfolio, calculate Black-Litterman portfolio returns and finally estimated portfolio performances. For this purpose, 10 international indices monthly portfolio performances are examined. The research is done separately every month from January until December in 2018 year; accordingly, 12 separated portfolios are evaluated.

4.2 DATA AND METHODOLOGY

4.2.1 Data Set of Research

The International Index Portfolio is evaluated by combining 10 international indices: Those indices are chosen according to *The Market Capitalization Rate*. As it is

illustrated on the Table 4.1 below .The indices price historical date is taken form the website: www.inesting.com .Daily Closing Prices of Indices are used for analysis of international portfolio. Analysis period is defined as 01/01/2018 until 31/12/2018. Thus, 12 different portfolios are combined. Calculation for Black-Litterman model is done on Excel (Microsoft excel 2010) and technical analysis is done on the website: <https://live.trading212.com/> (Demo Version).

Table 4.1: Market Capitalization Weight

N	Market TYPE (Index)	Index	MARKET (Country)	MARKET CAPITALIZATION (TRILLION)	PERCENT
1	New York Stock Exchange	NYSE	USA	23.12	34.78%
2	NASDAQ	NASDAQ	USA	10.93	16.44%
3	Tokyo Stock Exchange	NIKKEI	JAPAN	6.22	9.36%
4	Shanghai Stock Exchange	SSE	CHINA	5.01	7.54%
5	Hong Kong Stock Exchange	HSI	HONGKONG	4.46	6.71%
6	London Stock Exchange	FTSE	UK	4.38	6.59%
7	Euronext	EURONEXT	France	4.36	6.56%
8	Shenzhen Stock Exchange	SZSE	CHINA	3.49	5.25%
9	Toronto Stock Exchange	TSX.	CANADA	2.29	3.44%
10	Deutsche Boerse	DAX	GERMANY	2.22	3.34%
	Totally			66.48	100.00%

Test of normality is done on SPSS (IMB SPSS Statistics 25). The results obtained by SPSS are shown on the Table 4.2 below. As a Kolmogorov-Smirnova test of normality, we believe that we **reject the null hypothesis if $p < 0.05$** , in other words, if $p < 0.05$, our variables does not follow a normal distribution. In the K-S test we consider sig. results on SPSS outputs. Thus, indices: NYSE, NASDAQ, TSX, SZS are not normally disturbed. So far, we normalize index returns date, in order to apply Black-Litterman model. This date is normalized on SPSS by data normalization techniques.

Table 4.2: Test of Normality

	Kolmogorov-Smirnova			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
NYSE	0.111	190	0.000	0.917	190	0.0000
NASDAQ	0.107	190	0.000	0.954	190	0.0000
NIKKEI	0.064	190	0.056	0.972	190	0.0010
SSE	0.063	190	0.067	0.975	190	0.0020
HIS	0.063	190	0.065	0.976	190	0.0020
FTSE	0.058	190	.200*	0.988	190	0.0920
EURONEXT	0.054	190	.200*	0.989	190	0.1430
SZSE	0.459	190	0.000	0.075	190	0.0000
TSX.	0.356	190	0.000	0.141	190	0.0000

DAX	0.051	190	.200*	0.991	190	0.3110
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4.2.2 Methodology of Research

Analysis of those portfolios is divided into three parts. First, applying Black-Litterman model to monthly portfolios, second, applying technical analysis indicators and finally comparing obtained results each other.

Calculation in Black-Litterman method covers two main phrases. First, one is named as prior information and information set in formula contains the excess returns and historical covariance matrix of those excess returns.

The second information set in Black-Litterman model is named as investor's views. Those are derived according to CAPM and Technical Analysis.

Thus, Strategy of Black-Litterman model is as followed:

1. Obtain the excess returns and historical covariance matrix as the prior information set.
2. Obtain investor's views.
3. Blend this set of information via the Black-Litterman method.
4. Use this posterior information in the optimization process in order to find the optimum weights.
5. Measure portfolio returns, risk and portfolio performance.

Strategy of Technical Analysis:

1. Observing the entire chart history, according to figure out proven levels, mark those proven levels and draw Support and Resistance levels as important price barriers.
2. Detecting general trend whether flat or upward movement or down sloping. Noting the type of personality the trend has (Double tops, Triangle, Head and Shoulders) and make sure that they follow assumed trend direction.

3. Applying some Elliot waves such as Zig-zag according to identify general movement of trend. Detect a proper strategy, while observing if accumulation (Bull Market), distribution (Bear Market) or correction is going on.
4. Looking at Japanese chart patterns near the market levels as a bullish and bearish confirmation and note if the patterns are volatile enough to trade.
5. Using RSI, MACD and Volume technical Indicators as a confirmation of buy and sell signals.
6. Find Fibonacci levels; determine a target price using Fibonacci retracements.
7. Put a stop loss order in 1% of price.
8. Close position after price open at the determined target price or declares till the stop loss limitation.

4.3 APPLICATION ON TECHNICAL ANALYSIS

The trading period for this portfolio is determined as 1st of January – 31st of December 2018 year. Trading range is given from May 2017 until December 2018. The historical data is given to detect general price movements and trends. The technical analysis strategy is presented in the methodology of application. The DAX index analysis is illustrated step by step, there are given detailed information of every buy and sell signals, indicators, patterns, trend movement detectors, proven prices, Elliot waves, Fibonacci Retracements, however the rest of other indices are explained shortly, as far as the methodology of analyzing indices are the same for any indices. They are presented in the appendix.

DAX (Currency Euro) Figure 4.1, Figure 4.2: Technical Analysis DAX



Figure 4.1: Technical Analysis DAX



Figure 4.2: Technical Analysis DAX

There are four important price bounces detected on trend. The lowest price on trading ranges is 11933.0, followed by 12845.5, 13191.0 and 13522.5 that are also marked as the highest price in the current trading period. There is an accumulation phrase in May 2017, followed by an uptrend movement. Assuming this, we enter a buy position on 03.01.2018 at the price of 12855, 5 and determine the exit position at the previous resistance level.

Thus, few indicators confirm opening position on 03.01.2018: A doji pattern shows trend reversal. MACD indicator also shows positive value and it crosses over the signal level that means that MACD shows buy signal. At the same time, increasing prices is followed by increasing volume. RSI is 42.13. We are expecting price to reach at the previous resistance level. We close the position on 23.01.2018, at the price of 13545.0.

February- After a doji pattern on 28.01.2018 we wait for two more bars as a confirmation of downtrend movement, we enter a sell position on 31.01.2018 at the price of 13355.0, where a doji star confirms a trend reversal. MACD also is negative value and crossing below the signal line that indicates sell position. RSI is 66.7. Here Fibonacci retracements are used for indicating an exit signal and for counting the correction of trend. The most important levels in Fibonacci Retracement are 50.00% and 61.80%. In this position, prices retrace until 38.20 so we do not closing position until price movement goes previous support level. It bounces at the previous support level on 02.03.2018(**March**), where MACD crossover indicates trend reverse and RSI is 33.13. Thus; we close there the sell position at the price of 11975.0 and enter a buy position. We close this position at the doji start pattern on 17.03.2018 at the price of 12375.5, where MACD crossover indicates changing of the trend; also, volume increasing declares beginning of upward movement and ending of previous correction wave.

April –May- We can notice head and shoulder formation form 08.02.2018 until 22.03.2018 (price 11785.5) it breaks neckline on 23.03.2018, which indicates, trend reverse. In addition, RSI is 37.8. Thus, we enter a buy position. It passes Fibonacci 61.8% and goes beyond it, which shows that it is up trend and it does not have corrected feature anymore. We exit from the position on 22.05.2018 at the price of 13145.0, which is confirmed by breaking the previous resistance level and MACD crossover and overbought level of RSI with value of 68.2.

June- After 22.05.2018 there is a formation of head and shoulder, when price starts declaring investors buy an index and give impulse of trend to move upward till the previous top of head and shoulder formation. When it achieves second top of head and

shoulders formation, investors who caught an opportunity to sell when it was at the previous top, they will start exiting from market and price will start declining. Thus, on 15.06.2018 when price achieves at the top of formation and prices starts declining we enter a sell position at the price of 13113.0 and exit the position on 27.06.2018 at the price of 12228.0, which is confirmed by doji which states that trend reverse and volume increases can be clarified as trend reversal and uptrend starting point.

July- We enter a buy position on 04.07.2018 at the price of 12280.0, after doji and next two bars conformation, also, MACD crosses over the signal line RSI is 38.18 and close position on 30.07.2018 at the price of 12807.5, when doji detects trend reversal and MACD shown negative value.

It is clear that from 15.06.2018- C Elliot corrective wave is in action and trading on this market is maintained by sell position why following main downward slope and buy position while following it retrace and subwaves of main wave of C.

Trend start declining and we enter the sell position after two bars confirmation on 03.08.2018 at the price of 12660.0 and close the position at the price of Price 12206.5, on 17.08.2018 because reversal doji confirmation. For confirmation of retrace, we use Fibonacci levels of 50.0% and 61.8% and assume that, when prices hit those levels it is important signal of changing of movement. It hits 50% on 30.08.2018 and after two bars of confirmation downtrend; we enter a sell position on 03.09.2018 at the price of 12333.5 and close it on 14.09.2018 at the price of 12006.0 when doji confirms trend reverse.

Last quarter of 2018 is wave (c) corrective wave. It is defined as a downtrend. Nevertheless, during a downtrend there are some retracements. Where we go on buy order: **September** (12.09.2018-02.10.2018) - Enter a buy position- Open Price: 11965.5 – exit the position- Close Price: 12308.5. Moreover, **November** (30.10.2018-03.12.2018) - Enter a buy position- Open Price: 11218.5 – exit the position- Close Price: 11454.0. Whereas **October** (02.10.2018- Enter a sell position- Open Price: 12308.5. MACD crossover crosses below the signal line. RSI is 60.56, and exit the position, 29.10.2018) - Close Price: 11300.0 **and December** (03.12.2018-29.10.2018) - Enter a

sell position- Open Price: 11454.0– exit the position- Close Price: 10305.0 are sell signals.

January (03.01.2018-23.01.2018) – Enter a buy position- Open Price: 12855.5 – exit the position- Close Price: 13545.0.

February (31.01.2018-02.03.2018) – Enter a sell position- Open Price: 13355.0 – exit the position- Close Price: 11975.0.

March (02.03.2018-17.03.2018) – Enter a buy position- Open Price: 11975.0 – exit the position- Close Price: 12375.5.

April-May (23.03.2018-22.05.2018) – Enter a buy position- Open Price: 11785.5– exit the position- Close Price: 13145.0.

June (15.06.2018-28.06.2018) - Enter a sell position- Open Price: 13113.0 – exit the position- Close Price: 12228.0.

July (04.07.2018-30.07.2018) - Enter a buy position- Open Price: 12280.0– exit the position- Close Price: 12807.5.

August (30.07.2018-10.09.2018) - Enter a sell position- Open Price: 12807.5– exit the position- Close Price: 12013.5.

September (12.09.2018-02.10.2018) - Enter a buy position- Open Price: 11965.5 – exit the position- Close Price: 12308.5.

October (02.10.2018-29.10.2018) - Enter a sell position- Open Price: 12308.5– exit the position- Close Price: 11300.0

November (30.10.2018-03.12.2018) - Enter a buy position- Open Price: 11218.5 – exit the position- Close Price: 11454.0

December (03.12.2018-29.10.2018) - Enter a sell position- Open Price: 11454.0– exit the' position- Close Price: 10305.0

4.4 APPLICATION ON BLACK- LITTERMAN MODEL

4.4.1 The Prior

The prior information set in formula of Black-Litterman contains the excess returns implied by CAPM (Table 4.5) and technical analysis (Table 4.6) and historical covariance matrix of those excess returns. Calculating CAPM requires prior information set: there are risk-free rate and risk portfolios Betas (Table 4.3: Risk Free Rate/Risk Premium and Table 4.4 below) calculated by the Regression Analysis in excel.

Table 4.3: Risk Free Rate/Risk Premium

DATE	Risk Premium (RMkt-rF)	Risk Free Rate(rF)
2018-January	0.231	0.005
2018- February	-0.182	0.006
2018- March	-0.106	0.006
2018-April	0.019	0.007
2018May	0.121	0.006
2018-June	0.024	0.006
2018-July	0.152	0.008
2018-August	0.148	0.007
2018-September	0.005	0.008
2018-October	-0.337	0.008
2018-November	0.088	0.008
2018-December	-0.508	0.010

Resources: Fama-French 3 Factor-Daily

Table 4.4: Portfolio Beta

DATA	NYSE	NASDAQ	NIKKEI	SSE	HSI	FTSE	EURNX.	SZSE	TSX.	DAX
January	0.009	0.002	0.002	0.002	-0.001	0.004	0.003	0.000	0.001	0.004
February	0.001	0.010	-0.001	-0.003	-0.002	0.001	0.002	0.000	0.006	0.002
March	0.000	-0.002	0.000	0.000	0.002	-0.001	-0.001	0.003	-0.001	-0.002
April	-0.003	0.002	0.001	0.003	0.000	0.002	0.002	0.000	0.001	0.002
May	-0.002	-0.002	0.004	0.001	0.001	0.003	-0.004	0.006	0.007	-0.002
June	0.009	0.014	0.004	-0.007	0.008	0.006	0.005	0.012	-0.001	0.008
July	0.000	0.005	0.002	-0.007	-0.007	-0.004	-0.002	-0.006	-0.001	-0.003
August	-0.001	-0.003	0.002	0.001	0.007	0.000	0.001	-0.012	-0.004	0.003

September	-0.005	0.014	-0.003	0.010	-0.010	0.004	-0.002	-0.014	0.010	-0.005
October	0.001	-0.003	0.001	-0.001	0.005	-0.001	-0.001	0.005	-0.001	0.000
November	0.000	0.001	0.001	0.004	-0.001	-0.001	-0.001	0.001	0.000	0.000
December	0.003	-0.002	-0.001	0.001	0.001	-0.002	-0.001	0.000	0.000	0.003

Table 4.5: CAPM Excess Returns

INDEX	January	February	March	April	May	June	July	August	September	October	November	December
NYSE	0.70%	0.58%	0.57%	1.28%	0.55%	1.51%	0.79%	0.72%	0.76%	0.82%	0.83%	0.79%
NASDAQ	0.53%	0.36%	0.86%	0.16%	0.56%	2.08%	0.97%	0.74%	0.54%	0.75%	0.93%	1.13%
NIKKEI	0.54%	0.63%	0.40%	0.41%	0.70%	1.06%	0.86%	0.68%	0.74%	0.82%	0.92%	1.10%
SSE	0.54%	0.66%	0.66%	0.04%	0.63%	-0.12%	0.55%	0.68%	0.59%	0.79%	1.37%	0.90%
HIS	0.49%	0.65%	0.39%	0.77%	0.62%	1.40%	0.56%	0.61%	0.82%	0.87%	0.65%	0.95%
FTSE	0.58%	0.58%	0.72%	0.19%	0.66%	1.22%	0.67%	0.70%	0.66%	0.78%	0.72%	1.13%
EURONEXT	0.57%	0.56%	0.77%	0.34%	0.51%	1.15%	0.72%	0.68%	0.72%	0.78%	0.66%	1.06%
SZSE	0.51%	0.60%	0.21%	0.76%	0.75%	1.85%	0.60%	0.86%	0.85%	0.88%	0.98%	1.00%
TSX	0.52%	0.46%	0.67%	0.48%	0.77%	0.46%	0.77%	0.75%	0.59%	0.79%	0.78%	1.00%
DAX	0.60%	0.56%	0.79%	0.15%	0.54%	1.40%	0.68%	0.66%	0.75%	0.81%	0.77%	0.77%

Table 4.6: Technical Analysis Excess Returns

Index	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
NYSE	5.69%	5.78%	8.58%	11.00%	0.57%	2.89%	1.99%	3.47%	2.35%	9.77%	10.76%	13.21%
NASDAQ	8.04%	10.18%	8.72%	1.55%	1.99%	1.42%	2.13%	2.21%	2.92%	7.21%	8.28%	7.48%
NIKKEI	5.54%	9.92%	6.33%	6.78%	2.92%	3.24%	2.16%	2.70%	3.35%	4.01%	5.18%	4.68%
SSE	3.00%	10.14%	5.30%	4.11%	5.28%	5.47%	1.82%	8.71%	9.33%	10.94%	9.50%	6.90%
HIS	9.85%	10.26%	2.20%	4.72%	2.59%	1.10%	2.75%	4.13%	4.82%	2.48%	4.20%	4.90%
FTSE	6.36%	6.34%	5.59%	6.22%	6.01%	1.98%	1.79%	2.23%	1.95%	2.82%	3.02%	2.72%
EURONEXT	4.85%	8.10%	12.22%	2.42%	1.99%	3.04%	2.33%	5.76%	7.17%	9.43%	7.86%	5.59%
SZSE	0.00%	9.68%	4.91%	4.21%	12.00%	2.59%	4.29%	5.59%	2.82%	3.54%	3.36%	7.43%
TSX	5.57%	10.65%	5.41%	1.85%	3.65%	5.45%	3.70%	4.41%	2.84%	8.40%	9.53%	5.60%
DAX	5.36%	10.33%	4.71%	5.87%	4.30%	6.75%	4.30%	4.65%	4.42%	8.19%	2.10%	10.03%

4.4.2 The Investor Views

The second information set in Black-Litterman model is the investor's views and contains historical asset returns and the historical covariance matrix. First investor's views are driven by using CAPM model that is given on Table 4.7 below: and second, investor's views are driven by technical analysis techniques that are given on the Table 4.8.

Table 4.7: CAPM Views Matrix (Q)

INDEX	January	February	March	April	May	June	July	August	September	October	November	December
NYSE	0.18%	0.22%	0.16%	0.51%	0.04%	0.11%	0.25%	0.04%	0.22%	0.07%	0.18%	0.03%
NASDAQ	0.05%	0.36%	0.46%	0.01%	0.01%	1.02%	0.11%	0.05%	0.21%	0.06%	0.16%	0.01%
NIKKEI	0.02%	0.05%	0.01%	0.36%	0.19%	1.18%	0.31%	0.07%	0.15%	0.02%	0.09%	0.19%
SSE	0.03%	0.03%	0.27%	0.04%	0.01%	-0.12%	0.55%	0.03%	0.04%	0.04%	0.39%	0.14%
Hang Seng	0.49%	0.07%	0.18%	0.72%	5.10%	0.18%	0.02%	0.25%	0.23%	0.06%	0.72%	0.19%
FTSE 100	0.05%	0.01%	0.51%	0.14%	0.15%	0.76%	0.07%	0.05%	0.06%	0.00%	0.06%	0.13%
EURONEXT	0.02%	0.20%	0.09%	0.15%	0.51%	0.10%	0.05%	0.07%	0.12%	0.03%	0.01%	0.27%
SZSE	0.02%	0.04%	0.21%	0.72%	0.11%	0.34%	0.04%	0.15%	0.20%	0.10%	0.26%	0.20%
TSX	0.01%	0.09%	0.46%	0.33%	0.23%	0.59%	0.17%	0.14%	0.01%	0.01%	0.01%	0.00%
DAX	0.07%	0.11%	0.22%	0.10%	0.04%	0.25%	0.13%	0.05%	0.17%	0.01%	0.11%	0.29%

Table 4.8: Technical Analysis Views Matrix (Q)

Index	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
NYSE	0.12%	5.78%	2.25%	9.45%	0.57%	1.47%	2.79%	0.77%	0.40%	2.56%	6.56%	0.90%
NASDAQ	2.35%	0.26%	2.39%	1.55%	1.42%	0.32%	3.22%	2.21%	0.98%	0.98%	7.51%	4.76%
NIKKEI	2.54%	4.14%	4.13%	0.91%	0.93%	0.65%	0.33%	0.50%	0.43%	-6.93%	0.98%	1.96%
SSE	3.00%	0.22%	3.10%	4.11%	2.70%	5.47%	2.90%	4.06%	6.41%	3.73%	6.48%	2.22%
HIS	9.85%	4.48%	2.20%	3.17%	5.10%	1.10%	1.04%	1.46%	1.47%	2.48%	0.84%	2.18%
FTSE	3.36%	0.56%	0.68%	0.35%	4.02%	0.88%	0.30%	0.03%	1.95%	0.34%	2.25%	2.72%
EURONEXT	4.85%	4.22%	1.09%	0.87%	1.99%	1.06%	3.17%	1.63%	4.33%	2.22%	3.66%	2.88%
SZSE	0.00%	3.90%	2.71%	0.10%	7.70%	1.17%	2.60%	3.36%	0.47%	0.72%	0.34%	2.53%
TSX	5.57%	0.65%	0.50%	0.30%	3.08%	2.21%	0.00%	0.28%	0.90%	4.86%	8.75%	2.88%
DAX	0.51%	0.33%	4.50%	1.75%	2.31%	3.71%	2.27%	0.52%	1.57%	4.19%	0.77%	0.92%

4.4.3 Results of Black -Litterman Application

First step of Black-Litterman Model is to calculate the implied excess returns driven by CAPM (Table 4.9). Second step is to calculate the implied excess returns driven by technical analysis techniques (Table 4.10) and finally, to obtain reversal optimization weight (Table 4.11 and Table 4.12).

Table 4.9: Black –Litterman Implied Excess Returns Driven by CAPM

INDEX	January	February	March	April	May	June	July	August	September	October	November	December
NYSE	0.35%	0.29%	0.06%	0.64%	0.27%	0.75%	0.44%	0.01%	0.04%	-0.06%	-0.07%	0.01%
NASDAQ	0.27%	0.18%	0.13%	0.08%	0.28%	1.04%	-0.44%	0.04%	-0.20%	-0.09%	-0.02%	0.18%
NIKKEI	0.27%	0.32%	-0.08%	0.20%	0.35%	0.53%	0.68%	-0.01%	0.06%	-0.07%	-0.03%	0.18%
SSE	0.27%	0.33%	0.03%	0.02%	2.81%	-0.06%	0.09%	0.01%	-0.18%	-0.10%	0.20%	0.08%
(HSI)	0.24%	0.32%	-0.22%	0.38%	2.80%	0.70%	-0.04%	-0.05%	0.21%	-0.03%	-0.16%	0.09%
FTSE	0.29%	0.29%	0.62%	0.09%	2.89%	0.61%	-0.53%	0.00%	-0.03%	-0.06%	-0.13%	0.18%
EURONEXT	0.29%	0.28%	0.05%	0.71%	0.25%	0.58%	-0.16%	-0.01%	-0.01%	-0.07%	-0.16%	0.14%
SZSE	0.26%	0.30%	-0.31%	0.36%	2.94%	0.93%	0.15%	0.08%	0.07%	-0.02%	0.00%	0.11%
TSX	0.26%	0.23%	0.49%	0.24%	0.39%	0.23%	1.03%	0.03%	-0.09%	-0.06%	-0.10%	0.11%
DAX	0.30%	0.28%	0.37%	0.07%	0.27%	0.70%	0.02%	-0.02%	0.04%	-0.07%	-0.10%	0.00%

Table 4.10: Black –Litterman Implied Excess Returns Driven by Technical Analysis

Index	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
NYSE	2.85%	2.89%	4.29%	5.50%	0.28%	1.45%	1.00%	1.74%	1.18%	2.10%	2.09%	2.33%
NASDAQ	4.02%	5.09%	4.36%	0.78%	1.00%	0.71%	1.07%	1.11%	1.46%	1.58%	4.07%	2.12%
NIKKEI	6.20%	4.96%	3.17%	3.39%	1.46%	1.62%	1.08%	1.36%	1.68%	-1.73%	1.86%	2.32%
SSE	1.50%	5.07%	2.65%	2.06%	4.89%	2.73%	0.91%	2.04%	4.67%	4.77%	7.08%	3.13%
HIS	4.93%	5.13%	1.10%	2.36%	3.55%	0.55%	1.38%	0.95%	2.41%	0.97%	-1.96%	2.33%
FTSE	3.18%	3.17%	2.79%	2.23%	6.90%	0.99%	0.89%	1.12%	0.97%	1.23%	2.14%	2.35%
EURONEXT	2.43%	5.00%	3.25%	1.21%	1.00%	1.52%	-1.85%	1.77%	3.59%	2.33%	-0.20%	2.02%
SZSE	0.00%	4.84%	2.45%	0.05%	6.00%	1.30%	2.14%	1.69%	1.41%	1.71%	3.02%	2.16%
TSX	2.79%	5.32%	2.70%	0.92%	1.83%	2.73%	-1.16%	1.09%	1.42%	4.40%	3.70%	2.20%
DAX	2.68%	5.17%	3.35%	2.93%	2.15%	3.37%	2.15%	1.22%	2.21%	1.32%	1.58%	2.66%

Table 4.11: Black-Litterman Reversal Optimization Weights Derived by CAPM

INDEX	January	February	March	April	May	June	July	August	September	October	November	December
NYSE	18.7%	6.0%	2.8%	13.2%	-19.1%	11.8%	99.7%	-70.6%	-5.5%	-23.0%	28.6%	-3.2%
NASDAQ	-4.0%	-18.9%	-31.5%	-34.0%	-14.0%	24.7%	-60.5%	321.1%	-201%	8.9%	4.9%	4.5%
NIKKEI	15.8%	23.8%	43.9%	-26.3%	13.1%	-0.4%	17.1%	-94.4%	23.8%	-0.8%	-29.4%	32.0%
SSE	6.1%	11.6%	4.8%	-38.3%	12.0%	8.6%	0.8%	24.5%	-52.4%	0.3%	-29.7%	7.3%
HIS	20.2%	0.9%	37.2%	-46.2%	50.8%	8.6%	-18.4%	-77.8%	170.2%	1.7%	3.0%	16.5%
FTSE	3.5%	53.7%	2.1%	-41.6%	34.6%	9.2%	1.2%	10.7%	89.7%	26.9%	1.5%	1.2%
EURNXT	26.9%	-67.2%	11.1%	-19.4%	-23.9%	46.6%	0.0%	1.1%	-46.9%	2.9%	85.8%	77.2%
SZSE	14.7%	4.4%	93.8%	17.3%	47.7%	-1.5%	18.9%	25.0%	61.3%	-5.5%	12.6%	18.3%
TSX	27.3%	49.0%	-16.3%	104.0%	-0.3%	31.1%	70.7%	-19.3%	-12.7%	29.4%	0.8%	27.6%
DAX	-29.2%	36.7%	-47.9%	49.4%	-0.9%	-38.6%	-29.6%	-20.3%	74.0%	59.3%	21.8%	-81.5%
sum	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Table 4.12: Black-Litterman Reversal Optimization Weights Derived by Technical Analysis

Index	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
NYSE	2.1%	-0.6%	48.9%	16.83%	-26.4%	34.3%	-25.2%	-25.8%	6.6%	1.9%	1.2%	-3.2%
NASDAQ	5.8%	-22.6%	11.8%	-9.50%	-15.1%	79.1%	-79.6%	-77.3%	-12.5%	-51.8%	1.8%	4.5%
NIKKEI	34.8%	27.1%	-1.3%	20.99%	10.6%	25.2%	-13.0%	-1.3%	20.6%	14.0%	0.0%	32.0%
SSE	6.1%	12.3%	8.6%	6.73%	11.7%	3.8%	4.3%	11.6%	11.0%	-1.3%	42.2%	7.3%
HIS	36.0%	2.2%	-5.6%	37.99%	50.2%	18.8%	74.2%	51.2%	19.1%	65.3%	-0.4%	16.5%
FTSE	9.6%	17.5%	6.1%	15.72%	41.4%	4.8%	48.6%	37.5%	-4.2%	22.2%	52.2%	1.2%
EURONEXT	11.2%	-34.4%	83.5%	-23.06%	-43.0%	-87.1%	-13.3%	-0.5%	76.0%	-55.3%	-57.5%	77.2%
SZSE	-7.2%	3.7%	-11.6%	24.23%	48.7%	77.7%	42.2%	58.6%	10.5%	83.6%	5.9%	18.3%
TSX	21.3%	60.3%	14.4%	0.94%	2.9%	-76.2%	35.9%	33.4%	38.1%	-8.0%	62.8%	27.6%
DAX	-19.6%	34.5%	-54.7%	9.13%	18.9%	19.8%	25.9%	12.7%	-65.3%	29.2%	-8.3%	-81.5%

4.6. OBTAINING AND COMPARING THE RESULTS

In this work, 10 international indices daily prices are examined, accordingly 12 different monthly portfolios are evaluated and applied Black-Litterman model. There are two methodologies: first, the Black-Litterman Model combined with CAPM and the second Black-Litterman Model combined with technical analysis techniques. Portfolio returns, risk and measurement of portfolio performances measured by Sharpe ratio are illustrated on the Table 4.13: Portfolio Performances –Sharpe Ratio.

Table 4.13: Portfolio Performances –Sharpe Ratio

Portfolio	Technical Analysis			CAPM		
	Portfolio Return	Portfolio Risk	Sharpe Ratio	Portfolio Return	Portfolio Risk	Sharpe Ratio
Jan	4.96%	1.72%	2.59	0.27%	0.03%	-7.60
Feb	4.92%	0.87%	5.06	0.29%	0.05%	-4.44
Mar	3.89%	0.94%	3.51	-0.68%	0.30%	-4.29
Apr	2.96%	1.57%	1.50	0.77%	0.24%	0.69
May	8.10%	2.31%	3.21	4.05%	1.32%	2.54
Jun	-0.01%	0.94%	-0.64	0.51%	0.32%	-0.28
Jul	1.54%	1.29%	0.73	1.57%	0.48%	2.01

Aug	1.32%	0.37%	1.40	0.20%	0.03%	-17.43
Sep	3.15%	1.18%	2.07	0.00%	0.12%	-5.66
Oct	0.00%	1.82%	-0.44	-0.07%	0.02%	-35.66
Nov	6.70%	2.44%	2.42	-0.24%	0.11%	-9.83
Dec	1.81%	0.32%	2.53	0.25%	0.07%	-8.34



CONCLUSION

One of the major concerns in financial markets is to find out the best investment portfolio. The main model of portfolio selection was provided by Harry Markowitz, which became a fundamental of modern portfolio theory. He developed the Mean-Variance Model, which helps investors to select and construct the most efficient portfolio considering expected return and risk of the portfolio. Previously, an optimal portfolio was thought as the one, which maximizes just expected return. However, Fundamental analysis considers two main methods in portfolio selection, heuristic and quantitative. In heuristic method, asset allocation is made with investor's feeling and views about future performance of the investment and quantitative approaches are done by applying mathematical models. Before 1991, quantitative (mathematical) models were used for the portfolio selection process. Black Fisher and Litterman Robert (1991-1992) provided first model that combined heuristic approach to the quantitative approach of portfolio selection. This model used mathematical model of portfolio selection such as Markowitz Mean- Variance and Capital Asset Pricing Models and assembling it with investor's personal views. An innovative factor in Black-Litterman model is to combine traditional asset allocation models with individual investor's views. Nowadays this model is considered as a widely used asset allocation model. Despite of fundamental models of portfolio selection there are technical analyses models used for the investment decision making process. Technical analysts rely heavily upon the usage of charts. Technical analysts look market prices of security, record historical financial data on charts, study those charts in search of patterns that they find meaningful and use the patterns to predict future prices. One of the widely used techniques in technical analysis is Elliot Wave Principle and Fibonacci Retracements. Under these theories, every market has a law of its own. Every decision made in market produces meaningful information and it is itself production of meaningful information. Under the Elliot Wave Principle, every

price movement in the market is reflected by a structural progression. This progression is formed is unfolded in waves. Sometimes market appears to reflect outside event, but most of times it follows its own rules. For this concept, the waves are patterns that show directional movement of prices. Typically, they believe that past patterns of security prices will repeat in the future and therefore those patterns can be useful for predictive purpose.

Thus, this work is built upon the traditional Markowitz asset allocation, Black-Litterman and technical analysis models. The main purpose of this work is to use widely used asset allocation tool such as the Black-Litterman Model, which developed better-diversified portfolio by incorporation of personal investor's views in the investment decision process. For this purpose, two methodologies were constructed, first, using Capital Asset Pricing Model in the B-L formula to calculate personal investor's views, select optimized portfolio, calculate Black-Litterman portfolio returns and finally estimate portfolio performances and second methodology is to use Technical Analysis Model to calculate personal investor's views, select optimized portfolio, calculate Black-Litterman portfolio returns and finally estimated portfolio performances. Therefore, this work aimed to define profitable methodology of portfolio selection process.

In this work on portfolio diversification, Black-Litterman model constructed with investor's views driven by technical analysis developed better-optimized portfolio rather than traditional model of using CAPM. In the real investment situation, the Black-Litterman model combined with technical analysis model has shown better portfolio performances. Thus, according to results of this work, it can be said that the best way of increasing the profitability in the uncertain and unpredicted market is to combine fundamental method of market analysis and technical analysis aspects of trading. The combination of both technical and fundamental studies not only increases knowledge and confidence but can also increase investor's probability.

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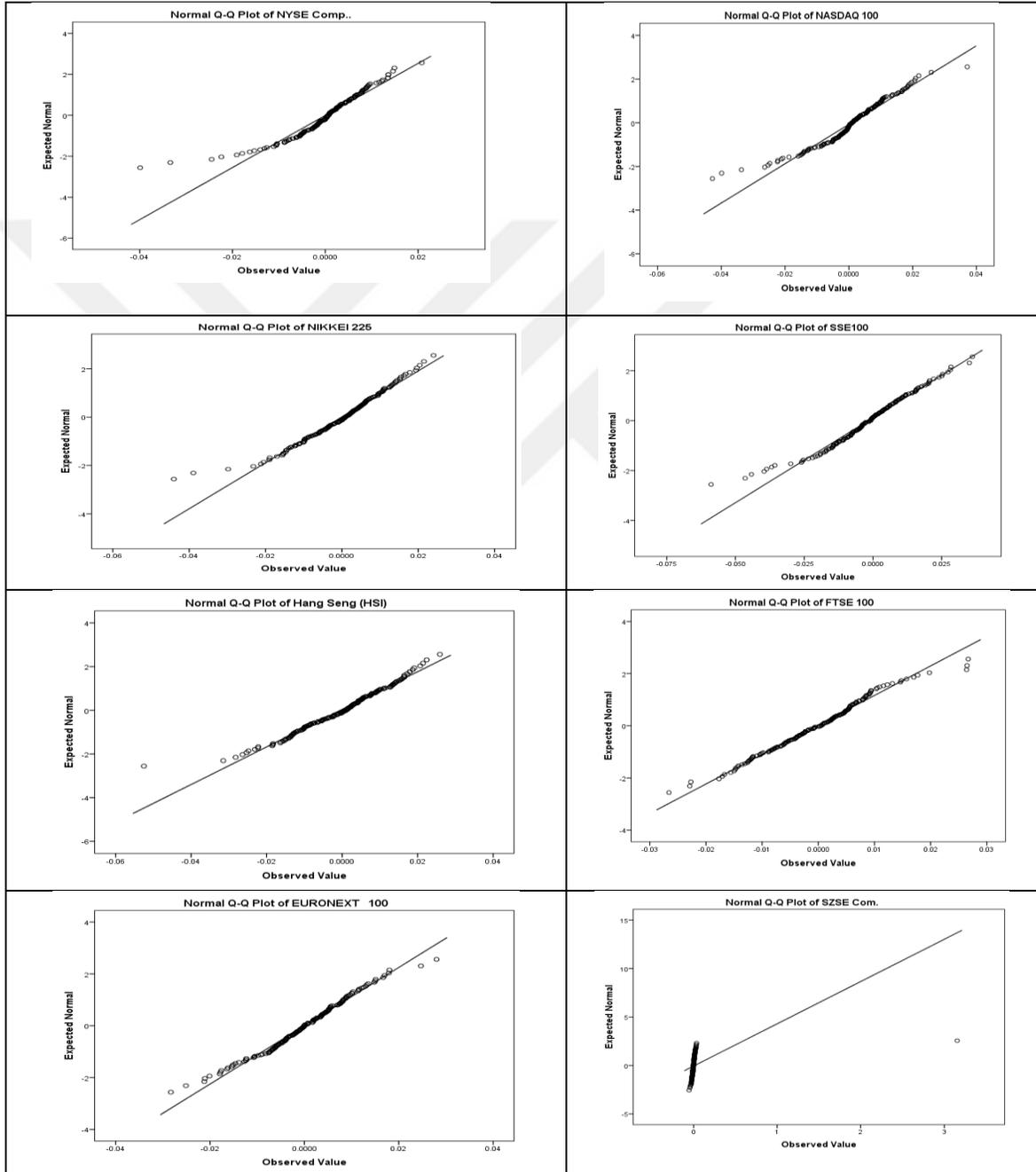
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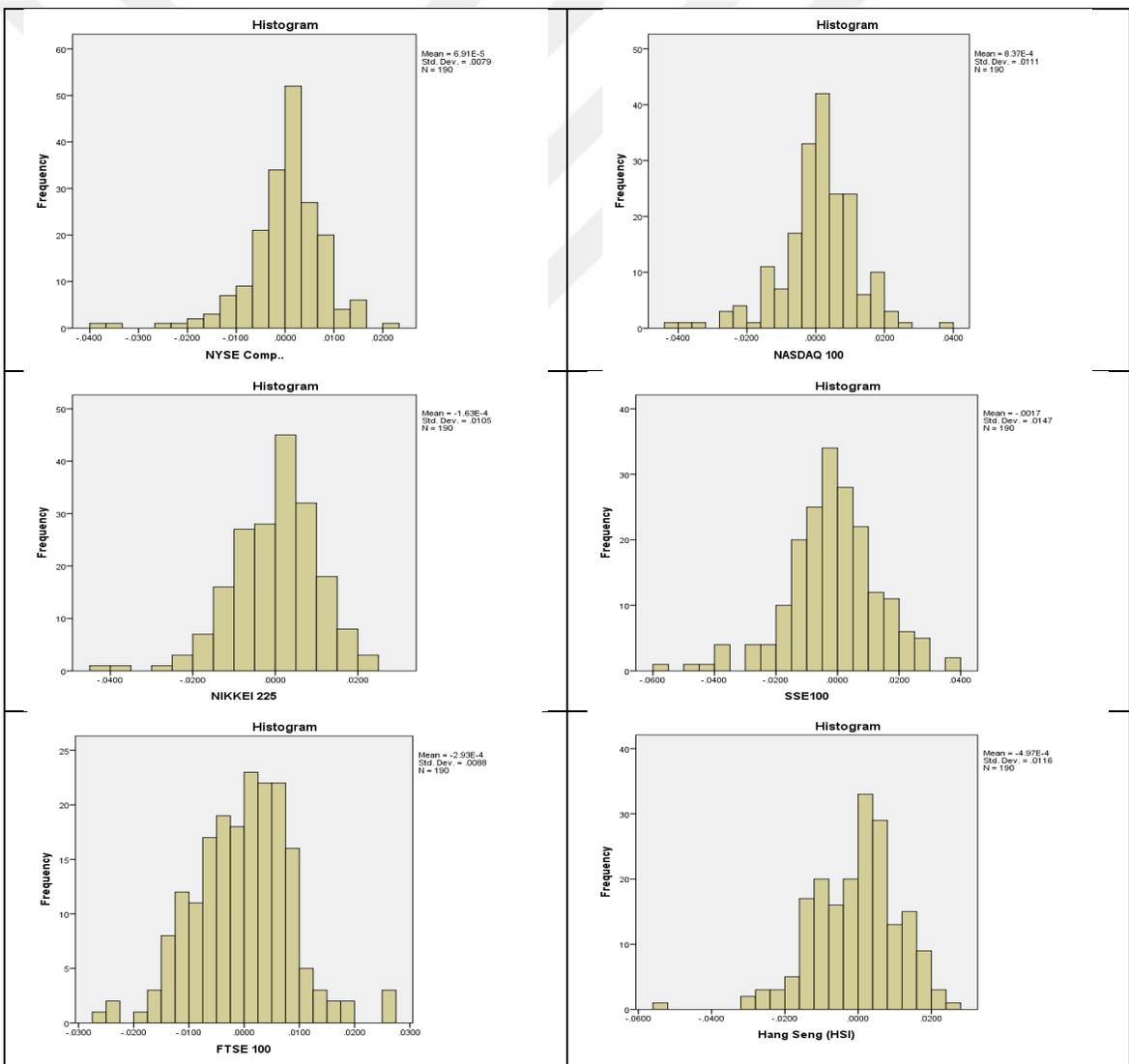
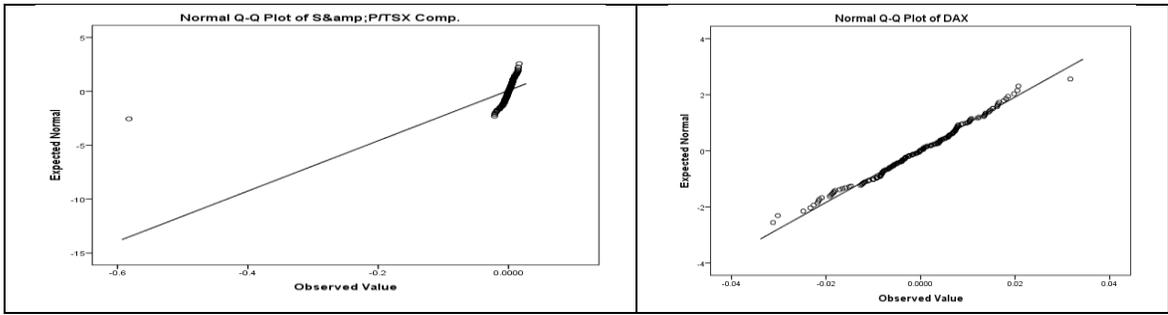
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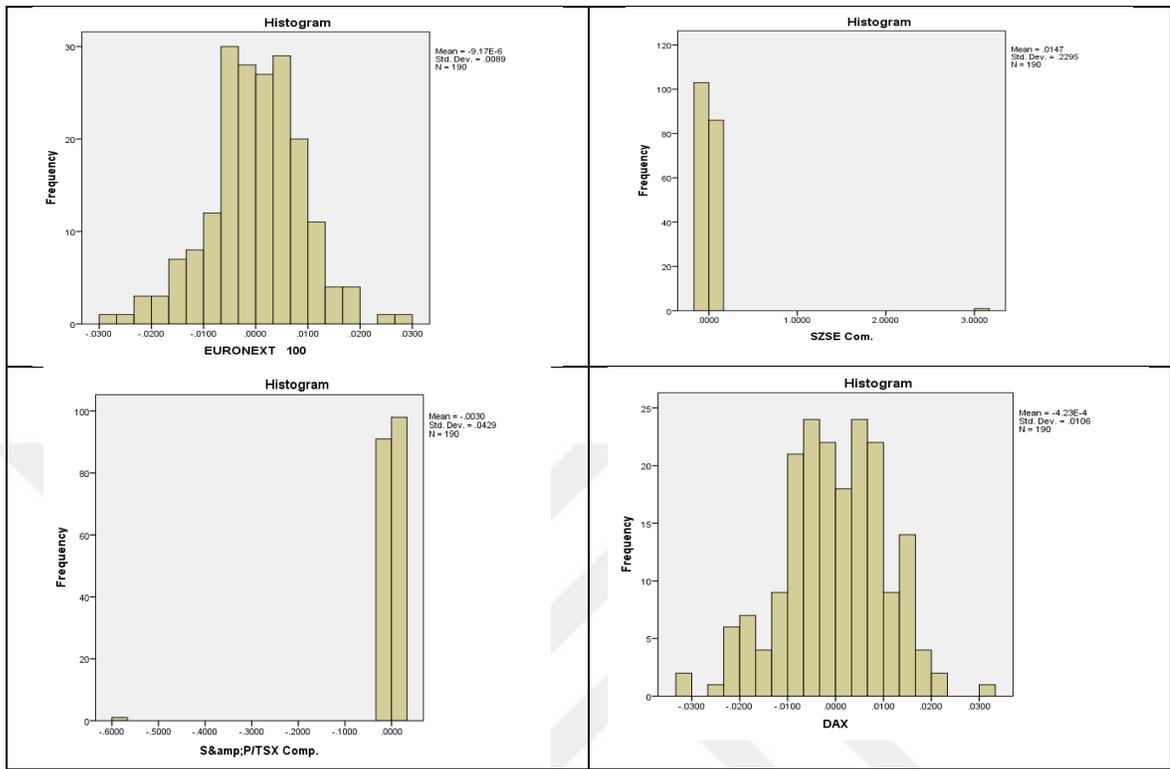
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APPENDIX

1. Outputs of SPSS (Test of Normality)







2. Technical Analysis of Indices

FTSE (Currency GBP) Figure



Figure 1: Technical Analysis FSTE

Table 1: Technical Analysis Review FTSE

1)Enter a sell position: Date (12.01.2018), Price (7765.5), Indicators: <u>Volume:</u> Low <u>Pattern:</u> A Doji Star <u>MACD Crossover:</u> Crosses below the signal line <u>RSI:</u> Overbought: 77.82 Fibonacci Retracement: - <u>Elliot Waves:</u> Wave (a) correction	Close the position: Date (12.02.2018), Price(6942.5), Indicators: <u>Volume:</u> increasing volume <u>MACD Crossover:</u> starting crossing the signal line <u>RSI:</u> 17.19 <u>Elliot Waves:</u> Finishing wave A starting corrective wave B <u>Support Level:</u> Hits the previous support level
2)Enter a buy position: Date (12.02.2018), Price(7232.0), Indicators: <u>Volume:</u> High <u>Pattern:</u> A Doji Star <u>MACD Crossover:</u> Crosses above the signal line <u>RSI:</u> 17.19 <u>Elliot Waves:</u> Wave (b) correction	Close the position: Date (27.02.2018), Price(7384.0), Indicators: <u>Fibonacci Retracement:</u> 50.0% and 61.28% expected price retracement and this price hits 50.0% and starts moving below that indicated closing the position <u>Support Level:</u> The previous support level became a resistance level. This price crosses this level and next candle bar closes below this line, which is a signal of closing position.
3)Enter a sell position: Date (28.02.2018), Price(7384.0), Indicators: <u>Volume:</u> Low <u>Pattern:</u> A Doji Star <u>MACD Crossover:</u> Crosses below the signal line <u>RSI:</u> Overbought: 45.32 Fibonacci Retracement: - <u>Elliot Waves:</u> Wave (c) correction	Close the position: Date (27.03.2018), Price(6971.5), Indicators: <u>Volume:</u> increasing volume <u>MACD Crossover:</u> Above the signal line <u>RSI:</u> 17.19 <u>Elliot Waves:</u> The end of Wave c starting uptrend. <u>Support Level:</u> Hits the previous support level.
4)Enter a buy position: Date (28.03.2018), Price(6986.0), Indicators: <u>Volume:</u> High <u>Pattern:</u> Bullish Engulfing <u>MACD Crossover:</u> Crosses Above a signal Line <u>RSI:</u> 28.05 Fibonacci Retracement: - goes on beyond 61.8%. <u>Elliot Waves:</u> An impulse Wave (1)	Close the position: Date (24.05.2018), Price(7811.0), Indicators: <u>Pattern:</u> A Doji Star followed by second two bar confirmation <u>MACD Crossover:</u> crosses below a signal line <u>RSI:</u> 81.89 <u>Resistance Level:</u> Hits the previous resistance level
5)Enter a sell position: Date (25.05.2018), Price(7782.0), Indicators: <u>Pattern:</u> Bearish Engulfing <u>MACD Crossover:</u> crosses below a signal line <u>RSI:</u> 81.89	Close the position: Date (10.09.2018), Price(7261.0) Indicators: <u>Pattern:</u> A Doji Star <u>Support Level:</u> Hits the previous resistance level accumulation phase during June and July and August. <u>MACD Crossover:</u> crosses below a signal line <u>RSI:</u> 26.02
6)Enter a sell position: Date (14.09.2018), Price(7261.0), Indicators: <u>Volume:</u> Low <u>Pattern:</u> A Doji Star followed by two bars confirmation <u>MACD Crossover:</u> Crosses above the signal line <u>RSI:</u> 30.08	Close the position: Date (27.12.2018), Price(6530.0), Indicators: <u>Volume:</u> increasing volume <u>MACD Crossover:</u> starting crossing above the signal line <u>RSI:</u> 28.05

NASDAQ (currency USD) Figure



Figure 2: Technical Analysis NASDAQ

Table 2: Technical Analysis Review NASDAQ

1)Enter a buy position: Date (02.01.2018), Price (6436.0), Indicators:	Close the position: Date (30.01.2018), Price(6953.5), Indicators:
Pattern: Doji Star followed by two bullish confirmation candlesticks. MACD Crossover: Crosses above the signal line RSI: 37.15 Elliot Waves: Motive wave (III)	MACD Crossover: Below the signal line. Resistance Level: Hits the previous resistance level RSI: 82,46
2)Enter a Sell position: Date (31.01.2018), Price(7987.5), Indicators:	Close the position: Date (09.02.2018), Price(6409.5), Indicators:
MACD Crossover: Below the signal line. Resistance Level: Hits the previous resistance level RSI: 82,46	Support Level: This price crosses previous support level and is followed by bullish candlesticks that indicate trend reversal. MACD Crossover: Crosses above the signal line RSI: 34.08
3)Enter a buy position: Date (12.02.2018), Price(6936.5), Indicators:	Close the position: Date (14.03.2018), Price(7044.0), Indicators:
Volume: Increasing MACD Crossover: Crosses above the signal line. RSI: 35.38 Elliot Waves: It covers an impulse Wave labeled as 1,2,3,4,5.	MACD Crossover: Below the signal line RSI: 69/02 Resistance Level: Hits the previous resistance level.
4)Enter a sell position: Date (20.03.2018), Price(6904.5), Indicators:	Close the position: Date (03.04.2018), Price(6315.0), Indicators:
Volume: Low Pattern: Doji Stars MACD Crossover: Crosses below the signal Line RSI: 66.47	Pattern: Doji Star followed by second two bearish confirmation RSI: 73.38. Resistance Level: Hits the previous Resistance level.
5)Enter a buy position: Date (07.04.2018), Price(7447.5), Indicators:	Close the position: Date (31.08.2018), Price(7665.30) Indicators:
Volume: Increasing	Pattern: A Doji Star

<p>Pattern: A Doji Star followed by two bars Bullish confirmation MACD Crossover: crosses above the signal line RSI: 43.37 Elliot Waves: Wave (V) - impulse Wave labeled as 1,2,3,4,5.</p>	<p>Support Level: Hits the previous resistance level accumulation phase during June and July and August. MACD Crossover: crosses below a signal line RSI: 26.02</p>
<p>6)Enter a sell position: Date (03.10.2018), Price(7665.3), Indicators:</p>	<p>Close the position: Date (27.12.2018), Price(5854.5), Indicators:</p>
<p>Volume: Low Pattern: A Doji Star followed by two bars bearish confirmation MACD Crossover: Crosses below the signal line RSI: 50.36</p>	<p>Fibonacci Retracement: It shows corrective waves and prices retraces till 50.0%. As a result, it confirms downtrend correction rather than trend reversal.</p>

NIKKEI225 (Currency JPY) Figure



Figure 3: Technical Analysis NIKKEI 225

Table 3: Technical Analysis Review NIKKEI

<p>1)Enter a buy position: Date (12.01.2018), Price (22820), Indicators:</p>	<p>Close the position: Date (24.01.2018), Price(24085), Indicators:</p>
<p><u>Pattern:</u> Doji Star followed by two bullish confirmation candlesticks. <u>MACD Crossover:</u> Crosses above the signal line <u>RSI:</u> 50.58</p>	<p><u>Resistance Level:</u> Hits the previous resistance level. <u>MACD Crossover:</u> crosses below the signal line. <u>RSI:</u> 65.35</p>
<p>2)Enter a Sell position: Date (29.01.2018), Price(23600), Indicators:</p>	<p>Close the position: Date (09.02.2018), Price(21260), Indicators:</p>
<p><u>MACD Crossover:</u> crosses below the signal line. <u>RSI:</u> 65.35 <u>Elliot Waves:</u> correction wave. Triangle(3,3,3,3) wave (a)</p>	<p><u>Support Level:</u> This price crosses previous support level and is followed by bullish candlesticks that indicate trend reversal. <u>RSI:</u> 31.43</p>
<p>3)Enter a buy position: Date (12.02.2018), Price(21233), Indicators:</p>	<p>Close the position: Date (26.02.2018), Price(22288), Indicators:</p>
<p><u>Volume:</u> Increasing <u>RSI:</u> 23.55</p>	<p><u>MACD Crossover:</u> crosses below the signal line <u>RSI:</u> 53.02</p>

<p><u>Elliot Waves:</u> correction wave. Triangle(3,3,3,3,3) wave (b)</p>	<p><u>Resistance Level:</u> Hits the previous resistance level. <u>Fibonacci Retracement:</u> 50.00%</p>
<p>4)Enter a sell position: Date (27.02.2018), Price(21044), Indicators:</p>	<p>Close the position: Date (02.03.2018), Price(20775) Indicators:</p>
<p><u>Volume:</u> Increasing <u>Pattern:</u> Doji Stars <u>MACD Crossover:</u> Crosses below the signal Line <u>RSI:</u> 51.65 <u>Elliot Waves:</u> correction wave. Triangle(3,3,3,3,3) wave (c)</p>	<p><u>Pattern:</u> Doji Star <u>RSI:</u> 36.05 <u>Support Level:</u> Hits the previous support level.</p>
<p>5)Enter a buy position: Date (02.03.2018), Price(20775), Indicators:</p>	<p>Close the position: Date (16.03.2018), Price(21825) Indicators:</p>
<p><u>Volume:</u> Increasing <u>Pattern:</u> A Doji Star followed by two bars Bullish confirmation <u>MACD Crossover:</u> crosses above the signal line <u>RSI:</u> 43.37 <u>Elliot Waves:</u> correction wave. Triangle(3,3,3,3,3) wave (d)</p>	<p><u>Pattern:</u> A Doji Star <u>Resistance Level:</u> Hits the previous resistance level <u>MACD Crossover:</u> crosses below a signal line <u>RSI:</u> 26.02 <u>Fibonacci Retracement:</u> 38.20%</p>
<p>6)Enter a sell position: Date (16.03.2018), Price(21825), Indicators:</p>	<p>Close the position: Date (27.03.2018), Price(20345), Indicators:</p>
<p><u>Volume:</u> Low <u>Pattern:</u> A Doji Star followed by two bars bearish confirmation <u>MACD Crossover:</u> Crosses below the signal line <u>RSI:</u> 50.36 <u>Elliot Waves:</u> correction wave. Triangle(3,3,3,3,3) wave (e)</p>	<p><u>Support Level:</u> Hits the previous support level. <u>MACD Crossover:</u> crosses above the signal line <u>RSI:</u> 56.58</p>
<p>7)Enter a buy position: Date (28.03.2018), Price(20910), Indicators:</p>	<p>Close the position: Date (02.10.2018), Price(24300), Indicators:</p>
<p><u>Volume:</u> High <u>Pattern:</u> A Doji Star followed by two bars, bullish confirmation <u>MACD Crossover:</u> Crosses above the signal line <u>RSI:</u> 50.36 <u>Elliot Waves:</u> Motive wave (1, 2, 3, 4, 5) <u>Fibonacci Retracement:</u> retraces more than 61.8% level</p>	<p><u>Resistance Level:</u> Hits the resistance level <u>MACD Crossover:</u> crosses below the signal line <u>RSI:</u>75.83 During this period: corrective wave 2(sell position, June) , corrective wave 4(sell position , August, September)</p>
<p>8)Enter a sell position: Date (04.10.2018), Price(24300), Indicators:</p>	<p>Close the position: Date (28.12.2018), Price(19430), Indicators:</p>
<p><u>Volume:</u> Low <u>Pattern:</u> A Doji Star followed by two bars, bearish confirmation <u>MACD Crossover:</u> Crosses below the signal line <u>RSI:</u> 23.45 <u>Elliot Waves:</u> corrective wave. Triangle (a.b.c.d.e.)</p>	<p><u>Support Level:</u> Hits the previous support level <u>MACD Crossover:</u> crosses below the signal line <u>RSI:</u> 32.30 During this period: corrective wave B, D (buy position, November)</p>

TSX(Currency CAD) Figure



Figure 4: Technical Analysis TSX

Table 4: Technical Analysis Review TSX

1)Enter a buy position: Date (02.01.2018), Price (2683.5), Indicators: <u>MACD Crossover</u> : Crosses above the signal line <u>RSI</u> : 71.05 <u>Elliot Waves</u> : motive wave 5.	Close the position: Date (30.01.2018), Price(2835.0), Indicators: <u>Resistance Level</u> : Hits the previous resistance level. <u>MACD Crossover</u> : crosses below the signal line. <u>RSI</u> : 87.89
2)Enter a Sell position: Date (01.02.2018), Price(2832.0), Indicators: <u>MACD Crossover</u> : crosses below the signal line. <u>RSI</u> : 87.49 <u>Elliot Waves</u> : correction wave. Triangle(3,3,3,3,3) wave (a)	Close the position: Date (09.02.2018), Price(2627.0), Indicators: <u>Support Level</u> : This price crosses previous support level and is followed by bullish candlesticks that indicate trend reversal. <u>RSI</u> : 37.26
3)Enter a buy position: Date (12.02.2018), Price(2636.0), Indicators: <u>Volume</u> : Increasing <u>RSI</u> : 39.71 <u>Elliot Waves</u> : correction wave. Triangle(3,3,3,3,3) wave (b)	Close the position: Date (28.02.2018), Price(2778.5), Indicators: <u>MACD Crossover</u> : crosses below the signal line <u>RSI</u> : 59.31 <u>Resistance Level</u> : Hits the previous resistance level. Fibonacci Retracement: 50.00%
4)Enter a sell position: Date (28.02.2018), Price(2734.0), Indicators: <u>Volume</u> : Increasing <u>Pattern</u> : Doji Star <u>MACD Crossover</u> : Crosses below the signal Line <u>RSI</u> : 61.76 <u>Elliot Waves</u> : correction wave. Triangle(3,3,3,3,3) wave (c)	Close the position: Date (02.03.2018), Price(2683.5) Indicators: <u>Pattern</u> : Doji Star <u>RSI</u> : 44.61 <u>Support Level</u> : Hits the previous support level.
5)Enter a buy position: Date (02.03.2018), Price(2683.5), Indicators: <u>Volume</u> : Increasing	Close the position: Date (13.03.2018), Price(2781.5) Indicators: <u>Pattern</u> : A Doji Star

<p>Pattern: A Doji Star followed by two bars Bullish confirmation</p> <p>MACD Crossover: crosses above the signal line</p> <p>RSI: 43.37</p> <p>Elliot Waves: correction wave. Triangle(3,3,3,3,3) wave (d)</p>	<p>Resistance Level: Hits the previous resistance level</p> <p>MACD Crossover: crosses below a signal line</p> <p>RSI: 60.51</p> <p>Fibonacci Retracement: 38.20%</p>
<p>6)Enter a sell position: Date (14.03.2018), Price(2778,5), Indicators:</p>	<p>Close the position: Date (28.03.2018), Price(2627.0), Indicators:</p>
<p>Volume: Low</p> <p>Pattern: A Doji Star followed by two bars bearish confirmation</p> <p>MACD Crossover: Crosses below the signal line</p> <p>RSI: 59.36</p> <p>Elliot Waves: correction wave. Triangle(3,3,3,3,3) wave (e)</p>	<p>Support Level: Hits the previous support level.</p> <p>Pattern: Doji star</p> <p>MACD Crossover: crosses above the signal line</p> <p>RSI: 37.58</p>
<p>7)Enter a buy position: Date (02.04.2018), Price(2600.3), Indicators:</p>	<p>Close the position: Date (28.09.2018), Price(2933.0), Indicators:</p>
<p>Volume: High</p> <p>Pattern: A Doji Star followed by two bars, bullish confirmation</p> <p>MACD Crossover: Crosses above the signal line</p> <p>RSI: 50.36</p> <p>Elliot Waves: Motive wave (1, 2, 3, 4, 5)</p> <p>Fibonacci Retracement: retraces more than 61.8% level</p>	<p>Resistance Level: Hits the resistance level</p> <p>MACD Crossover: crosses below the signal line</p> <p>RSI: 69.11</p> <p>During this period: corrective wave 2(sell position, May) , corrective wave 4(sell position ,June)</p>
<p>8)Enter a sell position: Date (04.10.2018), Price(2927.0), Indicators:</p>	<p>Close the position: Date (22.12.2018), Price(1943.0), Indicators:</p>
<p>Volume: Low</p> <p>Pattern: A Doji Star followed by two bars, bearish confirmation</p> <p>MACD Crossover: Crosses below the signal line</p> <p>RSI: 21.33</p> <p>Elliot Waves: corrective wave. Triangle (a.b.c.d.e.)</p>	<p>Support Level: Hits the previous support level</p> <p>MACD Crossover: crosses below the signal line</p> <p>RSI: 20.11</p> <p>During this period: corrective wave b, d (buy position, November)</p>

HIS(Currency HKD) Figure



Figure 5: Technical Analysis HSI

Table 5: Technical Analysis Review HIS

1)Enter a buy position: Date (02.01.2018), Price (30610), Indicators: MACD Crossover: Crosses above the signal line RSI: 70.09	Close the position: Date (29.01.2018), Price(33625.0), Indicators: Resistance Level: Hits the previous resistance level. MACD Crossover: crosses below the signal line. RSI: 88.90
2)Enter a Sell position: Date (01.02.2018), Price(32795), Indicators: MACD Crossover: crosses below the signal line. RSI: 83.63	Close the position: Date (12.02.2018), Price(29430.0), Indicators: Support Level: This price crosses previous support level and is followed by bullish candlesticks that indicate trend reversal. RSI: 33.18
3)Enter a buy position: Date (14.02.2018), Price(30042.0), Indicators: Volume: Increasing RSI: 39.71 Elliot Waves: correction wave. Triangle(3,3,3,3,3) wave (b)	Close the position: Date (28.02.2018), Price(38133.0), Indicators: MACD Crossover: crosses below the signal line RSI: 53.78 Resistance Level: Hits the previous resistance level.
4)Enter a buy position: Date (05.03.2018), Price(30435.0), Indicators: Pattern: Doji Star MACD Crossover: Crosses below the signal Line RSI: 38,05	Close the position: Date (22.03.2018), Price(31615.0) Indicators: Pattern: Doji Star RSI: 54.67 Resistance Level: Hits the previous resistance level
5)Enter a sell position: Date (22.03.2018), Price(31440.0), Indicators: Pattern: A Doji Star followed by two bars Bullish confirmation MACD Crossover: goes the same way as the signal line RSI: 55.37	Close the position: Date (08.05.2018), Price(29955.0) Indicators: Pattern: A Doji Star followed by bullish confirmation Support Level: Hits the previous Support level MACD Crossover: crosses above a signal line RSI: 43.03
6)Enter a buy position: Date (08.05.2018), Price (30435.0), Indicators: Volume: High Pattern: A Doji Star followed by two bars bullish confirmation MACD Crossover: Crosses above the signal line RSI: 41.02	Close the position: Date (07.06.2018), Price(31220.0), Indicators: Resistance Level: Hits the previous resistance level. Pattern: Doji star MACD Crossover: crosses below the signal line RSI: 60.04
7)Enter a sell position: Date (07.06.2018), Price(31220.0), Indicators: Pattern: A Doji Star followed by two bars, bullish confirmation MACD Crossover: Crosses below the signal line RSI: 60.04	Close the position: Date (31.10.2018), Price(24775.0), Indicators: Support Level: Hits the support level MACD Crossover: crosses above the signal line RSI: 34.97
8)Enter a buy position: Date (01.11.2018), Price(25930.0), Indicators: Support Level: Hits the support level MACD Crossover: crosses above the signal line RSI: 34.97	Close the position: Date (04.12.2018), Price(27115), Indicators: Support Level: Hits the previous support level MACD Crossover: crosses below the signal line RSI: 20.11

	During this period: corrective wave b, d (buy position, November)
9)Enter a sell position: Date (05.12.2018), Price(26765.0), Indicators:	Close the position: Date (28.12.2018), Price(25454.0), Indicators:
Support Level: Hits the support level MACD Crossover: crosses above the signal line RSI: 62.37	Support Level: Hits the previous support level MACD Crossover: crosses below the signal line RSI: 40.11

NYSE(Currency USD) Figure



Figure 6: Technical Analysis NYSE

Table 6: Technical Analysis Review NYSE

January(01.01.2018-26.01.2018)	A Buy position, at the Price 12915.0 – close the position 13650.5
February(21.01.2018-09.02.2018)	A Sell position,(Elliot Triangle Wave ABCDE- Wave A) at the Price 13440.0 – close the Position position 12355.5
February (10.02.2018-26.01.2018)	A Buy position, (Elliot Triangle Wave ABCDE- Wave B) at the Price 12460.0 – close the position 13007.5
February (27.02.2018-02.03.2018)	A Sell position, (Elliot Triangle Wave ABCDE- Wave C) at the Price 12460.0 – close the position 12432.5
March (05.03.2018-12.03.2018)	A Buy position, (Elliot Triangle Wave ABCDE- Wave D) at the Price 12508.3 - close the position 12942.5
March (13.03.2018-28.03.2018)	A Sell position, (Elliot Triangle Wave ABCDE- Wave E) at the Price 12953.8 - close the position 12291.5
April (03.04.2018-19.04.2018)	A Buy position, (Elliot Impulse Wave 12345- Wave 1) at the Price 12270.0 - close the position 12625.0
April (20.04.2018-03.05.2018)	A Sell position, (Elliot Impulse Wave 12345- Wave 2) at the Price 12270.0 - close the position 12400.5
May (04.05.2018-11.06.2018)	A Buy position, (Elliot Impulse Wave 12345- Wave 3) at the Price 12335.0 - close the position 12400.5
June (12.06.2018-03.07.2018)	A Sell position, (Elliot Impulse Wave 12345- Wave 3) at the Price 12886.5 - close the position 12420.0
July – August – September (05.07.2018-21.09.2018)	A Buy position, (Elliot Impulse Wave 12345- Wave 4 and 5) at the Price 12540.1 - close the position 13256.5

October (01.10.2018-29.10.2018)	A Sell position, (Elliot Triangle Wave ABCDE- Wave A) at the Price 13159.0 - close the position 11847.5
November (30.10.2018-08.11.2018)	A Buy position, (Elliot Triangle Wave ABCDE- Wave B) at the Price 11966.0- close the position 12682.8
November (08.11.2018-20.11.2018)	A Sell position, (Elliot Triangle Wave ABCDE- Wave C) at the Price 12682.2 - close the position 12042.0
November (21.11.2018-03.12.2018)	A Buy position, (Elliot Triangle Wave ABCDE- Wave D) at the Price 12085.5 close the position 12595.0
December (04.12.2018-27.12.2018)	A Sell position, (Elliot Triangle Wave ABCDE- Wave E) at the Price 12530.0 close the position 10875.0

SSE (Currency CNY) Figure



Figure 7: Technical Analysis SSE

Table 7: Technical Analysis Review SSE

January	Neutral (Accumulation Phase)
February (29.01.2018-12.02.2018)	A Sell position, at the Price 6366.5- close the position 5530.0
February –March (12.02.2018-14.03.2018)	A Buy position, at the Price 5530.0- close the position 6220.0
March-April (14.03.2018-23.04.2018)	A Sell position, at the Price 6220.0- close the position 5775.0
April- May (25.04.2018-23.05.2018)	A Buy position, at the Price 5930.0- close the position 6338.5
June (26.05.2018-06.07.2018)	A Sell position, at the Price 6275.0 - close the position 5085.0
July (08.07.2018-26.07.2018)	A Buy position, at the Price 5130.0- close the position 5657.5
August-September- October (27.07.2018-19.10.2018)	A Sell position, at the Price 5585.0- close the position 4195.0
October- November (19.10.2018-19.11.2018)	A Buy position, at the Price 4140.5 close the position 4803.0
December (20.11.2018-30.12.2018)	A Sell position, at the Price 4701.0 close the position 4260.0

EURONEXT (Currency EUR) Figure



Figure 8: Technical Analysis EURONEXT

Table 8: Technical Analysis Review EURONEXT

January (02.01.2018-23.02.2018)	A Buy position, at the Price 1030.5- close the position 1080.5
February (25.01.2018-09.02.2018)	A Sell position, (Elliot Triangle Wave ABCDE- Wave A) at the Price 1070.0- close the position 985.0
February (12.02.2018-26.02.2018)	A buy position, (Elliot Triangle Wave ABCDE- Wave B) at the Price 992.5- close the position 1030.0
February (28.02.2018-05.03.2018)	A sell position, (Elliot Triangle Wave ABCDE- Wave C) at the Price 1028.85 - close the position 992.0
March (05.03.2018-13.03.2018)	A Buy position, (Elliot Triangle Wave ABCDE- Wave D) at the Price 992.0- close the position 1025.0
March (14.03.2018-28.03.2018)	A Sell position, (Elliot Triangle Wave ABCDE- Wave E) at the Price 1030.7- close the position 985.0
April- May (03.04.2018-22.05.2018)	A Buy position, at the Price 1001.5- close the position 1090.5
June (25.05.2018-02.07.2018)	A Sell position, at the Price 1077.0 close the position 1030.8
July (03.07.2018-01.08.2018)	A Buy position, at the Price 1040.3 close the position 1080.9
August (08.08.2018-16.08.2018)	A Sell position, at the Price 1075.3 close the position 1050.5
August (16.08.2018-29.08.2018)	A Buy position, at the Price 1050.5close the position 1074.8
September (30.08.2018-11.09.2018)	A Sell position, at the Price 1065.0close the position 1028.5
September (11.09.2018-01.10.2018)	A Buy position, at the Price 1028.5 close the position 1066.0
October (02.10.2018-26.10.2018)	A Sell position,(Elliot Corrective waves ABC- A Wave at the Price 1060.8 close the position 960.0
November (30.10.2018-07.11.2018)	A Buy position,(Elliot Corrective waves ABC- B Wave at the Price 969.8 close the position 1001.5
November-December (08.11.2018-27.12.2018)	A Sell position,(Elliot Corrective waves ABC- CWave at the Price 995.0 close the position 894.9

SEZE(Currency CNY) Figure



Figure 9: Technical Analysis SZSE

Table 9: Technical Analysis Review SZSE

January	Neutral (Accumulation Phase)
February (29.01.2018-12.02.2018)	A Sell position, at the Price 1915.57 close the position 1768.6
February –March (13.02.2018-13.03.2018)	A Buy position, at the Price 1765.25 close the position 1895.0
March-April (14.03.2018-02.05.2018)	A Sell position, at the Price 1887.0close the position 1766.5
May (03.05.2018-23.05.2018)	A Buy position, at the Price 1741.9 close the position 1850.0
June (24.05.2018-06.07.2018)	A Sell position, at the Price 1825.4 - close the position 1502.45
July (08.07.2018-26.07.2018)	A Buy position, at the Price 1582.0- close the position 1623.5
August-September- October (27.07.2018-19.10.2018)	A Sell position, at the Price 1575.4- close the position 1222.55
October- November (19.10.2018-19.11.2018)	A Buy position, at the Price 1270.6 close the position 1418.85
December (20.11.2018-30.12.2018)	A Sell position, at the Price 1390.0 close the position 1250.6

RESUME

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