AN EXAMINATION OF BETAS FOR BORSA ISTANBUL

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ONUR KOCA

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_____

Prof. Dr. Meliha Altunışık
Director

I certify that this thesis satisfies all the requirements as a thesis for the degree of Master of Business Administration

_____

Prof. Dr. Ramazan Sarı
Head of Department

This is to certify that we have read this thesis and that in our opinion it is fully adequate, in scope and quality, as a thesis for the degree of Master of Business Administration

_____

Assoc. Prof. Dr. Adil Oran
Supervisor

Examining Committee Members

Prof. Dr. Uğur Soytaş	(METU, BA)	_____
Assoc. Prof. Dr. Adil Oran	(METU, BA)	_____
Assoc. Prof. Dr. Zeynep Önder	(Bilkent University, BA)	_____

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Name, Last name: Onur KOCA

Signature :

ABSTRACT

AN EXAMINATION OF BETAS FOR BORSA ISTANBUL

Koca, Onur

M.B.A., Department of Business Administration

Supervisor: Assoc. Prof. Dr. Adil Oran

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This study aims to investigate the Betas, which is called as systematic risk and introduced by Capital Asset Pricing Model (CAPM), of stocks traded in Borsa Istanbul (BIST). Issues about Beta have been examined for many years and mainly focus on its estimation and stability. These topics set up the core of this thesis. The closing prices of 203 eligible stocks between 2005 and 2015 are used in the work and data is collected from Thomson Reuters. The estimation of Beta is performed in four different methods, three return intervals, five periods of estimation and logarithmic returns and all calculations are done by using Eviews. The findings indicate that the market betas differ with respect to methods, return intervals, estimation lengths. Moreover, the market beta is estimated as lower than one as its theoretical value. This study provides evidence to instability of beta. Finally, the forecast performances of betas from different methods are compared.

Key Words: CAPM, Beta Estimation, Beta Stability, Systematic Risk, Risk and Return Relation

ÖZ

BORSA İSTANBUL İÇİN BETALARIN İNCELENMESİ

Koca, Onur

Yüksek Lisans, İşletme Bölümü

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Bu çalışma, Sermaye Varlıkları Fiyatlandırma Modeli (CAPM) tarafından ortaya konan ve sistematik risk olarak adlandırılan betayı Borsa İstanbul özelinde incelemeyi hedeflemektedir. Beta ile ilgili hususlarda yıllar boyunca çeşitli çalışmalar yapılmış olup, genel olarak betanın tahmini ve durağanlığı üzerine yoğunlaşmıştır ve bu iki konu, bu tezin esasını oluşturmaktadır. Çalışma için veriler Thomson Reuters veri tabanından alınmıştır ve uygun olan 203 hissenin, 2005 yılının başından 2015 yılının sonuna kadar olan kapanış fiyatları kullanılmıştır. Betaların tahmini, dört farklı metot, üç farklı getiri aralığı, beş farklı uzunlukta tahmin periyodu ve logaritmik getiriler kullanılarak gerçekleştirilmiştir. Hesaplamalarda Eviews programı kullanılmıştır. Bulgular, piyasa betasının, hesaplama metotlarına, getiri aralığına ve tahmin döneminin uzunluğuna göre farklılaştığını işaret etmektedir ve piyasa betasının teorik değer olan birden küçük olduğuna yönelik emareler bulunmaktadır. Ayrıca, betanın durağan olmadığı yönündeki çalışmaları destekleyici kanıtlar sunulmaktadır. Son olarak, farklı metotların öngörü performansı karşılaştırılmıştır.

Anahtar Kelimeler: Sermaye Varlıkları Fiyatlandırma Modeli, Beta Tahmini, Beta Durağanlığı, Sistematik Risk, Risk ve Getiri İlişkisi

To the Founders of Modern and Secular Republic of Turkey,

At foremost, Mustafa Kemal Atatürk

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

Stock markets as an important piece of finance provide benefits for both issuers and investors. Companies can create external financing by initial public offering and investors earn money through dividend payments or selling shares with the profit. It has become a popular investment choice for investors and majority of big firms are traded in markets. The amount of investment in stock exchanges has increased steadily in last decades and it is expected to continue its growth. The value of market capitalization of stock exchanges in member of the World Federation of Exchanges in 2015 estimated as 62.819 trillion US dollars. Hence, this situation has encouraged researchers to study on stock markets.

In the literature, many studies are conducted on stock markets and different aspects of stocks are examined. The changes in stock prices are tried to be explained by different factors. As a result, some theoretical models were presented. One of the well-known models is capital asset pricing model (CAPM), developed by Sharpe (1964), Lintner (1965) and Mossin (1966). This model claims that there is a positive linear relationship between the excess return on a stock and the excess return on the market. In other words, the return of a stock is explained by the return of the market portfolio.

The model introduces a new risk concept and it includes systematic risk and unsystematic risk. The coefficient of market return is called as “Beta”. Beta is defined as the systematic risk of a stock and it represents the risk that it is not

possible to eliminate through diversification because it is caused by the conditions of economy and market.

The CAPM has attracted significant attention from finance world. Its validity and applicability have been researched in stock markets of both developed and developing countries. The findings of studies do not draw precise conclusions related to the model because there are some studies which support CAPM and there are other studies that reject CAPM. Moreover, the assumptions of CAPM are criticized in many academic works and they result in stretching of assumptions. Arbitrage Pricing Theory and Fama-French three factor model are shown up against CAPM but they do not displace CAPM. Hence, it continues to be used by practitioners.

Great numbers of studies have focused on beta and its estimation and stability have become major topics. There are several issues on beta estimation. Firstly, the choice of the return interval used in estimation has become an issue with the availability of higher frequency. The effect of return interval of data on beta has been found as significant by Hawawini (1983) and Handa, Kothari and Wasley (1989). The use of daily, weekly, monthly or yearly return has an effect on value of estimated betas. Secondly, the length of data is a controversial issue. There is no general rule that how long should be the data used in calculations. Levhari and Levy (1977) demonstrated that the using shorter or longer period than "true" horizon creates a bias in beta estimation. The risk of a company, whose stocks are traded in the market, is subject to change as time changes. In order to capture true value of beta, the observations used in the estimation should be neither too long nor too short. In addition, Daves, Ehrhardt and Kunkel (2000) provide evidence to effect of horizon length. Thirdly, nonsynchronous trading of stocks is another issue. With the availability of data in shorter periods, Fama (1966) stated that some stocks' beta which are traded infrequently have bias in estimation. Therefore, return interval, estimation period and infrequent trade of share are problematic topics in beta estimation.

The other major issue on beta is the stability of beta. One of the assumptions of CAPM related to beta is that beta is constant over time. However, Blume (1971) indicated that betas of stocks changed over time. Several works on stability of beta have been conducted and mainly results are contradictory to the assumption.

Turkey is one of the developing countries and it has shown apparent economic progress in last decades. Many firms and individual investors have made direct or indirect investment to Turkey. Moreover, domestic enterprises and entrepreneurs have become aware of the other ways to access finance. As a consequence, financial markets are improved significantly. This improvement can be illustrated by some statistics (İstanbul Menkul Kıymetler Borsası, 2004; Borsa İstanbul, 2016). Firstly, the number of share listed in BIST has risen from 285 to 416 in the period between 2003 and 2015. Secondly, the market capitalization of companies in BIST was 69 billion US Dollars in the end of 2003 and it has reached to 190.15 billion US Dollars in the end of 2015. Thirdly, the total volume of transaction in BIST was 100.1 billion US Dollars in 2003 and it has reached to 381.73 billion US Dollars.

This study targets to examine the betas of stocks traded in Borsa Istanbul. The issues mentioned previous paragraphs are evaluated respectively. The data contains the period between 01.01.2005 and 31.12.2015. In this period, 203 stocks are traded continuously in whole period. Thus, they are used in the study. In the analysis, natural logarithmic returns, based on close price of stocks and XUTUM index, are used. Calculations are done by using daily, weekly and monthly returns. Four methods are used in estimation part and these methods are standard market model, Scholes-Williams method, Dimson's method and Vasicek's adjusted beta. The five time periods are formed according to their length and these are Five-year, four-year, three-year, two-year and one-year periods. Therefore, 440 different betas estimated for 203 stocks and this resulted in 89,320 different beta estimations. Moreover, time-varying characteristics of betas are investigated on same stocks used in beta estimation. There are nine periods and three return intervals in the stability

examination of betas. At last, the forecast performances of estimated betas are compared.

This study makes contributions to literature in several ways. Firstly, the time horizon of this study reflects recent trends of Turkey as it covers the last ten years. The effects of major changes in both local and global economy in last decade are captured like the global economic crisis, European Debt crisis, the decrease in interest rates, the lower inflations compared to previous decades, the rapid devaluation in currency and the changes in credit rating. Secondly, this dissertation is one of the studies that include high numbers of stocks. In numerically, 308 shares are covered in Bist All Share index and 203 of them used in the analysis. There are studies that use Bist 100 and all hundred stocks in the index but their stocks number is limited by hundred. Finally, Scholes-Williams beta estimation method, which is not applied in Turkish stock Markets before, is used in the study.

The organization of this thesis is reported as follows. In Chapter 2, the historical development of Beta is briefly explained and academic works on major issues of beta are summarized. Moreover, the studies, focus on Turkish Stock exchanges, are reported. The data and methodologies used in this study are shown in the Chapter 3. The estimation techniques are detailed and aspects of data are given. In Chapter 4, the results and findings are presented. Differences between estimation methods, differences in other measure are compared. The stability of beta is examined and forecast is done. In the last Chapter, conclusions are presented.

CHAPTER 2

LITERATURE REVIEW

The CAPM as one of the fundamental models in finance has been controversial topic and a large number of studies are done on it by researchers. Sharpe (1964), Lintner (1965) and Mossin (1966) are accepted as pioneers of the CAPM. The model explains the change in price of a stock with the change in market portfolio. The empirical CAPM model stated as below;

$$r_{it} - r_{ft} = \alpha_i + \beta_i(r_{mt} - r_{ft}) + \varepsilon_{it} \quad (1)$$

Where r_{it} is the return of stock i at time t, $r_f$is the risk free rate at time t, α_i is the intercept term of stock i, β_i is the beta of stock i, r_{mt} is the return of market index at time t, and ε_{it} is the error term of model. The equation 2 is obtained by taking variance of both side of equation 1.

$$\sigma_i^2 = \beta_i^2 \sigma_m^2 + \sigma_{\varepsilon_i}^2 \qquad (2)$$

σ_i^2 represents the total risk of security and it is equal to sum of systematic risk i.e. $\beta_i^2 \sigma_m^2$ and unsystematic risk i.e. $\sigma_{\varepsilon_i}^2$ in the right hand side of equation. Systematic risk is defined by Sharpe as the systematic portion of the predicted risk of an asset and it is the risk that cannot be diversified away with a portfolio because it is caused by the general condition of market and economy. On the other hand, unsystematic risk is specific to an asset and it can vanish through a portfolio. It results from specialties of firm. In the literature, it is also called as nonsystematic risk, diversifiable risk, unique risk, company-specific risk (Fabozzi et al, 2006).

Another expression for beta is the ratio of covariance between stock i and market to variance of market portfolio and it is represented as;

$$\beta_i = \frac{\sigma_{im}}{\sigma_m^2} \qquad (3)$$

This theoretical definition implies that market beta is equal to one. The stock with beta higher than one is accepted as riskier than average and the stock with beta lower than one is count as less risky than average.

The CAPM as an equilibrium model has several assumptions and these assumptions are listed below;

1. All investors focus on a single holding period, and they seek to maximize the expected utility of their terminal wealth by choosing among alternative portfolios on the basis of each portfolio's expected return and standard deviation.

2. All investors can borrow or lend an unlimited amount at a given risk-free rate of interest, r_{rf}, and there are no restrictions on short sales of any asset.

3. All investors have identical estimates of the expected returns, variances, and covariances among all assets (that is, investors have homogeneous expectations).

4. All assets are perfectly divisible and perfectly liquid (that is, marketable at the going price).

5. There are no transaction costs.

6. There are no taxes.

7. All investors are price takers (that is, all investors assume that their own buying and selling activity will not affect stock prices).

8. The quantities of all assets are given and fixed (Brigham and Ehrhardt, 2011).

Significant numbers of studies are conducted to test validity of CAPM. However, there is no consensus on this topic. There are some studies that support completely or partially the model and the academic works, which reject the CAPM, are presented. Although this situation, CAPM still continue to be used by many people.

Apart from the CAPM, beta as systematic risk has been used frequently by practitioners and numerous studies have focused on beta. Majority of these studies can be collected under two titles as estimation issues and stability. The return interval of stocks, the length of estimation period and the effect of thin trading are related to estimation of beta and the consistency of beta over time is about stability of beta. In following parts of this chapter, some of the academic works on these topics are presented.

2.1. Beta Estimation Issues

2.1.1 Return Interval

Hawawini (1983) investigate that the reason of the change in beta when return interval changes. Twenty shares, which were traded in S&P 500, were used and the data period was four year from January 1970 to December 1973. Betas were estimated in five return intervals and these are monthly, triweekly, bi weekly, weekly and daily. According to estimates in the work, calculated betas vary and some betas increase and some betas decrease when the return interval changes.

The Author argues that the reason is the existence of intertemporal relationships between the daily returns of individual securities and those of the general market. In order to prove that, the correlation coefficient between daily stock return and daily market return and its one day lag and lead were calculated. Then the ratio of sum of one day lag and one day lead correlation coefficient to concurrent correlation

coefficient, which is called as “q-ratio” by author, was computed. After that, some transformation were carried out by using the definition of beta i.e. the ratio of covariance between stock return and market return to variance of the market return. Thus, the equation obtained show that the effect of “q-ratio” on beta.

Handa et al (1989) examined the beta’s relationship with the return interval. It is claimed that the change in the covariance of stock with market is not proportional to the change in the variance of market when return interval changed. Thus, beta is affected from interval return because beta is calculated as dividing the covariance between stock and market by market variance. 20 portfolios formed according to market value of stock. The smallest 55 of companies are put into portfolio 1 and other portfolios contain stocks in ascending order. These portfolios are updated in each year with respect to their value rank in market and other related issues.

The work uses all stocks, which are listed in at least one year in the CRSP monthly tape during period, in New York Stock Exchange in period of between 1926 and1982. In addition, shares in American Stock Exchanges added for period of 1964-1982. Eight intervals are used and these are one day, one week, one month, two months, one quarter, four months, six months and one year. Betas of stock in different return intervals except from daily and weekly are estimated using 15 year overlapping period from 1926 to 1982. Daily and weekly betas are computed from 1968 to 1982 by using one year period. However, daily and weekly betas are not compared with other return intervals because sample periods are different. Betas are calculated by market model. The results are reported and it is seen that portfolios’ betas change when return interval changes.

The portfolios’ betas, which are greater than one, tend to increase and the portfolio betas’ which are smaller than one, tend to decrease as return interval increase. Therefore, the difference between high betas and low betas increases according to increase in return interval. Moreover, average beta of markets is equal to one in each

interval and standard errors of portfolios' betas increases as parallel to return interval.

2.1.2 Estimation Period

Levhari and Levy (1977) studied on the length of period used in beta estimation. Theoretical model is given firstly and then empirical evidence to support their claim is provided. In theoretical model, it is assumed that true horizon for beta is known and the two case i.e. data for longer period than true horizon and data for shorter period than true horizon are separately modeled. For the first case, β_1 is defined as true systematic risk and β_n is defined as systematic risk of n period data. The theoretical model is calculated in several steps including substitution and transformation. The behavior of β_n is described for three situation as follows. Firstly, if a stock has $\beta_1 = 1$, then β_n is also equal to 1. Secondly, if a stock is aggressive i.e. $\beta_1 > 1$, then β_n is greater than β_1. Thirdly, if a stock is defensive i.e. $\beta_1 < 1$, then β_n is smaller than β_1. For the second case, β_n is defined as true systematic risk and the shorter period, time one beta, is represented by β_1. This time relation is different. When stock is neutral, β_1 is equal to one. When a stock is aggressive, β_n is greater than β_1. When a stock is defensive, β_n is smaller than β_1.

Twenty stocks, which are ten defensive and ten aggressive without question, are used in empirical part. Data period is 1948-1968 and monthly return is used. The results support the theoretical findings. General behavior of β_n for both aggressive and defensive stocks is in the direction of away from β_1 as n increase.

Daves et al (2000) analyze both return interval and estimation period. The real data and simulated data are used in the study. Daily, weekly, two-weekly and monthly returns are used and the estimation periods vary from one year to eight year over the period of 1982-1989. 1329 firms are included in daily, weekly and two-weekly returns and 946 firms are in the monthly returns. Betas are estimated by standard market model. Firstly, the standard deviation of errors from regressions and standard

deviation of market returns are calculated for each return interval and each one year period. The mean of standard deviation of market return and mean of average standard errors of regressions from each year are used in simulation and average standard errors of estimated betas are simulated for four return intervals and eight estimation periods. According to results, when estimation period increases, standard error of estimated betas decreases. Also, there is an increase in it as return interval lengthens. Secondly, the comparison, between return intervals and between estimation periods, is done by using real data. The betas are estimated and mean standard errors of estimated betas are calculated for each interval and period. The results are align with simulation. The authors indicate that the daily data has smallest mean error of beta and it provide more precise beta estimate. Moreover, the period of three year is pointed due to its reduction in error because it reduces error by 91% percent of the whole reduction by changing one year period to eight year period.

In addition, Daves et al (2000) conduct a stationarity test on beta. In the eight year period, %86 of betas are not stationary and the ratio is decreases when estimation period shortens. This number is %47 percent for three year. Thus, the authors suggest three year of estimation periods over eight different periods.

2.1.3 Thin Trading

Fama (1965) studied on New York Stock Exchange with the aim of applying the Theil-Leenders test. This test examines the dependence of stock prices movements to the day before according to Information Theory. Price movements are categorized as advancing, declining and remaining unchanged. 2625 trading days between June 2, 1952 and October 29, 1962 are used in analysis. On the average, nearly 40 percent of stocks increases and 40 percent of stocks decreases and 20 percent of stocks remains unchanged in any day. The proportion of advancing, declining and remaining unchanged stocks is predicted by Theil-Leenders method, which is similar to simple linear model without intercept. The coefficient of previous day's proportion deviation from mean of proportion was calculated as 0.3.

After that, the author checks results with least square method, serial correlations and stationarity. The result of regression supports the findings of Theil-Leenders for advancing and declining proportions. Their coefficients are 0.2840 and 0.2846, respectively and they are close to 0.3. However, the coefficient of proportion of remaining unchanged is 0.6725 and it is quite different than Theil-Leenders's outcome. Then, serial correlations of proportions are examined. Advancing and declining proportions correlations' gets smaller and become insignificant after 1st lag and this situation is align with previous results. For remaining unchanged proportions, correlation between all previous lags is high. Then, the stationarity of proportions are investigated. The author indicate that mean of remaining unchanged decreases from 0.25 to 0.18 and this decrease cause a bias in the correlation coefficient. Trading days are splitting into subgroups, which consist of fifty days and their correlations are calculated. Average of subsamples' remaining unchanged proportions' first correlation is 0.202 and it is smaller than 0.673. Also, correlations for advancing and declining proportions are smaller than whole period's correlations.

Fama states that adjusting change in mean does not correct this bias completely and the real reason is about how data is collected and reported. The non-synchronous trade relation causes the bias because some stocks are not traded simultaneously with market events. Therefore, a change in the price of a stock, which was not traded in previous periods, in time t reflects the sum of previous period's and current period's change.

The effect of thin trading on stability of betas is evaluted by Dimson and Marsh (1983). The entire period in the study is between January 1955 and December 1979 and monthly returns are used in calculations. The period is broken down to sub periods of five years. The estimation of betas is based on two methods as simple regression and trade to trade(TT) regression. An index is calculated to measure the trading infrequency of stocks.

Firstly, market model results provides evidence that UK stock market betas have similarity with US stock market in correlation and stability. Secondly, stocks are grouped with respect to their trading infrequency and transition matrix is constructed with five classes. The matrix shows that trading frequency of stock does not change over periods and there is a positive relationship between trading frequency and average betas. The estimated betas from different methods are regressed by trading infrequency and it is expected that trading infrequecny should have lower explanatory power in TT method than simple regression if there is an effect of thin trading. The results of regression are line with the expectation and adjusted TT estimates for firm size have the lowest explanatory power of trade infrequency. Transition matrix, correlation between periods and mean tendency are computed for TT method and the TT betas are seemed as more instable than simple regression's betas. The work provides evidence that thin trading has serious effect of betas.

Martikainen (1991) research on the effect of thin trading on beta estimations with different return intervals in Finnish stock market. Daily, weekly and montly logaritmic returns of 38 stocks are used in the study and the data covers period from January 1971 to December 1986. All period is divided into eight equal samples and estimation of betas are based on market model. Firstly, beta estimated are evaluated and it is noticed that betas have higher values when return interval increases. The effect of thin trading is investigated in last ten year of data. The pearson correlation coefficients between betas and trading frequency measure are calculated and the daily betas have highest correlation with trading frequency. The betas are modeled with trading frequency for examining effect on stability and residuals of model are used in the stability analysis. Spearman rank correlation of residuals are reported and the results indicates that there is an instability in betas due to the trading frequency.

2.2. Stability of Beta

The coefficients of CAPM are estimated through ordinary least squares method and this method assumes these coefficients as constant through period. In literature, many

scholars have made research on this issue and the findings indicate that this assumption does not hold.

The stationarity of beta is examined by Blume (1971). In the study, monthly returns of stocks, which are listed in New York Stock Exchange, between July 1926 and June 1968 are used and betas are estimated by market model. The entire period is reviewed in six equal periods. The portfolios are formed in different size between 1 and 100. Betas of portfolios in one period are compared with next period's betas.

Blume states that portfolio with lowest beta has higher beta in next period and highest beta portfolio has lower beta in next period. This is counted as proof of mean tendency of beta over time. A correction method is proposed for future value of betas as calculating betas of previous period with coefficients that estimated by regressing previous period's beta with one predecessor period. Blume (1975, 1979) improves its correction method with theoretical background and provides more evidence to mean tendency.

Levy (1971) investigated stationarity of betas in similar method with Blume. Weekly returns and smaller periods with respect to Blume's work are used in the study. The lengths of estimation periods are 13, 26 and 52 weeks and entire period is 520 weeks from 1960 to 1970. The 500 stocks are included in the analyze and portfolios are formed with the size of 1, 5, 10, 25 and 50 stocks.

Firstly, product moment and rank order correlation are evaluated. The results show that the both of the correlations increases when the portfolio's size gets higher in all estimation period. Moreover, longer estimation period means higher correlations. Secondly, the averages of difference between actual betas of a period and predicted betas in previous period are critized. The portfolios with lowest betas are underestimated and the portfolios with highest betas are overestimated. In other words, there is similar situation in Blume's work and the tendecny for mean appears.

Fabozzi and Francis (1978) analyze the beta with the random coefficients model. The betas of 700 stocks are estimated by market model with the monthly returns between December 1965 and December 1971. The findings indicate that beta is variant over time as oppose to assumption.

Stochastic behaviour of beta is analyzed by Bos and Newbold (1984) and they try to find whether betas follows a first-order autoregressive process. 464 stocks which have monthly data between January 1970 and December 1979 are included in esimation and betas are estimated by market model. The hypothesis of fixed coefficient is tested by lagrange multiplier test and the results indicate that betas have stochastic behaviour. However, there is not enough evidence that support the claim of autoregressive process.

2.3. Works on Turkish Stock Market

Turkey founded its stock market in 1985 with the name "Istanbul Menkul Kıymetler Borsası". As a parallel to economic development of country, stock market shown improvements over years, especially late 2000s. Also, Turkey as an emerging economy gets attentions from foreign investors. Thus, this motivates the researches to work on Borsa Istanbul and many studies are conducted.

Odabaşı (2002) studied on beta of stocks, listed in Istanbul Stock Exchange (ISE). In the study, different estimation methods are compared and instability of beta is examined. 100 stocks, which present between 1992 and 1999, are included and ISE 100 index is used as market performance's measure. The returns of stocks are calculated as normal return. There are three estimation periods as one year, two years and four years. OLS, Dimson and Vasicek methods are applied for beta estimation and the model with two leads and two lags is used for Dimson method. The comparison of beta estimates is conducted by Wilcoxon sign test. Stability of betas are evaluated by the method proposed by Hildreth and Houck. Moreover, Blume regression is estimated for investigating tendency in betas.

According to results presented in the study, averages of betas for each estimation period and estimation method are usually less than one. Betas' average estimated by Dimson is seemed higher than Vasicek and OLS. The author test the difference between mean of methods by Wilcoxon Sign Test and the result of tests shows that the difference between OLS and Dimson and the difference between Vasicek and Dimson are generally significant. However, Vasicek and OLS techniques have no meaningful difference.

In the next part of study, tendency in betas is analyzed by Blume regression and OLS and Dimson Betas are included in this part. Results indicate that there is a regression tendency in betas and this is a sign for instability of betas. In the last part, Breusch-Pagan LM test is used for beta stability on OLS and Dimson betas. The results present that %83 of OLS's beta and %84 of Dimson's beta are instable during the period of eight years. The study demonstrates that the number of instable beta decreases when estimation period's length decreases.

Odabaşı (2003a) examines the effect of return interval, stability and diversification on betas. The 100 stocks listed in ISE are in the scope of study and the data period is from January 1992 to December 1999. Weekly and monthly returns are used and they are calculated as normal return. ISE 100 index is taken as market index. Betas are estimated by using standard market model. The duration of estimation periods differs from quarter to four years for weekly return and from one year to four years for monthly return.

Results of estimations illustrate that market beta is different for weekly and monthly returns in one year, two years and four years estimation periods according to t-test results. Also, mean of weekly betas are smaller than mean of monthly betas in all periods. The other output is that monthly betas have higher R^2 value than weekly betas. In addition, standard error is smaller when return interval decreases and estimation period increases. The correlation coefficient and rank correlation

coefficient are investigated and they are computed by using adjacent periods. The findings indicate that correlation increases when return interval decreases.

The second part of study is conducted by forming portfolios. For examining correlation, weekly returns are used and portfolio sizes are one, three, five, ten and twenty. Portfolios are determined by ordering estimated betas from first session in period length in descending order and selecting them starting from highest according to portfolio size. Correlation in portfolios' beta increases with the size of portfolio. Lastly, beta coefficients of portfolios are compared in consecutive two years. In the first year of two year, betas are estimated and stocks are put in portfolio from highest beta to lowest beta order. Each portfolio contains twenty stocks. In general, portfolios' averages changes through the mean in the second period. In other words, highest betas' portfolio average decreases and lowest betas' portfolio average increases in second period.

Odabaşı (2003b) analyzes the effect of return interval in ISE. The data cover 100 stocks listed in ISE and their close prices in the period between January 1992 and December 1999. The standard market model is used for beta estimation. Daily, weekly and monthly returns are used and they are computed as normal return based on their close price. The data is split into two sub periods as 1992-1995 and 1996-1999. In addition, the effect of return interval is examined for individual stocks and portfolios formed with respect to market value of companies.

The findings show that average beta increases when return interval increases and average R^2 has same trend. Moreover, t-test result verifies the difference in averages betas. In both sub periods, difference in daily and monthly betas and difference in weekly and monthly betas are found significant while daily and weekly beta have no statistically significant difference. Standard errors of beta estimates decreases as parallel to decrease in return interval as it is expected.

The outcomes of beta estimation are investigated with respect to market value of firms. The twenty companies which are the most valuable and the twenty companies which are the least valuable are formed into two portfolios in both sub periods. Then, their betas and other information are compared. The claim that "small (big) companies' betas increase (decrease) when the return interval gets longer" is examined. The test results show that there is no significant change in the mean beta of portfolios when return interval changes. Thus, the evidences do not support the claim.

Oran and Soytaş (2009) investigates the stability of betas in the ISE. They use event study methodology in their study and this distinguishes their work from the others. They examine both individual and portfolio beta stability. The return of stocks is calculated as logarithmic return and ISE 100 is used as a market index. The period covered by the study is from January 1996 to June 2007. They use length of 500 workdays and select them randomly for individual stocks. For portfolios, they form 500 portfolios consist of ten randomly selected stocks. The event dates are some for both individual stocks and portfolios. The market model is used in the part of their study in which characteristics of betas are analyzed and it is expanded with dummies for constant term and beta in the model in order to test stability. Their hypothesis about stability is tested by binomial test.

The results of analysis for individual stocks show that the average of betas is 0.7548 and average R^2 is %33 for market model. In the second model for testing stability, 152 of 500 betas' dummies are found as significant and this number is high enough to reject the null hypothesis that the relationship between stock returns and market return is stable. They also report that betas change from 0.1464 to 1.3867. For portfolios, the results indicate that the average of portfolio betas is 0.7549, which is closer to individual stocks' betas mean. The average R^2 of portfolios is significantly higher than average R^2 of individual stocks. The second model results for portfolios shows that there is instability in portfolio betas and 231 of 500 beta dummies are found as statistically meaningful. In the last part of study, stability of individual betas

and portfolios are compared. They test it by using the null hypothesis that portfolio betas are more stable than individual betas. According to z-test score, they failed to reject the null hypothesis.

Çelik (2013) examines the stability of sector betas. The data covers the period between start of 2005 and end of 2009 and it is divided into two sub sample at the time of 17.07.2007, which is considered as the begining of global crisis. The daily close price of sector indices and ISE All Share Index is used and the returns are computed as logarithmic return. Betas are estimated by rolling regression with 60 observations and recursive regression and then estimated betas are regressed by time. The significance of time trend's coefficient is considered as the sign of time varying behaviour of betas.

The stability assessment is done separately for each sub sample. The number of significant coefficient of time trend is 19 in pre-crisis period and 17 in crisis period over 24 for rolling regression method. For recursive regression, 19 in period of pre-crisis and 20 in period of crisis are found as instable.

İskenderoğlu (2012) studied on the betas of ISE between 2003 and 2011. The daily return of 74 stocks listed in ISE 100 Index is used and betas are estimated in four different period length and these are a month, three months, six months and a year. Thus, there are 103, 34 17 and 8 different observations for periods, respectively. Moreover, Blume method is performed by pooled regression and the limit theorem is for forecast future betas.

Average of betas by duration of estimation are 0.7611 for month, 0.8089 for three months, 0.8223 for six months and 0.8342 for a year. The coefficient of blume techniques are obtained and long term bteas are predicted by using them. In the long term as result of limit theorem, the mean for periods are predicted as 0.7577, 0.7855, 0.8128 and 0.8222 from month to a year, respectively.

Acaravcı, Kandır and Erişmiş (2009) compares different beta estimation methods. 123 stocks, which are presented in ISE between July 1996 and June 2008, and are in apart from financial sector and stock of group companies, are used. The ISE 100 Index is taken as a proxy for market portfolio. The return interval of data is monthly and original CAPM model is used for beta estimation. The data period is split into two sub samples for Vasicek adjustment and three sub samples for Blume's method. The betas from the period between July 2002 and June 2008 are compared.

The mean beta is 0.7770 for unadjusted beta, 0.6612 for Vasicek's betas and 0.9046 for Blume's betas. The Blume betas have the smallest range and standard deviation and it is followed by Vasicek's betas. The unadjusted betas have range and standard deviation more than two times of others. The t-test is conducted for pairwise comparisons. The results indicates that all methods give statistically different market beta estimations.

Tetik and Uğur (2010) investigates the effect of return interval on beta with respect to sectors. The eligible 184 share are categorized into four sectors and these sectors are industry, finance, service and technology. The data covers the duration between 2002 and 2006 and daily, weekly and monthly returns are used. The returns are computed as normal return and betas are estimated by market model. ISE All Share Index's return is the measure for market portfolio.

The findings indicate that average betas, standard error, range of betas and average R^2 increases when return interval lengthens in all sectors. The average beta of sectors are compared by t-test and finance sector is found as statistically different from other sectors while other sectors are not concluded as different from each other. In addition, finance sector show more reaction to market movements than others because its mean beta is higher than others. At last, mean betas of sectors in all interval imply that market beta is lower than one.

The impact of return interval choice on betas of ISE is analyzed by Tunçel (2009). 189 shares and ISE 100 Index as representative of market portfolio are used. The beta estimation is based on market model and daily data between 2000 and 2007. Daily, weekly and monthly returns are computed as normal return. There are three estimation periods as whole period and two sub periods which are constructed by dividing the whole period into two at the middle. The comparison between betas are conducted by t-test. In the study, betas of different return intervals in same period and betas of sub periods in same return intervals are compared. The results provide evidence for the claim that the betas of different return intervals are different. Moreover, it is seen that the average beta has changed in time in each return intervals.

Stock's betas, correlation coefficient and transition matrix are examined by Beyazıt (2005). The study uses 46 stocks and their monthly returns between 1990 and 2003. Black, Jensen, Scholes technique is used in beta estimation and Vasicek and blume's adjusment techniques are applied. There are 162 monthly observations in data period and the two different estimation periods are constructed. First one is consist of three equal sub periods with 54 months and second one is consist of two sub periods as first sub period containing 108 months and following period containing 54 months. There is an additional estimation period with last 34 months. The comparison period is between January 1999 and June 2003. According to outputs, the average betas increases when the duration of estimation data increases.

The transition matrix is formed with five risk classes and they are 0.54 and lower, between 0.55 and 0.84, between 0.85 and 1.14, between 1.15 and 1.44 and 1.45 and higher.The whole period is divided into 13 sub samples that each sub sample contains 12 montly observations. The matrix shows that at least %60 of betas in each risk group changes group in next period and this indicates that the betas have changing behaviour over time.

Another study examines the different beta estimation models in the ISE is done by Kalfa (2007). Standard market model, blume's method and Vasicek adjustment are three of the estimation methods. Moreover, combined model and adjustments for fundamental firm variables a.k.a fundamental beta are evaluated. The data covers 44 stocks and their close prices during the period between January 1991 and December 2006. The logarithmic return is used and returns are calculated over three return intervals as daily, weekly and monthly. ISE 100 Index is taken as market return measure. Entire period is divided into four sub periods and each sub periods length is four years. In addition, betas of portfolios with the size of 2, 3, 5, 8 and 10 are analyzed along with the individual stock betas. These portfolios are created by ordering from highest to lowest with respect to individual betas.

The average betas for stocks have different values in each interval and period. The monthly betas are higher than daily and weekly betas in each period. The difference between intervals is supported by pairwise t-test. Another outcome is that average betas except only one of them are smaller than one.

The correlation of betas between adjacent perods are examined and individual betas and portfolio betas are compared. The findings show that the correlation increases as parallel to size of portfolio.

The transition matrix is constructed for each return interval and there are three risk classes in it as low, middle and high. The matrix show that at least %40 percent of stocks in each risk group change its riskiness in next period in all return intervals.

The mean absolute deviation and mean absolute percentage error are used as performance measure in the prediction of next periods' betas. The blume regression, vasicek's adjustment and unadjusted betas are compared and 1999-2002 and 2003-2006 are the comparison times. The blume's method performs better than other methods in each period according to error measurements and increase in the portfolio

size decrease the error in all methods. Moreover, Vasicek's adjustment performs slighty better than unadjusted betas.

CHAPTER 3

DATA AND METHODOLOGY

3.1 Data

This thesis uses 203 firms' stocks which are traded in Borsa Istanbul. The data period is between January 3, 2005 and December 31, 2015. Price data for stocks is obtained from Thomson Reuters and the data is adjusted for stock splits, dividend payments and other related issues. The data period is divided into two as estimation period and forecast period. The entire estimation period starts at January 3, 2005 and ends at December 31, 2014. The data for forecast period is from January 2, 2015 and December 31, 2015.

The logarithmic returns are used in the study and they are calculated from the close price of stocks. The formulation for logarithmic returns is shown below;

$$LR_t = \ln(\frac{P_t}{P_{t-1}}) \qquad (4)$$

"Bist All Index", whose ticker symbol is "XUTUM", is used as market index. It is a value weighted index and it contains all traded stocks in BIST apart from investment trusts. The number of stock covered by XUTUM is 308. Stocks, which have at least one hundred twenty months history from 31.12.2014, are selected in the scope of this study. Therefore, 203 of 308 stocks are eligible. The list of these stocks and their observation counts are provided in the appendix.

There are stocks that have lower observations than market index beacuse some stocks are not traded in the entire period due to the some special issues of companies.

These days and sequential day are not included in estimations because they have possibility for misleading in estimations.

3.2 Methodology

3.2.1 Standard Market Model

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \qquad (5)$$

Where R_{it} is the return of stock i at time t, α_i is the intercept term of stock I, β_i is the beta of stock i, R_{mt} is the return of market index at time t, and ε_{it} is the error term of model. The coefficients of market model are estimated by ordinary least square method.

3.2.2 Scholes-Williams Method

Schloles and Williams (1977) proposed a method for estimation beta when thin trading occurs. This model is argued as robust for biasness and inconsistency caused by non-trading. The model represented as follows;

$$R_{it} = \alpha_{-1,i} + \beta_{-1,i} R_{m,t-1} + \varepsilon_{-1,it} \qquad (6)$$

$$R_{it} = \alpha_{0,i} + \beta_{0,i} R_{m,t} + \varepsilon_{0,it} \qquad (7)$$

$$R_{it} = \alpha_{+1,i} + \beta_{+1,i} R_{m,t+1} + \varepsilon_{+1,it} \qquad (8)$$

$$\beta_{SW} = \frac{\beta_{-1i} + \beta_{0i} + \beta_{+1i}}{1 + 2\rho_m} \qquad (9)$$

$$\alpha = \frac{1}{T-2} \sum_{t=2}^{T-1} R_{it} - \beta_{SW} \frac{1}{T-2} \sum_{t=2}^{T-1} R_{mt} \qquad (10)$$

Where

ρ_m= Autocorrelation coefficient of the market index

T = Total number of observation

This is an enhanced version of standard market model. The return of a stock is regressed by one lag, current and one lead of market return separately. Then, the ratio of sum of beta coefficient of these regressions to one plus two times of autocorrelation coefficient of market index is called as Scholes-Williams beta.

3.2.3 Dimson Method

This method is presented by Dimson (1979) with the similar aim of Scholes Williams, which is infrequent trading. The structure of model is given below;

$$R_{it} = a_i + \sum_{k=-n}^{n} \beta_{k,i} R_{m,t+k} + e_{it} \quad (11)$$

$$\beta_{DIM} = \sum_{k=-n}^{n} \beta_{k,i} \quad (12)$$

The multiple regressions with independent variables of k lag, synchronous and k lead of market return are run and the sum of betas gives the Dimson beta.

3.2.4 Vasicek Adjustment

Blume (1971) indicates that betas have time varying behavior and tendency towards mean of market beta. Vasicek (1973) works on same subject and introduces an adjustment for beta. The authors claim that the Bayesian approach is an adjustment for β with respect to estimated beta's distribution.

$$\hat{\beta}_v = w\beta_{i,OLS} + (1 - w)\bar{\beta}_{OLS} \quad (13)$$

$$w = \frac{\sigma_\beta^2}{\left(\sigma_\beta^2 + \sigma_{i,OLS}^2\right)} \quad (14)$$

Where

$\hat{\beta}_v$= Adjusted Vasicek beta

$\bar{\beta}_{OLS}$= The average of estimated betas,

$\beta_{i,OLS}$= The estimated beta of stock i,

$\sigma^2_{i,OLS}$= The variance of estimated beta of stock i,

σ^2_{β}= The variance of estimated betas.

In this method, betas are estimated through standard market model and the results are used in calculation of Bayesian coefficient. Then, the beta of stock i is obtained from equation (13).

CHAPTER 4

ANALYSIS AND EMPIRICAL RESULTS

The result of analysis, conducted according to methodology and data are mentioned in previous chapters, are presented in this part of thesis and the software “Eviews” and “Excel” are used in calculation. There are a dozen of data sets in this study and they formed by three return interval and five different estimation period length. Daily, weekly and monthly returns are the intervals and one year, two year, three year, four year and five year are the length of estimation periods. Each period starts with first workday of a year and ends with last workday of a year. The first sub period in each duration start with year 2005 and following sub period begins in year 2006. The last sub period in each length ends with year 2014. Table 1 reports the number of data sets with respect to period length and type of returns. The detailed representation of periods is provided in appendices.

Table 1: The number of data sets used in analysis

Length of Period	Number of Periods	Number of Return Intervals	Data Set
5 Year	6	3	18
4 Year	7	3	21
3 Year	8	3	24
2 Year	9	3	27
1 Year	10	2	20
Total	40		110

The number of observations covered by these periods is presented in Table 2. This numbers represent the count of XUTUM index during these periods and some stocks have fewer observations than reported in the table. All stocks have same number of monthly observations but there are small differences in daily and weekly. Moreover, there are differences in the number of workdays between years due to calendar effect.

Table 2 : The mean numbers of observations by length of periods and return intervals

		5-Year	4-Year	3-Year	2-Year	1-Year
Number of Observation	Daily	1258	1004	753	502	251
	Weekly	260	208	156	104	52
	Monthly	60	48	36	24	-

4.1 Descriptive Statistics

The descriptive statistics related to estimation models are reported in this subsection. Each models' statistics are shown in the separate tables. Each row represents the average of beta statistics calculated in all sub periods according to period lengths and return intervals in the research. The mean of beta, median, maximum, minimum, standard deviation, skewness and kurtosis are provided in the tables. For each estimation period, the statistics of estimated betas are presented in appendices.

Table 3 shows the descriptive statistics for standard market models. The average beta increases for all estimation periods when moving from daily returns to monthly returns. The mean betas of all sub periods except 1 year get closer value to each other and they are around 0.79 for daily, 0.82 for weekly and 0.92. In one year estimation, both daily and weekly average is smaller than others.

The range of betas is similar in daily and weekly beta but it is higher in monthly betas. In 2 year period and monthly return interval, it reaches its highest value. The average of maximum is close to 2 and the average of minimum is close to -0.4. It is noticed that betas get negative value in some periods. The standard deviation of betas

decreases when return interval shortens and duration of estimation period increase. The skewness of beta show different characteristics according to return interval. Betas have right skewed distribution in daily and weekly returns while they are left skewed in monthly. Finally, there is no pattern in kurtosis value.

Table 3 : Descriptive Statistics for Betas, which are estimated by Standard Market Model

Standard Market Model

Estimation Period	Return Interval	Average Beta	Median	Maximum	Minimum	Standard Deviation	Skewness	Kurtosis
5 Year	Daily	0.79002	0.774127	1.40002	0.31356	0.17839	0.426917	3.91496
	Weekly	0.82728	0.809633	1.44078	0.342424	0.20574	0.300538	2.98068
	Monthly	0.94125	0.936236	1.67467	0.202116	0.28313	-0.10615	2.85426
4 Year	Daily	0.7926	0.781376	1.39899	0.304341	0.18363	0.334831	3.802
	Weekly	0.82913	0.814499	1.47963	0.327672	0.21425	0.267488	2.97453
	Monthly	0.93891	0.936543	1.7574	0.085619	0.30096	-0.07402	3.03427
3 Year	Daily	0.79007	0.779991	1.41565	0.286988	0.19209	0.249418	3.66245
	Weekly	0.81685	0.807417	1.49878	0.254653	0.22928	0.228965	3.07895
	Monthly	0.92333	0.921501	1.89877	-0.07938	0.33157	-0.10854	3.31802
2 Year	Daily	0.79217	0.787897	1.42313	0.244627	0.20585	0.164403	3.46524
	Weekly	0.80674	0.799677	1.58738	0.128364	0.25514	0.132552	3.15828
	Monthly	0.91683	0.922004	2.04443	-0.36936	0.39483	-0.15954	3.61088
1 Year	Daily	0.76342	0.756227	1.47599	0.122312	0.23081	0.216836	3.69084
	Weekly	0.7755	0.771928	1.69478	-0.13692	0.3086	0.089273	3.37747

Scholes Williams estimation methods' results are reported in the table 4. The mean of beta is around 0.83 for daily, 0.92 weekly and 1.07 for monthly while they are 0.78 and 0.84 for daily and weekly of one year duration. The medians of estimated betas are closer to means. The spread of beta gets larger when the number of observations in estimation decreases and the length of return interval increases. Betas in monthly return intervals get extreme minimum values that they are negative. The average range in 2 year length and monthly return is nearly 4.65. Monthly betas have higher standard deviation than other returns. Also, longer estimation duration means smaller deviation. Kurtosis value is around 3.5 and does not have any pattern. Betas estimated by using monthly returns have negative skewness while daily and weekly have positive skewness.

Table 4 : Descriptive Statistics for Betas, which are estimated by Scholes Williams Model

Scholes Williams

Estimation Period	Return Interval	Average Beta	Median	Maximum	Minimum	Standard Deviation	Skewness	Kurtosis
5 Year	Daily	0.83102	0.826258	1.35947	0.344516	0.18562	0.179825	3.13182
	Weekly	0.92602	0.920202	1.68156	0.153246	0.28114	0.058405	2.91007
	Monthly	1.07222	1.064799	2.13874	-0.36383	0.40908	-0.26067	3.85229
4 Year	Daily	0.83666	0.831856	1.37721	0.32671	0.19348	0.100201	3.06628
	Weekly	0.93376	0.928719	1.77927	0.139071	0.29892	0.103596	3.05798
	Monthly	1.07706	1.075291	2.3153	-0.46592	0.45093	-0.16002	3.77077
3 Year	Daily	0.82828	0.826283	1.39773	0.248404	0.20881	0.063654	3.13663
	Weekly	0.91636	0.906108	1.91294	-0.01594	0.32613	0.101637	3.37637
	Monthly	1.0657	1.074971	2.56692	-0.90188	0.52911	-0.3117	4.28654
2 Year	Daily	0.82213	0.820914	1.45902	0.124406	0.23261	0.023466	3.25125
	Weekly	0.90308	0.888749	2.12727	-0.28709	0.38375	0.042506	3.76808
	Monthly	1.07039	1.07161	3.1754	-1.48446	0.67393	-0.4169	5.54495
1 Year	Daily	0.7876	0.785712	1.63545	-0.03508	0.2748	0.109142	3.46376
	Weekly	0.84959	0.836941	2.70133	-0.87491	0.52079	0.032837	4.382

Table 5 represents statistics about betas estimated by Dimson's estimation methods. Period of one year's mean for daily and weekly returns are 0.78 and 0.83 respectively. The other periods' mean is higher and closer to each other in all return intervals. The average range of beta differs with respect to size of periods and frequency of returns. There is a positive relation between length of betas' spread and length of return intervals. Negative betas are detected in all return intervals, especially in monthly. The average maximum beta is 3.21. The smallest range is belongs to five year and daily return and it is approximately 1. The standard deviation changes from 0.186 to 0.667 depending on estimation period and return interval. There is a trend that standard deviation increases with lengthening in return interval and shortening estimation span. Change in the skewness of beta does not show any characteristics movement but it is always negative in monthly return and positive and closer to zero in daily and weekly. In the same size of estimation length, monthly returns have highest kurtosis value comparing to others.

Table 5 : Descriptive Statistics for Betas, which are estimated by Dimson Model

		Dimson's Beta						
Estimation Period	Return Interval	Average Beta	Median	Maximum	Minimum	Standard Deviation	Skewness	Kurtosis
5 Year	Daily	0.83192	0.826355	1.35792	0.346873	0.18577	0.177581	3.12747
	Weekly	0.91035	0.905298	1.62642	0.170687	0.26843	0.055135	2.89265
	Monthly	1.07202	1.065873	2.18632	-0.41281	0.41854	-0.25218	3.86112
4 Year	Daily	0.83718	0.833965	1.37623	0.329618	0.1935	0.099879	3.06601
	Weekly	0.91721	0.907798	1.70477	0.167849	0.28361	0.095299	3.00591
	Monthly	1.07499	1.075754	2.37867	-0.4802	0.45768	-0.18041	3.81445
3 Year	Daily	0.82893	0.82955	1.39507	0.254304	0.20837	0.063512	3.12811
	Weekly	0.90144	0.890145	1.816	0.039002	0.30771	0.084035	3.24359
	Monthly	1.06368	1.080339	2.6193	-0.91391	0.52648	-0.33678	4.51235
2 Year	Daily	0.82299	0.823124	1.45673	0.140025	0.23162	0.024634	3.2374
	Weekly	0.8852	0.876789	2.00899	-0.22339	0.35971	0.032883	3.66465
	Monthly	1.0664	1.081182	3.21351	-1.59331	0.66669	-0.44302	6.09392
1 Year	Daily	0.78833	0.783914	1.63888	-0.01882	0.27376	0.125724	3.47897
	Weekly	0.83722	0.825268	2.46719	-0.71922	0.47078	0.030465	4.35304

Vasicek's adjustment statistics are similar to standard market model's output as it is expected. The statistics are reported in table 6. Average of betas changes between 0.76 and 0.79 for daily, between 0.78 and 0.83 for weekly and between 0.92 and 0.94 for monthly. It is seen that periods with one year length have smallest beta comparing to others. The difference in the range of betas is not as noticeable as it does in the other methods. All estimation periods and return intervals have approximately same size of range for betas. In the average, there is no minimum beta with negative sign and the highest maximum is around 1.56. Standard deviation of Vasicek's betas differs in only small amount between periods and return intervals when comparing other methods. The smallest deviation is 0.171 and the highest one is 0.246. As similar to previous methods, periods of monthly returns are negatively skewed and periods with other return intervals have positive skewness. Kurtosis values show some characteristics. They have higher value when return intervals get shorter and estimation periods get longer.

Table 6 : Descriptive Statistics for Betas, which are estimated by Vasicek's Adjustment

		Vasicek						
Estimation Period	Return Interval	Average Beta	Median	Maximum	Minimum	Standard Deviation	Skewness	Kurtosis
5 Year	Daily	0.79041	0.774958	1.39173	0.331303	0.17108	0.471701	4.11161
	Weekly	0.82732	0.81221	1.38375	0.366215	0.17813	0.360883	3.3614
	Monthly	0.94151	0.937847	1.44974	0.318481	0.20295	-0.13945	3.11112
4 Year	Daily	0.79295	0.78196	1.38967	0.322314	0.17479	0.385698	4.03153
	Weekly	0.82868	0.816992	1.40943	0.369492	0.18155	0.320154	3.36497
	Monthly	0.93815	0.936415	1.46593	0.298109	0.20833	-0.14084	3.13675
3 Year	Daily	0.79037	0.780656	1.40283	0.311983	0.18056	0.305165	3.92435
	Weekly	0.81644	0.809739	1.41789	0.335428	0.18796	0.285017	3.4909
	Monthly	0.92306	0.922157	1.49903	0.252599	0.21891	-0.15878	3.20883
2 Year	Daily	0.79239	0.788512	1.40658	0.286014	0.1895	0.217942	3.72262
	Weekly	0.80644	0.801164	1.45669	0.278629	0.19885	0.215176	3.48056
	Monthly	0.91641	0.92065	1.56211	0.172652	0.24634	-0.19306	3.12427
1 Year	Daily	0.76449	0.756951	1.43591	0.224028	0.20061	0.321256	4.14736
	Weekly	0.77608	0.772346	1.47489	0.190465	0.21537	0.248615	3.77069

According to results reported in previous tables, some inferences can be drawn. Firstly, the market beta increases when the return interval increases. In all methods for a period, daily market beta has smallest value and monthly market beta has highest value. Weekly market beta takes a place between them. The difference between average of monthly betas and daily betas is higher in Scholes Williams and Dimson than in standard market model and Vasicek and the average differences are 0.24, 0.24, 0.13 and 0.13, respectively. Moreover, Vasicek's and Standard Market Model's average betas are smaller than Scholes Williams' and Dimson's. In one year estimation period, the averages are close to each other when it is examined separately for daily and weekly. This topic is tested formally in next section. Secondly, the market betas except monthly Scholes Williams and Dimson are seemed as smaller than one, which is expected as a theoretical value.

There are similar behaviors between different estimation models according to outcomes. Standard Market Model's and Vasicek method's gives similar results and it is rational because the difference between them is that the estimated betas from market model are adjusted for Vasicek's betas. The other similarity is between Scholes Williams and Dimson methods. The differences in reported statistics are small and this is surprising. The calculation methods are provided in the chapter 3. Scholes William method estimates beta in four steps. In first three steps, coefficient for one lag, current and one lead of market index is estimated in separate equations and sum of these is divided by one plus two times of autocorrelation of market index. On the other hand, Dimson method is much simpler. Dimson beta is the sum of regression coefficients of one lag, current and one lead of market index estimated in one equation. The one of the possible explanations for this situation is that market index has low autocorrelation. The table 7 shows the average of absolute first auto correlation for estimation periods and return intervals. As it can see from the table, the average auto correlations are small. As individually, the market index have higher autocorrelation greater than 0.1 and lower than -0.1 over 17 of 110 data parts. The highest autocorrelation in absolute value is -0.32.

Table 7 : Autocorrelation for Market Indices by lengths of periods

Average of Absolute Autocorrelation in Sub Periods			
	Daily	Weekly	Monthly
5 Year	0.04698	0.02049	0.04424
4 Year	0.05007	0.02776	0.04542
3 Year	0.04648	0.04584	0.10308
2 Year	0.04951	0.05859	0.14536
1 Year	0.05379	0.10077	-

4.2 Market Beta Comparisons

In this section, market betas are compared with hypothesis testing. The comparison procedure is done for each sub period. The methodology for measuring the difference between means is selected their normality. When all of the subjects are distributed normally, Anova or t-test is used and Wilcoxon Sign Test or Kruskal-Wallis test is conducted when the absence of normality exist at least in one subject.

Firstly, the hypothesis test is applied for examining the difference in method. The estimated betas from different methods for same sub period are grouped separately. Then, the Jarque-Bera normality test is performed on betas. According to result of normality test, Anova or Kruskal-Wallis Test is conducted. The tested hypothesis is stated below;

H_0: There is no significant difference in the means of betas from different methods

H_1: There is a significant difference in the means of betas from different methods

The results of hypothesis test are presented in table 8. The number of rejected and not rejected hypothesis and total number sub periods are provided.

Table 8 : Hypothesis Tests Outcomes by Length of Estimation Periods and Return Intervals

Estimation Period	Return Interval	Fail to Reject H_0	Rejected H_0	Total Number Periods
5 Year	Daily	2	4	6
	Weekly	0	6	6
	Monthly	1	5	6
4 Year	Daily	0	7	7
	Weekly	0	7	7
	Monthly	1	6	7
3 Year	Daily	2	6	8
	Weekly	2	6	8
	Monthly	1	7	8
2 Year	Daily	5	4	9
	Weekly	3	6	9
	Monthly	3	6	9
1 Year	Daily	8	2	10
	Weekly	5	5	10

The estimation methods' market betas are found different in 56 of 63 sub periods in 3 year, 4 year and 5 year length. The similarity rate of market betas increases with respect to shortening in the estimation length. In 2 year duration of estimation, four methods give different market beta in 16 of 27 sub periods. Finally, at least one method gives different market beta in only 2 of 10 sub periods one year period length and daily return interval. In one year period and weekly return, the number periods, in which different market betas are obtained, is equal to the number of periods, in which difference in market betas of methods is found as statistically insignificant.

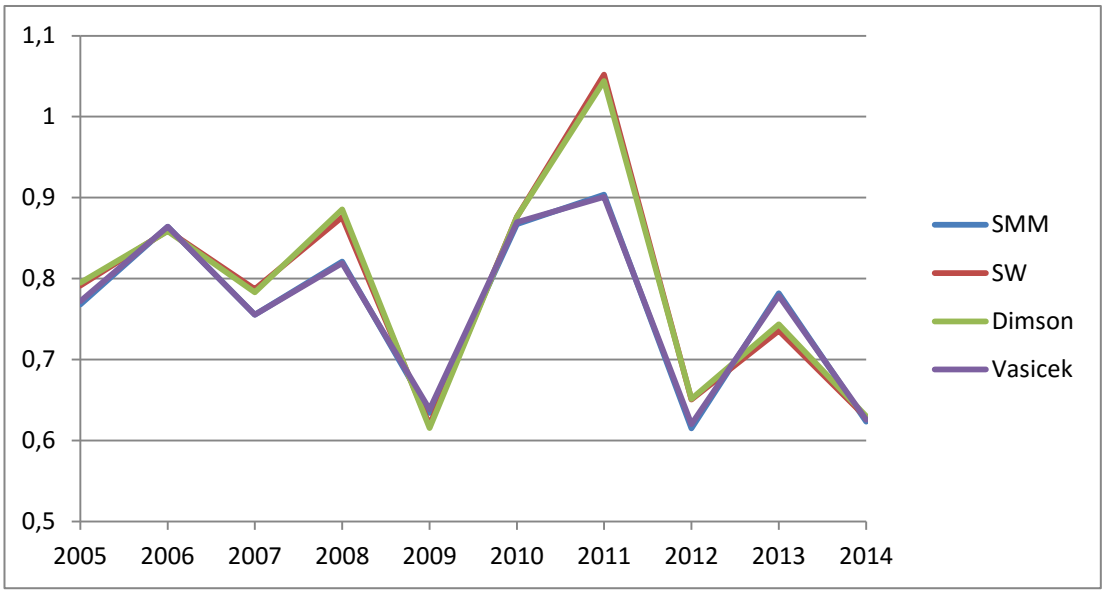

Figure 1 : Trends of Daily Market Betas Calculated from Four Estimation Methods

Figure 1 visualizes the trends in the daily market betas. On the yearly based, the market betas follow a fluctuated course. They start around 0.79 in 2005 and end nearly 0.62. It is noticeable that there are sharp changes in market betas. The striking decreases in 2009 and 2012 draw attention and there is a dramatic increase in Scholes William's and Dimson's average beta. The movements occur between 0.6 and 1.1 and its range is 0.5. According to hypothesis tests, the significant differences in average betas are only in 2008 and 2011 and these finding are supported by figure.

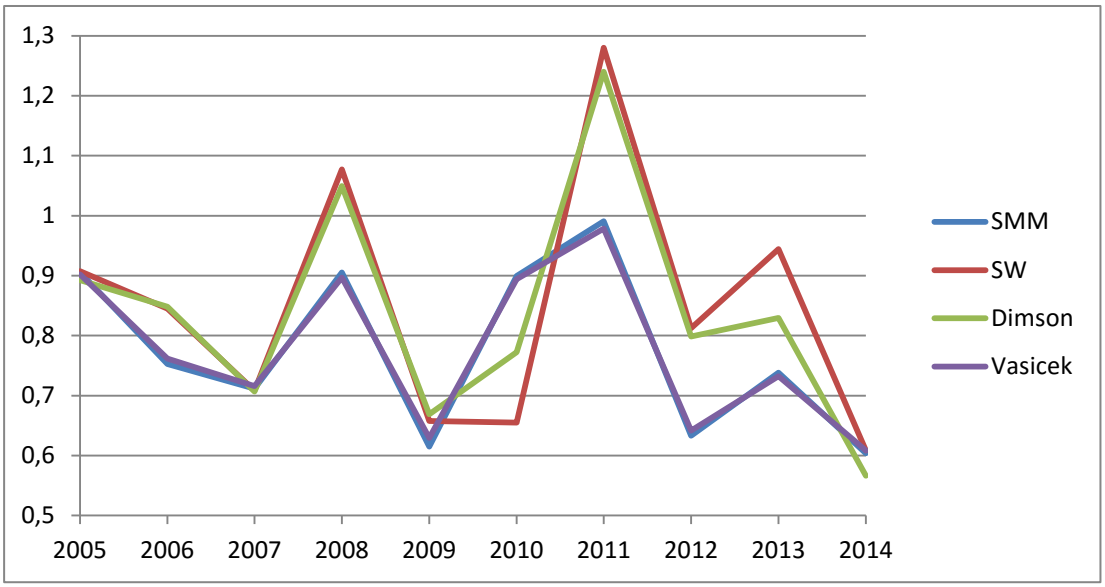

Figure 2 : Trends of Weekly Market Betas Calculated from Four Estimation Methods

The change in weekly market betas over years are presented in Figure 2. As similar to daily return interval, average betas based on weekly returns have waving trends. In year 2005, all methods' average beta is close to 0.90 and decrease to nearly 0.70 in 2007. The values of weekly market betas show similar behavior to daily but the changes after 2007 are more severe than daily. The peak value is close to 1.30 and the nadir value is nearly 0.60. The spread of changes is 0.70. The mean of methods are statistically significant in years of 2008, 2010, 2011, 2012 and 2013.

These figures highlight the critical characteristics of market beta. It is possible that there is an issue about stability of betas because the fluctuations of market betas are dramatic. The stability of beta investigated in next part of this work.

Secondly, the difference between return intervals is analyzed. The estimated betas by same methods in same periods but from different returns are formed together. According to result of normality test, ANOVA or Kruskal Wallis test is applied for test the hypothesis. In one year estimation length, there are two return intervals. Thus, t-test or Wilcoxon Sign Test is used for formal comparisons. The tested hypothesis for are expressed below.

H_0: There is no significant difference between return intervals for the market beta

H_1: There is a significant difference between return intervals for the market beta

The hypothesis for one year duration considers only daily and weekly returns. The modified hypothesis is;

H_0: There is no significant difference between daily and weekly return intervals for the market beta

H_1: There is a significant difference between daily and weekly return intervals for the market beta

Table 9 : Hypothesis Tests Outcomes by Length of Estimation Periods and Estimation Methods

Estimation Period	Return Interval	Fail to Reject H_0	Rejected H_0	Total Number Periods
5 Year	Market Model	0	6	6
	Vasicek	0	6	6
	Scholes Williams	0	6	6
	Dimson	0	6	6
4 Year	Market Model	0	7	7
	Vasicek	0	7	7
	Scholes Williams	0	7	7
	Dimson	0	7	7
3 Year	Market Model	0	8	8
	Vasicek	0	8	8
	Scholes Williams	0	8	8
	Dimson	0	8	8
2 Year	Market Model	1	8	9
	Vasicek	0	9	9
	Scholes Williams	1	8	9
	Dimson	1	8	9
1 Year	Market Model	6	4	10
	Vasicek	4	6	10
	Scholes Williams	3	7	10
	Dimson	2	8	10

Table 9 represents the hypothesis test results. Only 3 of 120 the null hypothesis, which are performed for periods of 2 years, 3 years, 4 years and 5 years, is not rejected and this results demonstrate that at least one return interval among daily, weekly and monthly returns gives different beta estimation for market. The rows for one year period show the comparison results for daily and weekly. The inference that the difference between daily and weekly average of beta does not differ sharply can be made.

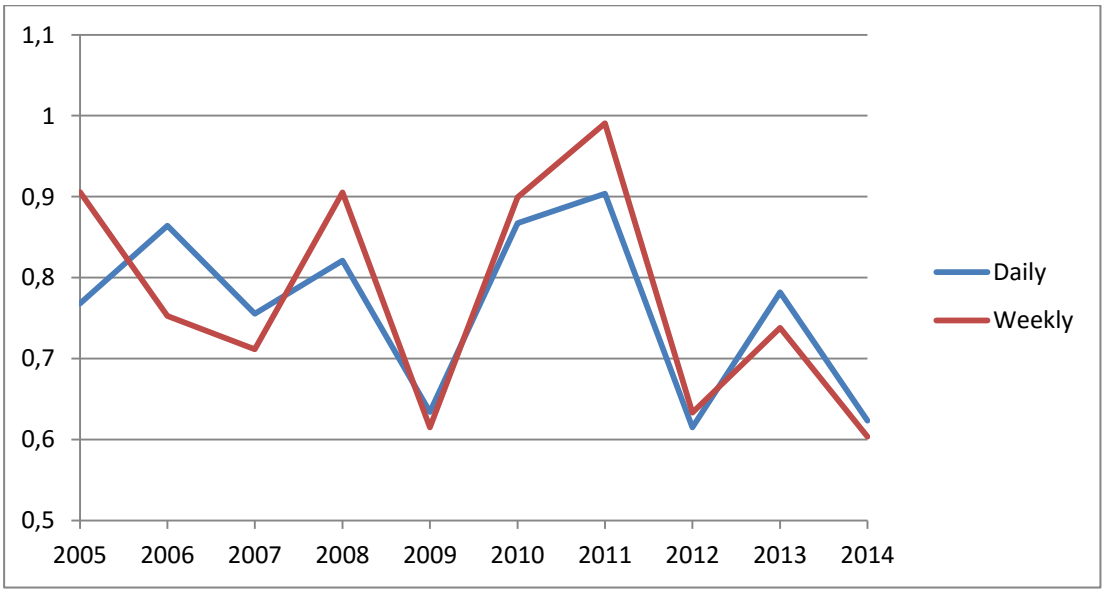

Figure 3 : Trends of Daily and Weekly Market Betas Estimated by Market Model

The standard market model's market betas for daily and weekly return intervals are illustrated by Figure 3. The movements in mean betas are close to each other and their directions are same except 2005. The descriptive statistics for standard market models imply that the average beta is higher when frequency of return decreases. However, daily beta is higher than weekly beta in 4 of 10 sub periods. Moreover, there is a similarity between other figures and it is that the difference between intervals and the difference between methods reach their highest value in 2008 and 2011.

4.3 Beta Stability

The stability of betas is investigated in this section of thesis. Stability is an issue about betas that investigated by many researchers. In the literature, there are many studies on stability in different stocks markets and most of them are for developed markets. There are few works which examines stability in BIST a.k.a Istanbul Stock Exchange (ISE). Odabasi (2003) and Oran and Soytas (2010) research the stability in ISE and the results of these studies demonstrate the instability of betas.

The annual markets betas have change over years as it is shown by Figure 1 and Figure 2. This picture arouses a suspicion about stability of betas. The method for examining stability in this work is similar to one used by Oran and Soytas (2010). The dummies are added to the standard market model in order to see whether there is a change in beta or alfa. The extended model for stability is presented below.

$$R_{it} = \alpha_{1i} + \alpha_{1i}D_i + \beta_{1i}R_{mt} + \beta_{1i}D_iR_{mt} + \varepsilon_{it} \qquad (10)$$

Where R_{it} is the return of stock i at time t, α_{1i} is the intercept term of stock i before the breakpoint, β_{1i} is the beta of stock i before the breakpoint, α_{2i} is the additive intercept term of stock i after the breakpoint , β_{2i} is the additive beta of stock i before the breakpoint, D_i is the dummy variable of stock I, R_{mt} is the return of market index at time t, and ε_{it} is the error term of model.

The dummy variable takes value of zero before the breakpoint time and takes value of one after the breakpoint. The time, which divides the period into two, is selected as randomly and it is different for each stock. The criterion for the date is that there should be at least one year data from beginning and ending because there should be enough data for estimation. Therefore, the date is selected after first year and last year are omitted and each date between them has equal probability for being chosen. The only exception is that 2 year length periods as there is no data between first year and last year. Thus, the beginning of second year is taken as a breakpoint.

The duration of investigation periods starts with the whole period between 2005 and 2014 and then the oldest year is dropped in the next investigated period. The shortest period's length is two year and thus the number sub period is nine. In the scope of examination for stability, three return intervals are reviewed separately.

The binomial test is used for testing the null hypothesis for stability.

The hypothesis for beta and alfa, tested by binomial test, is stated below;

H_0: There is no significant change in the beta of stocks through time

H_1: There is a significant change in the beta of stocks through time

H_0: There is no significant change in the alfa of stocks through time

H_1: There is a significant change in the alfa of stocks through time

The stability test results and related statistics are reported in Table 9. Number of significant alfa and beta dummies, mean of alfa dummies and beta dummies and the probability of outcomes according to binomial test are provided in table. The number of significant beta dummies is highest in daily return interval and it is followed by weekly and monthly. However, the difference in numbers between daily return and others is large. On the other hand, there is no difference between return intervals for number of significant alfa dummies. Moreover, the length of period does not seem to have an effect on both of the coefficients of dummies.

The result of binomial test for alfa dummies show that alfa values of the stocks have stability over periods. The only exception is that the daily period between 2009 and 2014 and its p-value is lower than critical value. In the stability of betas, there is an reverse of the situation in alfas. There is instability in the beta coefficients of stock in all periods except monthly return period of 2012-2014.

Table 10: Results and Statistics for Stability Tests Outcomes by Length of Estimation Periods and Return Intervals

The Period	Return Interval	Number of Significant		Average of		Binomial Test's P-Value	
		Alfa Dummy	Beta Dummy	Alfa Dummy	Beta Dummy	Alfa Dummy	Beta Dummy
2005-2014	Daily	8	84	0.000	-0.026	0.690	0.000
	Weekly	10	28	0.000	-0.063	0.436	0.000
	Monthly	12	21	0.003	-0.105	0.218	0.001
2006-2014	Daily	9	88	0.000	-0.055	0.564	0.000
	Weekly	10	46	0.001	-0.044	0.436	0.000
	Monthly	5	26	0.003	-0.045	0.943	0.000
2007-2014	Daily	7	87	0.000	-0.032	0.800	0.000
	Weekly	9	30	0.001	-0.069	0.564	0.000
	Monthly	8	23	0.003	-0.102	0.690	0.000
2008-2014	Daily	8	87	0.000	-0.039	0.690	0.000
	Weekly	4	46	0.000	-0.117	0.976	0.000
	Monthly	8	27	-0.002	-0.150	0.690	0.000
2009-2014	Daily	17	79	-0.001	-0.014	0.014	0.000
	Weekly	10	25	-0.003	-0.050	0.436	0.000
	Monthly	12	19	-0.009	-0.043	0.218	0.007
2010-2014	Daily	8	87	0.000	-0.119	0.690	0.000
	Weekly	11	50	0.000	-0.177	0.318	0.000
	Monthly	12	28	-0.005	-0.185	0.218	0.000
2011-2014	Daily	14	89	0.000	-0.113	0.086	0.000
	Weekly	7	45	0.001	-0.156	0.800	0.000
	Monthly	11	22	0.006	-0.121	0.318	0.001
2012-2014	Daily	11	54	0.000	0.048	0.318	0.000
	Weekly	12	17	0.001	0.130	0.218	0.027
	Monthly	10	12	0.009	0.091	0.436	0.218
2013-2014	Daily	12	62	0.001	-0.159	0.218	0.000
	Weekly	14	18	0.004	-0.135	0.086	0.014
	Monthly	8	24	0.011	-0.509	0.690	0.000

4.4 Forecast Performance of Estimated Betas

Betas have different usage areas in the literature and they are not use solely for predicting historical responsiveness of stocks. One of them is predicting future movement of stocks. In this part of this thesis, the forecast of stocks' returns is carried out by using the betas and alfas estimated over stocks' reaction to market movements. The data in the estimations is belong to period between 2005 and 2014 and realized returns of stocks in 2015 are used for measuring the forecast performance of estimated betas by different estimation methods, duration of estimation and return intervals. The procedure in the evaluation of forecast performance is as follows. Firstly, the periods whose betas are used end in 2014 and their start depend on the length of them. The start years for five years, four years, three years and two years are 2010, 2011, 2012 and 2013, respectively and one year period begins in 2014. Three return intervals take a part in predictions and they forecast only their own data. To explain clearly, daily returns, weekly returns and monthly returns are forecasted by the betas estimated from the interval that which they are. The four methods in the estimation part are included in this section. The number of observation is 253 for daily returns, 52 for weekly returns and 12 for monthly returns.

The mean absolute deviation and mean square of errors are the criterions that evaluation based on. They are calculated for each stock and the sum of them is taken as the performance result of a method. The return intervals are not compared because the observation numbers in them are different. Moreover, the size of change in return intervals are different because the frequencies of return measure reflected by them are different.

Table 11 : Sum of MAD and Sum of MSE for Forecast Errors of Estimated Betas by Periods and Return Intervals

Estimation Period	Return Interval	Sum of MAD				Sum of MSE			
		SMM	SW	Dimson	Vasicek	SMM	SW	Dimson	Vasicek
2010-2014	Daily	2.8538	2.8692	2.8678	2.8538	26.8864	26.9707	26.9606	26.8827
	Weekly	6.2313	6.3069	6.2924	6.2216	26.9686	27.4112	27.3360	26.9175
	Monthly	14.0987	14.4346	14.5040	14.0093	27.1247	27.9088	28.0868	26.9425
2011-2014	Daily	2.8496	2.8665	2.8645	2.8492	26.9204	27.0043	26.9901	26.9129
	Weekly	6.2215	6.3173	6.3141	6.2076	26.9935	27.4716	27.4595	26.9261
	Monthly	14.1461	14.6029	14.6599	14.0319	27.4324	28.4226	28.5648	27.1872
2012-2014	Daily	2.8428	2.8532	2.8517	2.8421	26.9907	27.1804	27.1551	26.9777
	Weekly	6.2071	6.2441	6.2478	6.1924	26.9513	27.1665	27.1855	26.8817
	Monthly	14.0695	14.3576	14.4769	13.9509	27.3099	27.9311	28.2607	27.0724
2013-2014	Daily	2.8479	2.8600	2.8576	2.8467	26.9545	27.1793	27.1399	26.9374
	Weekly	6.2311	6.2808	6.2878	6.2085	27.0091	27.2820	27.3237	26.9027
	Monthly	14.3375	14.4739	14.6127	14.1506	27.7993	28.2569	28.6688	27.3783
2014	Daily	2.8634	2.8921	2.8879	2.8605	27.2861	27.6401	27.5744	27.2405
	Weekly	6.3914	6.4644	6.5633	6.3311	27.7286	28.2355	28.7979	27.4346

Table 10 summarizes the outcome of the forecasts and sum of MAD and sum of MSE are reported differently for periods, methods and return intervals. The performances are evaluated in the order of daily, weekly and monthly. Firstly, the smallest values for sum of MAD of each method in daily returns are in the period between 2012 and 2014. According to them, Vasicek's betas have the best performance and standard market model's betas are close to it.

However, the length of best performer period changes when the sum of MSE is considered. In that case, the estimation period of 2010-2014 has the lowest values and the ranking between methods is same as period of 2012-2014. Secondly, standard market model, Scholes Williams, Dimson and Vasicek methods forecast weekly returns better with betas of the period between 2012 and 2014 comparing to other periods. This result is indicated by both of the measurements of forecast errors. Vasicek method's forecast best among all methods. Thirdly, monthly betas' prediction performance is analyzed. Sum of MAD and sum of MSE highlight the period of 2012-2014 as the minimums of all methods and Vasicek' betas perform better than others.

In summary, there are two consequences according to forecast outputs. The first one is that three years is the optimum period of beta estimation because all methods have their lowest error score in that long except Vasicek's weekly betas. The second result is that Vasicek method forecast the return of stock with smaller error than other methods.

CHAPTER 5

CONCLUSION

In this thesis, the betas of stocks in Borsa Istanbul are examined in the period between 2005 and 2014. They are calculated based on different methods, different sub periods and return interval, separately. The stability of betas is analyzed and the forecast performances of betas are compared. The data is collected from database of Thomson Reuters and the prices are adjusted for stock related issues such as, stocks splits, dividend payment, etc. The daily, weekly and monthly return intervals are used and the returns are calculated as logarithmic return. The entire period is divided into sub periods and starts and ends are determined as including the complete data of a year.

Beta estimates are estimated with four different estimation techniques as standard market model, Scholes Williams, Dimson and Vasicek. The descriptive statistics indicates the difference in market beta of methods and the formal test are conducted to whether there is a statistically meaningful difference. The results of test prove that there is a significant difference in mean betas between methods in longer periods. As the estimation periods shorten, the market betas do not differ significantly. Moreover, the claim that the return intervals have an effect on average betas is tested and it is found that averages of betas are different in different return intervals.

The number of estimated market betas is 440 and the values of market betas are mainly lower than one in daily and weekly returns. This result is different from theoretical expectation because the beta is defined as the proportion of covariance between stock i and market portfolio to variance of market portfolio. For the market, the expected value of beta is equal to one from the definition. This result could be caused by the stocks, which are not included in the study because of the insufficient

observation but in the coverage of index. Otherwise, the reason could be related to market efficiency or data

The stability of betas is investigated in different length of periods and return intervals by using market model. The dummy variables are added to market model and the probability of number of occurrences is evaluated by binomial test under null hypothesis that betas are stable. The results prove that the betas are instable over time and the alfas are found as stable in the contrary.

The performance of beta estimation techniques in forecast is measured in this study. The realized returns of stocks in 2015 are predicted by the historical betas of daily, weekly and monthly return intervals and mean absolute deviation and mean square of errors are used for comparisons. The betas from the period between 2012 and 2014 perform better than other periods and the method, which has lowest error, is the vasicek adjustment.

The results of this study are in line with the literature. The findings are summarized as the difference in betas estimations by method and return intervals, smaller market betas than one, instability in betas. The similar outcomes to this dissertation are reported by studies on Turkish stock market.

In future studies, betas of stocks could be examined by the different data sets from Borsa İstanbul and other methods. For data, the other indices in Borsa İstanbul could be used and the number of stocks in the study could be increased. Moreover, working with an index and the all stocks covered by that index, the more precise conclusion could be drawn for market beta. As this study and literature shows, the betas have time varying behavior. The effectiveness of dynamic estimation techniques under instability could be examined. Finally, the forecast performance of beta estimates could be analyzed further by different periods for forecast.

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APPENDICES

A. LIST OF STOCKS INCLUDED IN THE STUDY

Table 12 : The List of Stock Used in the Study and their observation numbers by return interval

Ticker Symbol	Number of Observations		
	Daily	Weekly	Monthly
ADANA	2517	521	121
ADBGR	2517	521	121
ADEL	2517	521	121
ADNAC	2517	521	121
AEFES	2517	521	121
AFYON	2516	521	121
AGYO	2516	521	121
AKBNK	2517	521	121
AKCNS	2517	521	121
AKENR	2517	521	121
AKGRT	2517	521	121
AKSA	2517	521	121
AKSUE	2515	521	121
ALARK	2517	521	121
ALCAR	2517	521	121
ALCTL	2517	521	121
ALGYO	2517	521	121
ALKA	2517	521	121
ALKIM	2517	521	121
ALYAG	2516	521	121
ANACM	2517	521	121
ANHYT	2517	521	121
ANSGR	2517	521	121
ARCLK	2517	521	121
ARENA	2517	521	121

Table 12 : The List of Stock Used in the Study and their observation numbers by return intervals (cont'd)

Ticker Symbol	Number of Observations		
	Daily	Weekly	Monthly
ARSAN	2517	521	121
ASELS	2517	521	121
ASLAN	2516	521	121
ASUZU	2517	521	121
ATAGY	2517	521	121
ATEKS	2517	521	121
AVGYO	2516	521	121
AYEN	2517	521	121
AYGAZ	2512	521	121
BAGFS	2517	521	121
BAKAB	2517	521	121
BANVT	2517	521	121
BFREN	2517	521	121
BJKAS	2516	521	121
BOLUC	2517	521	121
BOSSA	2517	521	121
BOYNR	2517	521	121
BOYP	2517	521	121
BRISA	2517	521	121
BRSAN	2517	521	121
BRYAT	2517	521	121
BSOKE	2517	521	121
BTCIM	2517	521	121
BUCIM	2517	521	121
BURCE	2517	521	121
CELHA	2517	521	121
CEMTS	2517	521	121
CIMSA	2517	521	121
CLEBI	2517	521	121
CMBTN	2517	521	121
CMENT	2517	521	121

Table 12 : The List of Stock Used in the Study and their observation numbers by return intervals (cont'd)

Ticker Symbol	Number of Observations		
	Daily	Weekly	Monthly
COMDO	2516	521	121
CRDFA	2517	521	121
DAGHL	2513	521	121
DENCM	2517	521	121
DERIM	2516	521	121
DEVA	2517	521	121
DGGYO	2517	521	121
DGKLB	2516	521	121
DGZTE	2517	521	121
DITAS	2517	521	121
DMSAS	2517	521	121
DOAS	2517	521	121
DOHOL	2516	521	121
DURDO	2517	521	121
DYOBY	2516	521	121
ECILC	2517	521	121
ECZYT	2517	521	121
EDIP	2517	521	121
EGCYH	2516	521	121
EGCYO	2517	521	121
EGEEN	2516	521	121
EGGUB	2517	521	121
EGLYO	2515	521	121
EGSER	2517	521	121
EMKEL	2514	521	121
ENKAI	2517	521	121
ERBOS	2517	521	121
EREGL	2514	521	121
ERSU	2512	521	121
ESCOM	2517	521	121
FENER	2517	521	121

Table 12 : The List of Stock Used in the Study and their observation numbers by return intervals (cont'd)

Ticker Symbol	Number of Observations		
	Daily	Weekly	Monthly
FINBN	2516	521	121
FMIZP	2517	521	121
FROTO	2517	521	121
GARAN	2517	521	121
GARFA	2517	521	121
GENTS	2517	521	121
GEREL	2517	521	121
GLYHO	2514	521	121
GOODY	2517	521	121
GSDDE	2517	521	121
GSDHO	2517	521	121
GSRAY	2516	521	121
GUBRF	2517	521	121
GUSGR	2517	521	121
HEKTS	2517	521	121
HURGZ	2517	521	121
IEYHO	2496	518	121
IHEVA	2517	521	121
IHLAS	2513	521	121
IHMAD	2509	521	121
INDES	2517	521	121
INTEM	2517	521	121
IPEKE	2517	521	121
ISCTR	2517	521	121
ISFIN	2517	521	121
ISGSY	2517	521	121
ISGYO	2517	521	121
IZMDC	2517	521	121
IZOCM	2517	521	121
KARSN	2517	521	121
KARTN	2517	521	121

Table 12 : The List of Stock Used in the Study and their observation numbers by return intervals (cont'd)

Ticker Symbol	Number of Observations		
	Daily	Weekly	Monthly
KCHOL	2511	521	121
KENT	2517	521	121
KERVT	2517	521	121
KIPA	2517	521	121
KLMSN	2517	521	121
KNFRT	2517	521	121
KONYA	2517	521	121
KORDS	2517	521	121
KOZAA	2516	521	121
KRDMA	2517	521	121
KRDMB	2517	521	121
KRDMD	2517	521	121
KRSTL	2517	521	121
KUTPO	2516	521	121
LOGO	2517	521	121
MAALT	2517	521	121
MAKTK	2512	521	121
MARTI	2517	521	121
MERKO	2517	521	121
METRO	2515	521	121
MGROS	2515	521	121
MIPAZ	2517	521	121
MNDRS	2517	521	121
MRDIN	2517	521	121
MRSHL	2517	521	121
NETAS	2516	521	121
NTHOL	2516	521	121
NTTUR	2516	521	121
NUGYO	2517	521	121
NUHCM	2517	521	121
OLMIP	2515	521	121

Table 12 : The List of Stock Used in the Study and their observation numbers by return intervals (cont'd)

Ticker Symbol	Number of Observations		
	Daily	Weekly	Monthly
OTKAR	2517	521	121
OZGYO	2517	521	121
PARSN	2517	521	121
PEGYO	2515	521	121
PENGD	2517	521	121
PETKM	2508	520	121
PETUN	2517	521	121
PIMAS	2517	521	121
PINSU	2517	521	121
PKART	2517	521	121
PNSUT	2517	521	121
PRKAB	2517	521	121
PRKME	2517	521	121
RHEAG	2515	521	121
SAHOL	2517	521	121
SANKO	2517	521	121
SARKY	2517	521	121
SASA	2517	521	121
SISE	2517	521	121
SKBNK	2516	521	121
SKTAS	2517	521	121
SODA	2517	521	121
SONME	2514	521	121
TATGD	2516	521	121
TBORG	2517	521	121
TCELL	2515	521	121
TEKST	2517	521	121
TEKTU	2515	521	121
THYAO	2510	520	121
TIRE	2516	521	121
TOASO	2517	521	121

Table 12 : The List of Stock Used in the Study and their observation numbers by return intervals (cont'd)

Ticker Symbol	Number of Observations		
	Daily	Weekly	Monthly
TRCAS	2517	521	121
TRKCM	2517	521	121
TSKB	2517	521	121
TTRAK	2517	521	121
TUKAS	2517	521	121
TUPRS	2512	521	121
ULKER	2517	521	121
UNYEC	2517	521	121
USAK	2515	521	121
USAS	2517	521	121
VAKFN	2517	521	121
VAKKO	2517	521	121
VESTL	2517	521	121
VKGYO	2516	521	121
VKING	2516	521	121
YATAS	2517	521	121
YAZIC	2517	521	121
YGYO	2516	521	121
YKBNK	2515	521	121
YKGYO	2515	521	121
YUNSA	2517	521	121
YYAPI	2515	521	121
ZOREN	2517	521	121

B. DESCRIPTIVE STATISTICS OF BETAS BY METHODS AND PERIODS

Table 133 : Descriptive Statistics of Betas Estimated by Market Model with length of Five Years

Standard Market Model's Betas - 5 Years								
Estimation Period	Return Interval	Average Beta	Median	Maximum	Minimum	Standard Deviation	Skewness	Kurtosis
2010-2014	Daily	0.7903	0.7908	1.3829	0.3909	0.1690	0.3291	3.8413
	Weekly	0.8054	0.7950	1.4219	0.3821	0.1896	0.2798	2.9956
	Monthly	0.8924	0.8818	1.5080	0.2163	0.2741	-0.1267	2.8090
2009-2013	Daily	0.7749	0.7557	1.3781	0.3772	0.1643	0.6762	4.1900
	Weekly	0.7905	0.7819	1.3776	0.3658	0.1881	0.3279	3.0222
	Monthly	0.9139	0.9296	1.4846	0.2874	0.2611	-0.2351	2.5706
2008-2012	Daily	0.7956	0.7729	1.4155	0.3540	0.1761	0.5197	3.8708
	Weekly	0.8613	0.8436	1.4337	0.3232	0.2108	0.2548	2.8175
	Monthly	0.9558	0.9519	1.6196	0.2313	0.2769	-0.1443	2.7222
2007-2011	Daily	0.7997	0.7837	1.4292	0.3187	0.1776	0.4225	3.9141
	Weekly	0.8576	0.8350	1.4644	0.3410	0.2067	0.2984	2.9531
	Monthly	0.9737	0.9680	1.7691	0.1947	0.2843	-0.0674	2.8155
2006-2010	Daily	0.7955	0.7802	1.4234	0.2215	0.1896	0.2699	3.7743
	Weekly	0.8238	0.7971	1.4362	0.3297	0.2165	0.3165	2.9981
	Monthly	0.9553	0.9446	1.8845	0.0995	0.3027	-0.0757	3.1886
2005-2009	Daily	0.7842	0.7615	1.3710	0.2190	0.1937	0.3440	3.8993
	Weekly	0.8251	0.8053	1.5109	0.3128	0.2228	0.3259	3.0976
	Monthly	0.9565	0.9416	1.7822	0.1836	0.2996	0.0124	3.0197

Table 14 : Descriptive Statistics of Betas Estimated by Market Model with length of Four Years

Standard Market Model's Betas - 4 Years								
Estimation Period	Return Interval	Average Beta	Median	Maximum	Minimum	Standard Deviation	Skewness	Kurtosis
2011-2014	Daily	0.7718	0.7747	1.3840	0.3432	0.1849	0.2701	3.7466
	Weekly	0.7779	0.7729	1.4526	0.3536	0.2049	0.3978	3.2589
	Monthly	0.8595	0.8764	1.6354	-0.0437	0.2976	-0.0118	3.2641
2010-2013	Daily	0.8178	0.8251	1.3423	0.4057	0.1677	0.1534	3.3023
	Weekly	0.8360	0.8291	1.4177	0.3799	0.1949	0.2106	2.6363
	Monthly	0.9510	0.9479	1.7785	0.1827	0.2957	-0.0174	3.0002
2009-2012	Daily	0.7715	0.7562	1.4041	0.4124	0.1675	0.7641	4.4976
	Weekly	0.8062	0.7902	1.4179	0.3397	0.2008	0.2297	2.8848
	Monthly	0.8854	0.9095	1.4905	-0.0034	0.2914	-0.2733	2.5871
2008-2011	Daily	0.8087	0.7898	1.4129	0.3544	0.1777	0.4227	3.6887
	Weekly	0.8786	0.8621	1.4847	0.3335	0.2136	0.2100	2.8734
	Monthly	0.9925	0.9829	1.6935	0.1876	0.2876	-0.1720	2.8722
2007-2010	Daily	0.7808	0.7592	1.4503	0.2063	0.1936	0.2959	3.8338
	Weekly	0.8361	0.8083	1.4696	0.2815	0.2208	0.2587	2.9896
	Monthly	0.9598	0.9692	1.8565	-0.0028	0.3109	-0.2017	3.2568
2006-2009	Daily	0.7859	0.7705	1.4294	0.1882	0.2011	0.2678	3.7787
	Weekly	0.8117	0.7985	1.5063	0.2921	0.2345	0.3240	3.0678
	Monthly	0.9461	0.9335	1.9637	0.0436	0.3193	-0.0254	3.2703
2005-2008	Daily	0.8117	0.7941	1.3699	0.2201	0.1930	0.1697	3.7663
	Weekly	0.8573	0.8404	1.6086	0.3133	0.2303	0.2415	3.1109
	Monthly	0.9781	0.9365	1.8837	0.2353	0.3041	0.1835	2.9892

Table 15 : Descriptive Statistics of Betas Estimated by Market Model with length of Three Years

Standard Market Model's Betas - 3 Years								
Estimation Period	Return Interval	Average Beta	Median	Maximum	Minimum	Standard Deviation	Skewness	Kurtosis
2012-2014	Daily	0.7130	0.7028	1.4168	0.2612	0.2046	0.4540	3.8563
	Weekly	0.6873	0.6733	1.4526	0.2268	0.2296	0.6729	3.7314
	Monthly	0.7738	0.7590	1.7357	-0.2637	0.3125	-0.0590	3.5090
2011-2013	Daily	0.8029	0.7996	1.3826	0.3428	0.1859	0.0605	3.2213
	Weekly	0.8108	0.7987	1.4529	0.3201	0.2116	0.2769	2.9131
	Monthly	0.9232	0.9391	2.0382	-0.1790	0.3265	0.1301	3.7238
2010-2012	Daily	0.8390	0.8581	1.3769	0.4198	0.1715	0.0711	3.3586
	Weekly	0.8886	0.8886	1.4967	0.3861	0.2201	0.0855	2.6405
	Monthly	0.9257	0.9249	1.8973	-0.0152	0.3475	-0.2691	3.4272
2009-2011	Daily	0.7929	0.7798	1.3972	0.4350	0.1656	0.6377	4.0724
	Weekly	0.8317	0.8315	1.4038	0.3601	0.2027	0.1699	2.6404
	Monthly	0.9376	0.9623	1.5477	0.1879	0.3039	-0.1908	2.4375
2008-2010	Daily	0.7872	0.7681	1.4358	0.2630	0.1964	0.2824	3.5709
	Weekly	0.8572	0.8336	1.4948	0.2668	0.2311	0.1533	2.9196
	Monthly	0.9776	0.9801	1.7836	-0.0202	0.3158	-0.2981	3.3567
2007-2009	Daily	0.7666	0.7417	1.4621	0.1630	0.2078	0.2878	3.8642
	Weekly	0.8240	0.8046	1.5604	0.1995	0.2417	0.2768	3.1815
	Monthly	0.9511	0.9502	1.9497	-0.0801	0.3277	-0.1473	3.4553
2006-2008	Daily	0.8179	0.8006	1.4171	0.1916	0.2023	0.0571	3.5914
	Weekly	0.8430	0.8230	1.6120	0.2860	0.2453	0.2572	3.0622
	Monthly	0.9601	0.9172	2.1492	0.0877	0.3299	0.1933	3.4321
2005-2007	Daily	0.8011	0.7891	1.4368	0.2196	0.2027	0.1446	3.7643
	Weekly	0.7924	0.8061	1.5170	-0.0082	0.2522	-0.0608	3.5429
	Monthly	0.9376	0.9392	2.0887	-0.3525	0.3888	-0.2274	3.2025

Table 16 : Descriptive Statistics of Betas Estimated by Market Model with length of Two Years

Standard Market Model's Betas - 2 Years								
Estimation Period	Return Interval	Average Beta	Median	Maximum	Minimum	Standard Deviation	Skewness	Kurtosis
2013-2014	Daily	0.7339	0.7307	1.4088	0.2678	0.2107	0.3129	3.3293
	Weekly	0.7031	0.6913	1.4270	0.1792	0.2390	0.3553	3.2163
	Monthly	0.8404	0.8658	1.6788	-0.6548	0.3786	-0.5043	3.7460
2012-2013	Daily	0.7432	0.7367	1.3450	0.2732	0.2098	0.2424	3.2441
	Weekly	0.7112	0.6879	1.5412	0.1603	0.2441	0.4991	3.2565
	Monthly	0.8532	0.8397	2.0299	-0.0917	0.3381	0.1181	3.4373
2011-2012	Daily	0.8225	0.8471	1.4910	0.3467	0.2016	-0.0297	3.3369
	Weekly	0.8765	0.8674	1.6985	0.2349	0.2571	0.1079	3.0857
	Monthly	0.8787	0.8585	2.3066	-0.4100	0.4033	0.1010	4.3656
2010-2011	Daily	0.8892	0.9010	1.3401	0.4011	0.1720	-0.0591	3.0225
	Weekly	0.9523	0.9463	1.5794	0.4141	0.2357	0.1281	2.5377
	Monthly	1.0613	1.0547	2.1767	-0.0918	0.4070	0.2078	3.4409
2009-2010	Daily	0.7302	0.7046	1.4447	0.2192	0.1935	0.5981	4.0543
	Weekly	0.7415	0.7427	1.4845	0.1757	0.2390	-0.0500	3.0393
	Monthly	0.8373	0.8852	1.7088	-0.5278	0.4081	-0.6615	3.5979
2008-2009	Daily	0.7700	0.7393	1.4480	0.2176	0.2153	0.2490	3.6182
	Weekly	0.8464	0.8440	1.6092	0.1618	0.2559	0.1544	3.1088
	Monthly	0.9696	0.9699	1.8593	-0.1192	0.3345	-0.2877	3.5448
2007-2008	Daily	0.8029	0.7934	1.4568	0.1641	0.2110	0.0282	3.6785
	Weekly	0.8674	0.8517	1.7158	0.1723	0.2613	0.1464	3.1606
	Monthly	0.9693	0.9551	2.2161	0.0031	0.3438	0.1486	3.3847
2006-2007	Daily	0.8122	0.8293	1.4225	0.1415	0.2192	-0.0476	3.5588
	Weekly	0.7356	0.7177	1.5372	-0.2694	0.2870	-0.0867	3.8354
	Monthly	0.8739	0.9114	2.2952	-1.0190	0.5230	-0.3063	3.5444
2005-2006	Daily	0.8255	0.8090	1.4514	0.1703	0.2195	0.1855	3.3446
	Weekly	0.8267	0.8480	1.6936	-0.0735	0.2773	-0.0616	3.1843
	Monthly	0.9678	0.9577	2.1285	-0.4131	0.4170	-0.2515	3.4362

Table 17 : Descriptive Statistics of Betas Estimated by Market Model with length of One Year

Standard Market Model's Betas - 1 Year								
Estimation Period	Return Interval	Average Beta	Median	Maximum	Minimum	Standard Deviation	Skewness	Kurtosis
2014	Daily	0.6233	0.6094	1.6271	0.0533	0.2353	0.8846	5.3858
	Weekly	0.6035	0.5948	1.6126	-0.1741	0.2990	0.3363	3.7888
2013	Daily	0.7820	0.7749	1.3668	0.2755	0.2219	0.1172	2.8329
	Weekly	0.7381	0.7240	1.5191	0.0206	0.2624	0.2025	2.9489
2012	Daily	0.6149	0.6043	1.5880	-0.0072	0.2524	0.6109	4.7375
	Weekly	0.6332	0.6102	1.7382	-0.3562	0.3634	0.3982	3.4659
2011	Daily	0.9039	0.9110	1.4486	0.3622	0.2131	-0.1497	2.7129
	Weekly	0.9905	1.0110	1.8996	-0.1622	0.2961	-0.0801	3.4746
2010	Daily	0.8672	0.8899	1.3791	0.1173	0.1972	-0.2433	3.4373
	Weekly	0.8995	0.8964	1.8025	0.0523	0.2818	0.1704	3.1779
2009	Daily	0.6340	0.6068	1.5039	0.0098	0.2426	0.7796	4.4323
	Weekly	0.6150	0.6339	1.4961	-0.4038	0.3265	-0.1482	3.9080
2008	Daily	0.8211	0.8091	1.4332	0.1667	0.2253	-0.0780	3.4344
	Weekly	0.9052	0.8961	1.8405	0.1112	0.2922	0.0505	3.1317
2007	Daily	0.7556	0.7510	1.5069	-0.0242	0.2261	0.1204	3.8699
	Weekly	0.7116	0.7118	1.5871	-0.3223	0.3024	-0.0589	3.9945
2006	Daily	0.8642	0.8547	1.4346	0.1234	0.2579	-0.1490	3.0608
	Weekly	0.7527	0.7344	1.7128	-0.2576	0.3526	0.0085	3.0122
2005	Daily	0.7681	0.7512	1.4717	0.1464	0.2362	0.2757	3.0047
	Weekly	0.9057	0.9066	1.7393	0.1229	0.3096	0.0134	2.8722

Table 18 : Descriptive Statistics of Betas Estimated by Scholes Williams Method with length of Five Years

Scholes-Williams Betas - 5 Year								
Estimation Period	Return Interval	Average Beta	Median	Maximum	Minimum	Standard Deviation	Skewness	Kurtosis
2010-2014	Daily	0.8299	0.8342	1.3814	0.3613	0.1816	0.0865	3.0006
	Weekly	0.8746	0.8675	1.7836	0.2687	0.2605	0.1426	3.1776
	Monthly	0.9185	0.9088	2.1219	-0.7511	0.4249	-0.3660	4.1750
2009-2013	Daily	0.8014	0.7959	1.3426	0.4303	0.1684	0.4272	3.2799
	Weekly	0.8885	0.8808	1.4707	0.2979	0.2572	0.0777	2.4523
	Monthly	0.9862	0.9968	1.9217	-0.7492	0.3812	-0.4420	4.4535
2008-2012	Daily	0.8525	0.8420	1.3336	0.3869	0.1852	0.1114	2.9372
	Weekly	0.9804	0.9807	1.6704	0.0860	0.2841	-0.0303	2.9454
	Monthly	1.1137	1.1084	2.0846	-0.3338	0.4133	-0.2613	3.5858
2007-2011	Daily	0.8549	0.8470	1.3702	0.3678	0.1836	0.0922	3.0531
	Weekly	0.9653	0.9673	1.7411	0.0962	0.2863	0.0393	2.9681
	Monthly	1.1507	1.1388	2.2124	-0.3419	0.4210	-0.2105	3.7849
2006-2010	Daily	0.8283	0.8234	1.3840	0.2613	0.1959	0.1482	3.1554
	Weekly	0.9180	0.8985	1.6954	0.0656	0.3026	0.0041	2.9454
	Monthly	1.1197	1.1172	2.2374	-0.1175	0.4194	-0.2660	3.6385
2005-2009	Daily	0.8190	0.8151	1.3451	0.2595	0.1990	0.2136	3.3647
	Weekly	0.9293	0.9264	1.7282	0.1051	0.2963	0.1170	2.9716
	Monthly	1.1446	1.1189	2.2544	0.1105	0.3946	-0.0182	3.4760

Table 19 : Descriptive Statistics of Betas Estimated by Scholes Williams Method with Length of Four Years

Scholes-Williams Betas - 4 Years								
Estimation Period	Return Interval	Average Beta	Median	Maximum	Minimum	Standard Deviation	Skewness	Kurtosis
2011-2014	Daily	0.8154	0.8123	1.4113	0.2748	0.1997	0.0960	3.0378
	Weekly	0.8843	0.8775	1.6629	0.2493	0.2691	0.1648	2.8407
	Monthly	0.9545	0.9589	2.2667	-0.8194	0.4554	-0.2597	4.0241
2010-2013	Daily	0.8606	0.8765	1.3839	0.3990	0.1855	-0.0399	2.7237
	Weekly	0.9592	0.9547	2.0927	0.2745	0.2899	0.3084	3.7690
	Monthly	0.9878	0.9862	2.3155	-0.9524	0.5069	-0.1174	3.6588
2009-2012	Daily	0.8203	0.8055	1.3519	0.4732	0.1697	0.3626	3.1424
	Weekly	0.8642	0.8491	1.5855	0.1128	0.3038	0.0731	2.5637
	Monthly	0.9841	1.0068	2.2159	-0.4773	0.4629	-0.2419	3.2482
2008-2011	Daily	0.8658	0.8565	1.3292	0.3863	0.1866	0.0042	2.9365
	Weekly	1.0056	1.0186	1.7935	0.0494	0.2999	-0.0299	3.1354
	Monthly	1.1595	1.1593	2.2413	-0.4310	0.4187	-0.3723	4.0370
2007-2010	Daily	0.8216	0.8164	1.4049	0.2692	0.2000	0.0991	3.1729
	Weekly	0.9277	0.9332	1.7630	-0.0149	0.3096	-0.0453	3.2038
	Monthly	1.1185	1.1278	2.3889	-0.5479	0.4432	-0.3641	4.2690
2006-2009	Daily	0.8219	0.8140	1.3879	0.2316	0.2073	0.1100	3.2458
	Weekly	0.9263	0.9207	1.7279	0.0311	0.3071	0.0235	2.9980
	Monthly	1.1251	1.1117	2.2958	-0.1155	0.4487	-0.1311	3.5143
2005-2008	Daily	0.8510	0.8418	1.3713	0.2529	0.2056	0.0695	3.2048
	Weekly	0.9691	0.9471	1.8292	0.2712	0.3130	0.2305	2.8954
	Monthly	1.2098	1.1764	2.4829	0.0821	0.4209	0.3663	3.6441

Table 20 : Descriptive Statistics of Betas Estimated by Scholes Williams Method with length of Three Years

Scholes-Williams Betas - 3 Years								
Estimation Period	Return Interval	Average Beta	Median	Maximum	Minimum	Standard Deviation	Skewness	Kurtosis
2012-2014	Daily	0.6922	0.6826	1.4239	-0.0023	0.2315	0.4896	3.8847
	Weekly	0.7817	0.7684	1.6187	0.0571	0.2688	0.0770	2.8537
	Monthly	0.8233	0.8118	2.1275	-1.1587	0.4190	-0.5249	5.7107
2011-2013	Daily	0.8517	0.8535	1.4202	0.3059	0.2065	-0.0489	2.8038
	Weekly	0.9798	0.9791	1.9082	0.2632	0.3004	0.3181	3.3174
	Monthly	1.0488	1.0404	2.6064	-1.0079	0.5693	-0.1278	3.7247
2010-2012	Daily	0.9203	0.9324	1.4170	0.4158	0.1987	-0.1967	2.7242
	Weekly	0.9772	0.9557	2.7868	-0.3097	0.3775	0.4207	5.5249
	Monthly	0.9963	1.0234	3.3498	-2.3208	0.7908	-0.6666	5.4136
2009-2011	Daily	0.8427	0.8419	1.3257	0.4908	0.1678	0.1971	2.8657
	Weekly	0.8845	0.8793	1.6426	0.0969	0.3347	-0.0745	2.6841
	Monthly	1.0177	1.0486	2.2053	-0.6561	0.4481	-0.3189	3.6247
2008-2010	Daily	0.8285	0.8135	1.3628	0.2510	0.2057	0.0141	3.0743
	Weekly	0.9659	0.9445	1.8985	-0.0913	0.3263	-0.1324	3.5202
	Monthly	1.1211	1.1414	2.4099	-0.6691	0.4400	-0.5221	4.6119
2007-2009	Daily	0.8128	0.8102	1.4128	0.2043	0.2141	0.0597	3.2958
	Weekly	0.9391	0.9531	1.8054	-0.0645	0.3147	-0.0076	3.3374
	Monthly	1.1252	1.1231	2.5343	-0.5357	0.4735	-0.2082	4.1092
2006-2008	Daily	0.8587	0.8586	1.3943	0.2158	0.2177	-0.0612	3.0700
	Weekly	0.9653	0.9555	1.9233	0.2004	0.3305	0.2095	2.8023
	Monthly	1.2024	1.1658	2.8233	-0.2298	0.5338	0.3353	3.5828
2005-2007	Daily	0.8193	0.8175	1.4252	0.1058	0.2284	0.0555	3.3745
	Weekly	0.8375	0.8133	1.7202	-0.2796	0.3561	0.0023	2.9710
	Monthly	1.1907	1.2453	2.4789	-0.6369	0.5584	-0.4603	3.5147

Table 21 : Descriptive Statistics of Betas Estimated by Scholes Williams Method with Length of Two Years

Scholes-Williams Betas - 2 Years								
Estimation Period	Return Interval	Average Beta	Median	Maximum	Minimum	Standard Deviation	Skewness	Kurtosis
2013-2014	Daily	0.7040	0.6944	1.4352	-0.0657	0.2414	0.2730	3.4694
	Weekly	0.7886	0.7863	1.6233	-0.0532	0.2971	-0.1468	2.8395
	Monthly	0.8694	0.8975	2.0461	-2.3017	0.4935	-1.8560	12.7364
2012-2013	Daily	0.7129	0.6952	1.5247	0.0058	0.2439	0.3951	3.5622
	Weekly	0.8864	0.8725	1.9164	0.1138	0.2976	0.1936	3.2970
	Monthly	0.8609	0.8402	2.3591	-1.1902	0.5090	-0.4531	4.9962
2011-2012	Daily	0.9386	0.9499	1.5117	0.2610	0.2366	-0.2897	2.7771
	Weekly	1.0251	0.9767	2.6080	-0.1746	0.3990	0.3703	4.0723
	Monthly	1.1364	1.1343	4.2069	-2.7346	0.9458	-0.6431	5.3436
2010-2011	Daily	0.9810	0.9840	1.5066	0.4228	0.2107	-0.1349	2.7852
	Weekly	1.1045	1.0584	3.4697	-0.4257	0.4838	0.6002	5.9181
	Monthly	1.3137	1.2571	5.5758	-1.0975	0.9491	0.7079	5.4573
2009-2010	Daily	0.7241	0.7246	1.3948	0.0751	0.2047	0.2282	3.7889
	Weekly	0.6706	0.6844	1.6326	-1.1790	0.4582	-0.7221	4.8540
	Monthly	0.8401	0.8879	2.3731	-1.5899	0.5505	-0.7464	5.1483
2008-2009	Daily	0.8188	0.8195	1.3647	0.1256	0.2235	-0.0638	3.2584
	Weekly	0.9816	0.9767	1.9552	-0.1463	0.3346	-0.1176	3.6974
	Monthly	1.1329	1.1290	2.5493	-0.6263	0.4721	-0.3547	4.3802
2007-2008	Daily	0.8580	0.8683	1.4185	0.2212	0.2303	-0.1527	3.0456
	Weekly	0.9918	0.9892	2.0267	0.0979	0.3455	0.2581	2.9886
	Monthly	1.2274	1.1953	3.3098	-0.8317	0.6052	0.4424	4.4359
2006-2007	Daily	0.8288	0.8323	1.4484	0.0793	0.2555	-0.1462	3.2585
	Weekly	0.7836	0.7761	1.8965	-0.5034	0.4123	-0.1225	3.3673
	Monthly	1.0554	1.0796	3.6065	-2.3783	0.9994	-0.4268	3.8178
2005-2006	Daily	0.8329	0.8199	1.5266	-0.0055	0.2468	0.1021	3.3161
	Weekly	0.8954	0.8784	2.0170	-0.3133	0.4256	0.0692	2.8785
	Monthly	1.1972	1.2236	2.5520	-0.6099	0.5407	-0.4224	3.5889

Table 22 : Descriptive Statistics of Betas Estimated by Scholes Williams Method with Length of One Year

Scholes-Williams Betas - 1 Year								
Estimation Period	Return Interval	Average Beta	Median	Maximum	Minimum	Standard Deviation	Skewness	Kurtosis
2014	Daily	0.6287	0.6004	1.5689	-0.0375	0.2841	0.3987	3.3640
	Weekly	0.6087	0.6394	1.6106	-0.9365	0.3657	-0.2493	4.4426
2013	Daily	0.7355	0.7079	1.5698	-0.0467	0.2638	0.3202	3.1920
	Weekly	0.9443	0.9626	2.3464	0.1338	0.3618	0.3112	3.5442
2012	Daily	0.6506	0.6580	1.7473	-0.3295	0.3095	0.3779	3.9714
	Weekly	0.8126	0.7970	3.0530	-0.9088	0.4971	0.0144	5.9685
2011	Daily	1.0520	1.0613	1.7580	0.3061	0.2768	-0.1277	2.8221
	Weekly	1.2798	1.1398	3.7321	-0.5719	0.5855	0.7579	5.0342
2010	Daily	0.8766	0.8754	1.7903	-0.1615	0.2542	-0.2259	4.2225
	Weekly	0.6550	0.6869	5.1817	-3.3195	0.9708	-0.2480	7.4274
2009	Daily	0.6190	0.6137	1.5810	-0.1632	0.2610	0.4144	4.1646
	Weekly	0.6576	0.6768	1.7358	-1.0874	0.4811	-0.5101	4.0711
2008	Daily	0.8760	0.8979	1.4458	0.1431	0.2514	-0.2541	3.0854
	Weekly	1.0772	1.0390	2.2965	0.0827	0.4086	0.1794	3.1973
2007	Daily	0.7869	0.7970	1.7202	-0.0895	0.2798	0.0667	3.7502
	Weekly	0.7083	0.7072	2.2407	-0.6983	0.4264	-0.0249	3.6496
2006	Daily	0.8594	0.8700	1.6497	-0.1208	0.3049	-0.0505	3.1920
	Weekly	0.8448	0.8168	2.6474	-1.0065	0.6117	0.1551	3.4630
2005	Daily	0.7913	0.7754	1.5235	0.1486	0.2626	0.1715	2.8734
	Weekly	0.9075	0.9039	2.1691	-0.4369	0.4992	-0.0574	3.0222

Table 23 : Descriptive Statistics of Betas Estimated by Dimson Method with Length of Five Years

Dimson's Betas - 5 Years								
Estimation Period	Return Interval	Average Beta	Median	Maximum	Minimum	Standard Deviation	Skewness	Kurtosis
2010-2014	Daily	0.8271	0.8325	1.3793	0.3643	0.1801	0.1021	3.0411
	Weekly	0.8662	0.8633	1.6789	0.2933	0.2497	0.1246	3.0000
	Monthly	0.9344	0.9126	2.1897	-0.8564	0.4424	-0.3216	4.2128
2009-2013	Daily	0.7999	0.7878	1.3417	0.4300	0.1679	0.4463	3.3291
	Weekly	0.8523	0.8564	1.4135	0.2004	0.2455	0.0179	2.5292
	Monthly	0.9721	0.9777	2.0430	-0.9129	0.4190	-0.4244	4.4248
2008-2012	Daily	0.8562	0.8452	1.3276	0.3884	0.1861	0.0887	2.9059
	Weekly	0.9655	0.9656	1.6389	0.1335	0.2686	-0.0091	2.9677
	Monthly	1.1104	1.1191	2.1548	-0.3763	0.4251	-0.2692	3.5719
2007-2011	Daily	0.8570	0.8497	1.3691	0.3731	0.1842	0.0815	3.0218
	Weekly	0.9513	0.9521	1.7052	0.1447	0.2717	0.0566	2.9739
	Monthly	1.1430	1.1396	2.2062	-0.2776	0.4125	-0.1951	3.7507
2006-2010	Daily	0.8299	0.8269	1.3818	0.2641	0.1963	0.1437	3.1353
	Weekly	0.9087	0.8953	1.6390	0.1156	0.2880	0.0032	2.9400
	Monthly	1.1391	1.1374	2.2726	-0.1509	0.4194	-0.2747	3.7471
2005-2009	Daily	0.8214	0.8160	1.3479	0.2613	0.1999	0.2032	3.3316
	Weekly	0.9181	0.8990	1.6830	0.1367	0.2870	0.1376	2.9451
	Monthly	1.1331	1.1089	2.2516	0.0972	0.3928	-0.0279	3.4593

Table 24 : Descriptive Statistics of Betas Estimated by Dimson Method with Length of Four Years

Dimson's Betas - 4 Years								
Estimation Period	Return Interval	Average Beta	Median	Maximum	Minimum	Standard Deviation	Skewness	Kurtosis
2011-2014	Daily	0.8117	0.8148	1.4086	0.2853	0.1973	0.1109	3.0882
	Weekly	0.8816	0.8716	1.6683	0.2480	0.2682	0.1678	2.8274
	Monthly	0.9661	0.9565	2.3818	-0.9250	0.4770	-0.3284	4.1257
2010-2013	Daily	0.8585	0.8748	1.3801	0.3985	0.1840	-0.0261	2.7458
	Weekly	0.9053	0.8985	1.8616	0.2596	0.2591	0.2122	3.4973
	Monthly	0.9637	0.9781	2.3501	-0.9605	0.4971	-0.2911	3.9047
2009-2012	Daily	0.8186	0.8070	1.3539	0.4740	0.1697	0.3788	3.1856
	Weekly	0.8585	0.8434	1.5076	0.1460	0.2853	0.0495	2.5137
	Monthly	1.0048	1.0186	2.4343	-0.4633	0.5119	-0.0809	3.2350
2008-2011	Daily	0.8699	0.8608	1.3226	0.3898	0.1876	-0.0202	2.9101
	Weekly	0.9879	0.9936	1.7466	0.1029	0.2812	-0.0152	3.1832
	Monthly	1.1569	1.1540	2.3358	-0.4607	0.4332	-0.3882	3.9804
2007-2010	Daily	0.8241	0.8202	1.4034	0.2715	0.2009	0.0875	3.1416
	Weekly	0.9151	0.9096	1.6903	0.0443	0.2947	-0.0173	3.1572
	Monthly	1.1247	1.1309	2.4023	-0.5149	0.4365	-0.3500	4.2714
2006-2009	Daily	0.8236	0.8175	1.3857	0.2339	0.2079	0.1031	3.2264
	Weekly	0.9192	0.9126	1.6969	0.0597	0.2993	0.0141	2.9853
	Monthly	1.1308	1.1395	2.3770	-0.1781	0.4499	-0.1425	3.6730
2005-2008	Daily	0.8538	0.8426	1.3792	0.2543	0.2071	0.0652	3.1643
	Weekly	0.9527	0.9254	1.7620	0.3145	0.2975	0.2560	2.8772
	Monthly	1.1780	1.1527	2.3694	0.1412	0.3982	0.3182	3.5108

Table 25 : Descriptive Statistics of Betas Estimated by Dimson Method with Length of Three Years

Dimson's Betas - 3 Years								
Estimation Period	Return Interval	Average Beta	Median	Maximum	Minimum	Standard Deviation	Skewness	Kurtosis
2012-2014	Daily	0.6948	0.6953	1.4066	0.0528	0.2276	0.4968	3.8524
	Weekly	0.7843	0.7733	1.6278	0.0500	0.2723	0.0695	2.8402
	Monthly	0.8360	0.8323	2.4407	-1.5835	0.4675	-0.7569	6.9435
2011-2013	Daily	0.8487	0.8578	1.4153	0.3134	0.2040	-0.0353	2.8221
	Weekly	0.9273	0.9171	1.8346	0.2678	0.2794	0.2747	3.2562
	Monthly	1.0112	1.0322	2.4247	-1.1094	0.5517	-0.4092	3.9990
2010-2012	Daily	0.9181	0.9320	1.4184	0.4154	0.1977	-0.1988	2.7202
	Weekly	0.9587	0.9454	2.4067	-0.0887	0.3289	0.3227	4.6177
	Monthly	1.0354	1.0496	3.3029	-1.9442	0.7150	-0.4799	5.5536
2009-2011	Daily	0.8410	0.8409	1.3280	0.4897	0.1677	0.2141	2.8961
	Weekly	0.8772	0.8641	1.5399	0.1400	0.3097	-0.0898	2.6108
	Monthly	1.0309	1.0685	2.5297	-0.6733	0.5144	-0.2232	3.4204
2008-2010	Daily	0.8330	0.8197	1.3542	0.2401	0.2073	-0.0106	3.0549
	Weekly	0.9498	0.9390	1.8084	-0.0235	0.3069	-0.0996	3.5064
	Monthly	1.1305	1.1491	2.5804	-0.7865	0.4675	-0.5254	4.7012
2007-2009	Daily	0.8159	0.8130	1.4112	0.1983	0.2153	0.0446	3.2611
	Weekly	0.9293	0.9291	1.7856	-0.0339	0.3079	0.0077	3.3135
	Monthly	1.1143	1.1038	2.5285	-0.4973	0.4659	-0.1992	4.1353
2006-2008	Daily	0.8606	0.8605	1.4016	0.2182	0.2189	-0.0600	3.0438
	Weekly	0.9536	0.9434	1.8967	0.2525	0.3160	0.1976	2.8242
	Monthly	1.1920	1.1738	2.7521	-0.0873	0.4968	0.3841	3.8293
2005-2007	Daily	0.8194	0.8172	1.4255	0.1065	0.2283	0.0574	3.3743
	Weekly	0.8313	0.8098	1.6284	-0.2522	0.3405	-0.0104	2.9797
	Monthly	1.1593	1.2333	2.3954	-0.6299	0.5331	-0.4844	3.5166

Table 26 : Descriptive Statistics of Betas Estimated by Dimson Method with Length of Two Years

Dimson's Betas - 2 Years								
Estimation Period	Return Interval	Average Beta	Median	Maximum	Minimum	Standard Deviation	Skewness	Kurtosis
2013-2014	Daily	0.7077	0.7073	1.4248	0.0079	0.2359	0.3019	3.4258
	Weekly	0.7897	0.7916	1.6426	-0.0725	0.3050	-0.1394	2.8540
	Monthly	0.8637	0.8726	2.4151	-3.0581	0.5781	-2.1502	15.2880
2012-2013	Daily	0.7180	0.7081	1.5176	0.0791	0.2398	0.4068	3.5066
	Weekly	0.8067	0.7834	1.8882	0.0997	0.2821	0.2681	3.4873
	Monthly	0.7855	0.8416	2.1996	-1.7491	0.5367	-0.8646	5.9092
2011-2012	Daily	0.9328	0.9433	1.5026	0.2748	0.2335	-0.2757	2.7749
	Weekly	1.0120	0.9681	2.4387	-0.1063	0.3795	0.3222	3.8541
	Monthly	1.1355	1.1421	3.6401	-2.3347	0.8376	-0.6539	5.4783
2010-2011	Daily	0.9787	0.9817	1.5019	0.4215	0.2095	-0.1430	2.7666
	Weekly	1.0616	1.0570	2.8446	-0.1910	0.3930	0.4865	5.1997
	Monthly	1.3073	1.2641	5.2139	-0.9528	0.7816	0.6127	6.2970
2009-2010	Daily	0.7218	0.7221	1.3939	0.0663	0.2059	0.2282	3.8446
	Weekly	0.6822	0.7005	1.5733	-0.9727	0.4193	-0.6932	4.6118
	Monthly	0.9135	0.9220	3.3936	-1.7339	0.7683	-0.0726	4.8526
2008-2009	Daily	0.8250	0.8265	1.3733	0.1131	0.2257	-0.0946	3.2310
	Weekly	0.9694	0.9657	1.9041	-0.1141	0.3251	-0.0985	3.7170
	Monthly	1.1281	1.1353	2.7350	-0.7625	0.5031	-0.3848	4.5058
2007-2008	Daily	0.8620	0.8681	1.4182	0.2234	0.2327	-0.1580	3.0021
	Weekly	0.9747	0.9849	2.0019	0.1555	0.3302	0.2700	3.0209
	Monthly	1.1726	1.1472	3.0257	-0.5514	0.5202	0.4927	4.5378
2006-2007	Daily	0.8275	0.8282	1.4375	0.0921	0.2515	-0.1400	3.2771
	Weekly	0.7890	0.7712	1.8516	-0.5250	0.4066	-0.1619	3.3509
	Monthly	1.1006	1.1805	3.6634	-2.5437	0.9329	-0.5664	4.3318
2005-2006	Daily	0.8334	0.8227	1.5407	-0.0180	0.2501	0.0962	3.3080
	Weekly	0.8814	0.8685	1.9358	-0.2840	0.3967	0.0421	2.8863
	Monthly	1.1908	1.2252	2.6351	-0.6537	0.5418	-0.4002	3.6448

Table 27 : Descriptive Statistics of Betas Estimated by Dimson Method with Length of One Year

Dimson's Betas - 1 Year								
Estimation Period	Return Interval	Average Beta	Median	Maximum	Minimum	Standard Deviation	Skewness	Kurtosis
2014	Daily	0.6300	0.5958	1.5737	-0.0098	0.2759	0.4658	3.5140
	Weekly	0.5665	0.5879	1.7224	-1.2571	0.4214	-0.3865	5.0783
2013	Daily	0.7435	0.7259	1.5738	0.0617	0.2567	0.3401	3.1241
	Weekly	0.8294	0.7971	2.0152	0.0198	0.3293	0.2572	3.5599
2012	Daily	0.6515	0.6476	1.7390	-0.2972	0.3071	0.3860	3.9368
	Weekly	0.7984	0.7900	3.0036	-0.9101	0.4846	0.0372	5.9887
2011	Daily	1.0441	1.0435	1.7246	0.3317	0.2706	-0.1247	2.8005
	Weekly	1.2400	1.1424	3.4443	-0.5611	0.5359	0.6790	4.9677
2010	Daily	0.8764	0.8739	1.8581	-0.1668	0.2590	-0.1944	4.3833
	Weekly	0.7722	0.8023	3.3032	-1.4507	0.5722	-0.0364	6.3060
2009	Daily	0.6154	0.6049	1.5922	-0.1616	0.2631	0.4555	4.2265
	Weekly	0.6688	0.6943	1.8088	-1.2639	0.5115	-0.5442	4.2023
2008	Daily	0.8856	0.9099	1.4615	0.1303	0.2582	-0.2543	3.0302
	Weekly	1.0494	1.0239	2.2637	0.0736	0.3807	0.1963	3.3750
2007	Daily	0.7830	0.7897	1.6500	-0.0874	0.2689	0.0774	3.7538
	Weekly	0.7066	0.7074	2.3131	-0.7633	0.4378	-0.0442	3.7623
2006	Daily	0.8588	0.8656	1.6439	-0.1192	0.3039	-0.0469	3.1841
	Weekly	0.8483	0.8284	2.7199	-0.9111	0.5884	0.0689	3.4880
2005	Daily	0.7950	0.7824	1.5719	0.1302	0.2741	0.1527	2.8365
	Weekly	0.8925	0.8789	2.0780	-0.1684	0.4458	0.0774	2.8023

Table 28 : Descriptive Statistics of Betas Estimated by Vasicek's Adjustment with Length of Five Years

Vasicek's Betas - 5 Years								
Estimation Period	Return Interval	Average Beta	Median	Maximum	Minimum	Standard Deviation	Skewness	Kurtosis
2010-2014	Daily	0.7903	0.7908	1.3749	0.4035	0.1611	0.3886	4.1360
	Weekly	0.8034	0.7966	1.3879	0.4060	0.1601	0.3695	3.7661
	Monthly	0.8873	0.8870	1.3710	0.3407	0.1803	-0.2856	3.3763
2009-2013	Daily	0.7755	0.7564	1.3691	0.3857	0.1565	0.7400	4.5289
	Weekly	0.7916	0.7849	1.3456	0.3951	0.1579	0.4768	3.7365
	Monthly	0.9126	0.9245	1.3434	0.3569	0.1763	-0.3817	3.2856
2008-2012	Daily	0.7962	0.7744	1.4075	0.3656	0.1686	0.5732	4.0529
	Weekly	0.8616	0.8451	1.3753	0.3448	0.1846	0.2848	3.0127
	Monthly	0.9581	0.9529	1.4352	0.2873	0.2031	-0.0702	2.9108
2007-2011	Daily	0.8002	0.7843	1.4208	0.3502	0.1705	0.4697	4.0682
	Weekly	0.8575	0.8379	1.3892	0.3609	0.1801	0.3310	3.1614
	Monthly	0.9740	0.9692	1.4868	0.2700	0.2077	-0.0876	3.0028
2006-2010	Daily	0.7958	0.7816	1.4153	0.2454	0.1827	0.3003	3.8837
	Weekly	0.8249	0.8008	1.3972	0.3507	0.1901	0.3622	3.2319
	Monthly	0.9590	0.9476	1.5707	0.2945	0.2251	-0.0223	3.1473
2005-2009	Daily	0.7844	0.7622	1.3628	0.2373	0.1871	0.3584	4.0000
	Weekly	0.8249	0.8079	1.4073	0.3398	0.1959	0.3410	3.2598
	Monthly	0.9580	0.9458	1.4914	0.3615	0.2252	0.0106	2.9439

Table 29 : Descriptive Statistics of Betas Estimated by Vasicek's Adjustment with Length of Four Years

Vasicek's Betas - 4 Years								
Estimation Period	Return Interval	Average Beta	Median	Maximum	Minimum	Standard Deviation	Skewness	Kurtosis
2011-2014	Daily	0.7716	0.7746	1.3762	0.3625	0.1762	0.3293	4.0176
	Weekly	0.7762	0.7742	1.4153	0.3833	0.1720	0.5020	3.9968
	Monthly	0.8540	0.8699	1.4428	0.2025	0.1973	-0.1699	3.5953
2010-2013	Daily	0.8176	0.8246	1.3337	0.4140	0.1580	0.2015	3.5795
	Weekly	0.8333	0.8311	1.3796	0.4055	0.1592	0.2013	3.2089
	Monthly	0.9428	0.9488	1.3666	0.3623	0.1865	-0.4426	3.3319
2009-2012	Daily	0.7732	0.7577	1.3917	0.4241	0.1563	0.8931	5.0309
	Weekly	0.8086	0.7941	1.3749	0.4198	0.1614	0.4358	3.6473
	Monthly	0.8893	0.9019	1.3533	0.3229	0.1914	-0.1730	2.8557
2008-2011	Daily	0.8094	0.7903	1.4035	0.3749	0.1687	0.4765	3.8652
	Weekly	0.8784	0.8653	1.4011	0.3591	0.1831	0.2341	3.0319
	Monthly	0.9930	0.9861	1.4716	0.2897	0.2038	-0.1428	3.0464
2007-2010	Daily	0.7812	0.7606	1.4404	0.2320	0.1855	0.3349	3.9701
	Weekly	0.8362	0.8122	1.4030	0.3429	0.1909	0.2912	3.1995
	Monthly	0.9629	0.9667	1.5163	0.2596	0.2235	-0.0899	3.1138
2006-2009	Daily	0.7860	0.7714	1.4204	0.2098	0.1936	0.2880	3.8942
	Weekly	0.8118	0.7996	1.4113	0.3313	0.2051	0.3583	3.2668
	Monthly	0.9477	0.9347	1.6060	0.2737	0.2370	-0.0362	3.1952
2005-2008	Daily	0.8117	0.7946	1.3619	0.2389	0.1852	0.1766	3.8633
	Weekly	0.8562	0.8425	1.4809	0.3444	0.1993	0.2185	3.2035
	Monthly	0.9774	0.9467	1.5049	0.3761	0.2188	0.0685	2.8190

Table 30 : Descriptive Statistics of Betas Estimated by Vasicek's Adjustment with Length of Three Years

Vasicek's Betas - 3 Years								
Estimation Period	Return Interval	Average Beta	Median	Maximum	Minimum	Standard Deviation	Skewness	Kurtosis
2012-2014	Daily	0.7129	0.7035	1.4065	0.2981	0.1937	0.5260	4.1368
	Weekly	0.6877	0.6752	1.3671	0.3264	0.1922	0.8455	4.4244
	Monthly	0.7760	0.7646	1.4089	0.1635	0.2013	0.1616	3.7081
2011-2013	Daily	0.8023	0.8001	1.3713	0.3669	0.1748	0.1046	3.4660
	Weekly	0.8081	0.8051	1.4087	0.3765	0.1705	0.2932	3.4513
	Monthly	0.9127	0.9345	1.4766	0.2742	0.2054	-0.3316	3.3467
2010-2012	Daily	0.8393	0.8562	1.3593	0.4481	0.1558	0.1410	3.7979
	Weekly	0.8845	0.8886	1.4445	0.4459	0.1685	-0.0336	3.1937
	Monthly	0.9230	0.9251	1.3657	0.2793	0.2115	-0.4158	3.2083
2009-2011	Daily	0.7948	0.7817	1.3813	0.4505	0.1511	0.7990	4.6561
	Weekly	0.8338	0.8315	1.3671	0.4605	0.1544	0.3661	3.3618
	Monthly	0.9379	0.9508	1.3877	0.3480	0.1910	-0.2773	2.8874
2008-2010	Daily	0.7879	0.7695	1.4241	0.2964	0.1858	0.3300	3.7219
	Weekly	0.8573	0.8387	1.3960	0.3377	0.1956	0.1679	3.0682
	Monthly	0.9819	0.9792	1.5088	0.2839	0.2183	-0.1052	3.1272
2007-2009	Daily	0.7666	0.7432	1.4507	0.1842	0.1987	0.3149	4.0017
	Weekly	0.8227	0.8081	1.4410	0.3059	0.2070	0.2952	3.3078
	Monthly	0.9516	0.9505	1.5411	0.2267	0.2328	-0.0975	3.1578
2006-2008	Daily	0.8176	0.8012	1.4062	0.2128	0.1932	0.0681	3.7002
	Weekly	0.8414	0.8279	1.4964	0.3267	0.2113	0.2478	3.1881
	Monthly	0.9586	0.9337	1.6409	0.3253	0.2323	0.0401	3.0707
2005-2007	Daily	0.8016	0.7899	1.4232	0.2388	0.1913	0.1577	3.9143
	Weekly	0.7960	0.8029	1.4223	0.1039	0.2042	0.0980	3.9319
	Monthly	0.9428	0.9389	1.6626	0.1199	0.2586	-0.2447	3.1644

Table 31 : Descriptive Statistics of Betas Estimated by Vasicek's Adjustment with Length of Two Years

Vasicek's Betas - 2 Years								
Estimation Period	Return Interval	Average Beta	Median	Maximum	Minimum	Standard Deviation	Skewness	Kurtosis
2013-2014	Daily	0.7333	0.7310	1.3957	0.2987	0.1974	0.3530	3.5687
	Weekly	0.7020	0.6944	1.3557	0.2231	0.1933	0.4465	3.8465
	Monthly	0.8367	0.8557	1.3997	0.2734	0.2328	-0.2979	2.8021
2012-2013	Daily	0.7422	0.7373	1.3336	0.2862	0.1951	0.2862	3.4373
	Weekly	0.7106	0.6918	1.3418	0.2818	0.1944	0.5996	3.5351
	Monthly	0.8498	0.8455	1.5204	0.2168	0.2042	-0.0492	3.3180
2011-2012	Daily	0.8223	0.8460	1.4692	0.3688	0.1818	0.0544	3.7620
	Weekly	0.8724	0.8713	1.5456	0.3942	0.1877	0.0063	3.3799
	Monthly	0.8719	0.8676	1.4980	0.1220	0.2421	-0.3070	3.3600
2010-2011	Daily	0.8884	0.8996	1.3249	0.4444	0.1504	-0.0688	3.3856
	Weekly	0.9442	0.9476	1.3927	0.4873	0.1692	-0.0996	2.7475
	Monthly	1.0446	1.0579	1.6692	0.3301	0.2309	-0.3149	3.3962
2009-2010	Daily	0.7344	0.7089	1.4207	0.3438	0.1720	0.8579	4.5548
	Weekly	0.7494	0.7423	1.4302	0.3987	0.1703	0.4891	3.8593
	Monthly	0.8550	0.8751	1.5101	0.2697	0.2415	-0.0694	2.7760
2008-2009	Daily	0.7701	0.7418	1.4339	0.2465	0.2023	0.2845	3.7614
	Weekly	0.8446	0.8446	1.4554	0.3075	0.2114	0.1463	3.1384
	Monthly	0.9708	0.9699	1.5355	0.2561	0.2240	-0.1072	3.1032
2007-2008	Daily	0.8020	0.7940	1.4417	0.1953	0.1993	0.0384	3.7983
	Weekly	0.8625	0.8532	1.5652	0.2901	0.2202	0.0935	3.1482
	Monthly	0.9646	0.9608	1.5752	0.2401	0.2302	-0.0681	2.8559
2006-2007	Daily	0.8123	0.8283	1.4061	0.1777	0.2050	-0.0303	3.7528
	Weekly	0.7419	0.7210	1.4739	0.0589	0.2277	0.2684	3.9473
	Monthly	0.8818	0.8931	1.7152	-0.1559	0.3414	-0.2253	3.0682
2005-2006	Daily	0.8264	0.8097	1.4334	0.2126	0.2022	0.1860	3.4826
	Weekly	0.8303	0.8444	1.5496	0.0661	0.2152	-0.0136	3.7228
	Monthly	0.9726	0.9604	1.6358	0.0016	0.2700	-0.2985	3.4386

Table 32 : Descriptive Statistics of Betas Estimated by Vasicek's Adjustment with Length of One Year

Vasicek's Betas - 1 Year								
Estimation Period	Return Interval	Average Beta	Median	Maximum	Minimum	Standard Deviation	Skewness	Kurtosis
2014	Daily	0.6258	0.6103	1.5896	0.1969	0.2067	1.1963	6.8968
	Weekly	0.6087	0.5985	1.5225	0.0769	0.2121	1.0928	6.4897
2013	Daily	0.7789	0.7755	1.2958	0.2959	0.2023	0.0636	2.9370
	Weekly	0.7322	0.7272	1.2553	0.1932	0.1957	0.1021	2.9609
2012	Daily	0.6204	0.6062	1.5201	0.1636	0.2120	0.9978	5.9721
	Weekly	0.6414	0.6150	1.5746	0.0314	0.2434	0.7310	4.1626
2011	Daily	0.9009	0.9097	1.4258	0.3881	0.1821	-0.2083	3.0679
	Weekly	0.9787	1.0063	1.4830	0.4424	0.1940	-0.1876	2.8131
2010	Daily	0.8697	0.8846	1.3448	0.4147	0.1538	-0.0323	3.1176
	Weekly	0.8942	0.8974	1.4007	0.3810	0.1829	-0.0340	2.9245
2009	Daily	0.6385	0.6108	1.4551	0.1368	0.2131	0.9989	5.1239
	Weekly	0.6293	0.6275	1.4326	0.0727	0.2211	0.6453	4.5170
2008	Daily	0.8191	0.8102	1.4123	0.2146	0.2055	-0.0956	3.5371
	Weekly	0.8967	0.8970	1.6112	0.2582	0.2337	-0.0949	3.0987
2007	Daily	0.7553	0.7519	1.4670	0.0230	0.2021	0.1178	4.3300
	Weekly	0.7155	0.7117	1.4586	0.1891	0.2076	0.3074	4.1308
2006	Daily	0.8643	0.8561	1.4107	0.1901	0.2316	-0.1404	3.2177
	Weekly	0.7617	0.7364	1.5576	-0.0176	0.2631	0.1618	3.3586
2005	Daily	0.7719	0.7541	1.4379	0.2166	0.1970	0.3147	3.2736
	Weekly	0.9023	0.9064	1.4529	0.2775	0.2000	-0.2378	3.2509

C. TURKISH SUMMARY

Borsa finansın önemli bir parçası olarak hem hisse senedi çıkarana şirkete hem de yatırımcıya fayda sağlamaktadır. Firmalar halka arz yoluyla dış finansman sağlayabilir ve yatırımcılar da temettü ödemeleri veya hisseleri karla satarak para kazanabilir. Borsa, popüler bir yatırım seçeneği haline gelmiştir ve büyük şirketlerin çoğunluğu piyasada işlem görmektedir. Hisse senedi piyasalarına olan yatırım miktarı son on yıllarda istikrarlı bir şekilde artmıştır ve bu artışın devam etmesi beklenmektedir. Dünya Borsalar Federasyonu, üye borsalarda işlem gören şirket paylarının toplam piyasa değerini 2015 yılında 62.819 trilyon Amerikan Doları olarak hesaplamaktadır. Sonuç olarak, bu durum araştırmacıları borsalar üzerine çalışmaya teşvik etmektedir.

Literatürde, borsalar üzerine ve hisse senetlerinin farklı özellikleri üzerine yapılmış çok sayıda çalışma bulunmaktadır. Hisse senedi fiyatlarındaki değişimler bir çok değişkenle açıklanmaya çalışılmıştır. Nitekim bazı teorik modeller ortaya çıkmıştır. Bunlar içerisinde en bilinen modellerden birisi, Sharpe (1964), Lintner (1965) ve Mossin (1966) tarafından geliştirilen Sermaye Varlıkları Fiyatlandırma Modeli(SVFM)'dir. Bu model, bir hisse senedinin fazla getirisi ile piyasa portföyünün fazla getirisi arasında pozitif bir lineer bir ilişki olduğunu iddia etmektedir. Diğer bir deyişle, bir hisse senedinin getirisi, piyasa portföyünün getirisi ile açıklanmaktadır.

Bu model yeni bir risk kavramı ileri sürmüştür ve bu sistematik risk ve sistematik olmayan risk tanımlarını içermektedir. Piyasa getirisinin, kat sayısı "Beta" olarak adlandırılmaktadır. Beta, bir hissenin sistematik riski olarak tarif edilmektedir ve ekonomi ve piyasanın koşullarından kaynaklandığı için çeşitlendirme yoluyla ile bertaraf edilmesi mümkün olmayan riski temsil etmektedir.

SVFM, finans dünyasından ciddi bir ilgi gördü. Gelişmiş ve gelişmekte olan ülke borsalarında geçerliliği ve uygulanabilirliği araştırılmıştır. Çalışmaların bulguları

modelle ilgili kesin bir yargıya varmamaktadır çünkü modeli destekleyen veya reddeden çok sayıda çalışma bulunmaktadır. Ayrıca, bir çok çalışmada SVFM'in varsayımlarının değerlendirmesi yapılmıştır ve bunun sonucunda bazı varsayımlar esnetilmiştir. SVFM'ye yönelik olarak Arbitraj Fiyatlandırma Teorisi ve Fama-French Üç Faktör Varlık Fiyatlandırma modeli ortaya konulmuştur ancak bu modeller SVFM'nin yerini alamamıştır. Sonuç olarak, bir çok çalışmada SVFM kullanılmaya devam etmektedir.

Çok sayıda çalışma betaya odaklanmıştır ve betanın tahmini ile durağanlığı ana konuları olmuştur. Betanın tahmin edilmesi ile ilgili bir kaç husus bulunmaktadır. İlk olarak, geçmişe kıyasla daha yüksek sıklıkta verinin erişilebilir olmasıyla, getiri aralığının seçimi önem kazanmıştır. Hawawini (1983) ve Handa, Kothari ve Wasley (1989) çalışmaları verinin getiri aralığının betanın tahmininde önemli bir etkisi olduğunu göstermektedir. Günlük, haftalık, aylık veya yıllık getiri kullanılması hesaplanan Beta değerini etkilemektedir. Tahmin periyodunun uzunluğu bir başka tartışmalı konu olarak görülmektedir. Ne kadar uzunluktaki bir data ile çalışması gerektiğine ilişkin bir genel geçek bir kural bulunmamaktadır. Levhari ve Levy (1977) gerçek tahmin ufkundan daha kısa veya daha uzun bir sürenin kullanılmasının beta tahmininde bir yanlılık oluşturduğunu göstermiştir. Hisseleri piyasada işlem gören bir firmanın riski zamanla değişmektedir. Betanın gerçek değerini elde edebilmek için tahmin ufku olması gerekenden ne daha uzun ne de daha kısa olmalıdır. Buna ek olarak, Daves, Ehrhardt ve Kunkel (2000) tahmin döneminin uzunluğunun etkisine ilişkin kanıtlar sunmuştur. Üçüncül olarak ise bazı hisselerin eşzamanlı işlem görmemesinin etkisi üzerine çalışılmıştır. Fama (1966) yapmış olduğu çalışmasında sıklıkla işlem görmeyen hisse senetlerinin Betasının tahmininde bir yanlılık olduğunu ifade etmiştir. Özetle, getiri aralığı, tahmin süresi ve hissenin sık işlem görmemesi, betanın tahmini ile ilgili sorunlu konular olarak görülmektedir.

Beta ile ilgili sorunlardan bir diğer ana başlık betanın durağanlığıdır. Betaya ilişkin varsayımlardan birisi, betanın değerinin tahmin döneminde sabit olduğunu kabul etmektedir. Ancak Blume (1971) çalışmasında hisselerin Beta değerlerinin

değiştiğini işaret etmiştir. Bir çok çalışma betanın durağanlığına odaklanmıştır ve sonuçlar varsayımın aksini işaret etmektedir.

Türkiye, gelişmekte olan ülkeler grubunda yer almaktadır ve son on yıl içerisinde ciddi bir ekonomik gelişme göstermiştir. Bir çok şirket ve yatırımcı dolaylı veya dolaysız olarak Türkiye'de yatırım yapmaktadır. Ayrıca, bir çok yerel girişim ve girişimci finansmana erişimde alternatiflere ilişkin farkındalık sahibi olmuştur. Bunun sonucunda, finansal piyasalar ciddi bir gelişme kaydetmiştir. Bu gelişme rakamlarla ifade edilecek olursa, işlem gören hisse sayısı 2003 yılından 2015 yılına kadar olan süreçte 285'ten 416'ya çıkmıştır. Borsa İstanbul'da işlem gören hisselerin piyasa değeri 2003 yılı sonunda 69 milyar Amerikan Doları iken, bu değer 2015 yılı sonunda 190.15 milyar Amerika Dolarına ulaşmıştır. Son olarak da, yıllık işlem hacmi 2003 yılındaki değerine göre üç kattan daha fazla artarak, 100.1 milyar Amerikan Dolarından 381.73 milyar Amerikan Dolarına yükselmiştir.

Bu çalışma, Borsa İstanbul'da işlem gören hisselerin betalarını incelemeyi amaçlamaktadır. Önceki paragraflarda belirtilen hususlar sırayla incelenmektedir. Veri seti, 01.01.2005 tarihinden 31.12.2015'e kadar olan zamanı kapsamaktadır. Bu süreçte, 203 adet hisse sürekli olarak işlem görmüştür. Bu sebeple, bu hisseler çalışmaya dahil edilmiştir. Hisselerin ve Bist Tüm Endeksinin kapanış fiyatı üzerinden hesaplanan logaritmik getiriler kullanılmıştır. Hesaplamalar günlük, haftalık ve aylık getiriler üzerinden yapılmıştır. Dört tahmin metodu kullanılmıştır ve bunlar sırasıyla standart pazar modeli, Scholes Williams metodu, Dimson metodu ve Vasicek düzeltmesi. Beş yıllık, dört yıllık, üç yıllık, iki yıllık ve bir yıllık uzunluklarda olmak üzere beş tahmin ufku düzenlenmiştir. Bunun sonucunda, 203 hissenin her biri için 440 farklı Beta tahmin edilmiştir ve bu da toplamda 89,320 adet farklı betanın tahmini ile neticelenmiştir. Buna ek olarak, beta tahmininde kullanılar hisseler üzerinden betanın zamanla içinde değişip değişmediği de araştırılmıştır. Durağanlık incelemesinde dokuz farklı zaman periyodu ve üç getiri aralığı kullanılmıştır. Son olarak da, tahmin edilen betaların, öngörü performansı karşılaştırılmıştır.

Bu çalışma literatüre üç açıdan katkı yapmaktadır. İlk olarak, bu çalışma son on yılı kapsaması nedeniyle Türkiye'deki son eğilimlerin etkilerini yansıtmaktadır. Küresel Ekonomik Kriz, Avrupa Borç Krizi, faiz oranlarındaki düşüş ve önceki on yıllara kıyasla düşük enflasyon oranları, döviz kurlarındaki hızlı artış ve Türkiye'nin kredi notlarındaki değişimler gibi hem yerel hem de küresel önemli olayların etkileri görülebilmektedir. İkincil olarak, Bist Tüm endeksi 308 hisseyi içermektedir ve bunların 203 adedi bu çalışmada kullanılmıştır. Bist 100 endeksi ve içerdiği tüm hisseleri kullanan çalışmalar bulunmaktadır ancak endeks işlem yüz hisseyi içermektedir. Son olarak, Scholes Williams metodu ile beta tahmini, Türkiye pay piyasasında bu çalışma ile ilk defa kullanılmaktadır.

Çalışmanın veri seti, tahmin periyodu ve öngörü periyodu olarak ikiye ayrılmıştır. 3 Ocak 2005 tarihinden 31 Aralık 2014'e kadar olan zaman Beta tahmininde kullanılmıştır. 2 Ocak 2015'ten 31 Aralık 2015'e kadar olan süreç ise betaların öngörü performansını ölçmekte değerlendirilmiştir. Bazı hisse senetleri kullanılan endeksten daha az sayıda gözleme sahiptir. Bunun nedeni şirketlerin özel durumları sebebiyle işleme kapatılmış olmasıdır. Hisselerin işleme kapalı olduğu günler ve bunları takip eden gün, yanıltıcı olabileceği için tahminlerde analizlerde kullanılmamıştır.

Çalışmada dört farklı beta tahmini kullanılmıştır. Birinci metot, literatüre de pazar modeli olarak adlandırılan ve hisse getirisinin, pazar getirisi ile basit doğrusal modellenmesidir. İkinci metot, Schloles ve Williams (1977) tarafından öne sürülen ve seyrek işlem gören hisselerin yanıltıcı etkisine dirençli olduğu ifade edilen tahmin metodudur. Bu metotta üç farklı regresyon modelinin beta katsayı kullanılarak hisse senedinin betası elde edilmektedir. Hissenin t zamanındaki getirisi ayrı ayrı t-1 zamanındaki piyasa getirisi, t zamanındaki piyasa getirisi ve t+1 zamanındaki piyasa getirisi ile modellenmektedir. Ardından elde edilen beta katsayıları toplanarak, Pazar endeksinin birinci oto korelasyonunun bir ile toplamına bölünerek hissenin betası bulunmaktadır. Üçüncü metot, Dimson (1979) tarafından Scholes Williams ile aynı amaçla önerilmiştir. Bu modelde, bir hissenin t zamanındaki getirisi, piyasasın t-1, t ve t+1 zamanlarındaki getirileri ile çoklu regresyon modellemesi yapılmaktadır.

Farklı zamanlardaki piyasa getirilerinin katsayıları toplanarak Beta elde edilmektedir. Dördüncü ve son metot ise Vasicek (1973) tarafından öne sürülen ve bayesci yaklaşımla betaların zamanla ortalamaya yönelimine yönelik düzeltme metodudur. Bir hissenin pazar modeli ile elde edilen beta katsayısının ve bütün hisselerin beta katsayılarının ortalamasının ağırlıklandırılarak toplanması ile elde edilir. Hesaplamada hissenin betası ağırlık ile çarpılır ve betaların ortalaması ile birin ağırlıktan farkı ile çarpılır. Kullanılan ağırlık değeri, tahmin edilen betaların varyansının, kendisi ile hissenin betasının varyansının toplamına bölünmesi ile elde edilir.

Tahmin için ayrılan on yıllık süreç, tahmin ufuklarının uzunluğuna göre alt periyotlara ayrılmıştır. Her periyot uzunluğu için başlangıç yılı bir yıl ilerletilerek alt periyotlar oluşturulmuştur ve farklı getiri aralıklarına göre ayrı setler oluşturulmuştur. Sonuç olarak beta tahmininde beş farklı tahmin ufku ve üç farklı getiri aralığı için toplam 110 farklı veri seti kullanılmıştır. Sadece aylık getiri aralığı ve bir yıllık yatırım ufkunda gözlem sayısı yetersiz olduğu için hesaplama yapılmamıştır.

Pazar modeli sonuçlarına göre, ortalama betanın tüm tahmin dönemlerinde günlük getiri aralığından aylık getiri aralığına doğru arttığı gözlemlenmektedir. Ortalama betanın, bir yıllık tahmin uzunluğu dışında günlük getiri için 0.79, haftalık getiri için 0.82 ve aylık getiri için 0.92 civarında değerlere sahip olduğu görülmektedir. Bir yıllık tahmin süresi için günlük ve haftalık getirilerin beta ortalaması diğer dönemlere göre daha küçüktür.

Betaların açıklığı günlük ve haftalık getiriler için benzer olmakla birlikte aylık getiri aralığın daha geniştir. İki yıllık tahmin ufku ve aylık getiri aralığı için en yüksek beta 2'ye ve en düşük beta -0.4 yakın bir değer almış olup, en geniş dağılım aralığı bu alt döneme aittir. Ayrıca, betanın negatif değer aldığı da görülmektedir. Betaların standart sapması, getiri aralığı kısaldıkça ve tahmin dönemi uzadıkça azalmaktadır. Betanın çarpıklığı getiri aralığına göre değişmektedir. Günlük ve haftalık getiri

aralığı için sağdan çarpıklık görülmekte iken, aylık getiri aralığında soldan çarpıklık görülmektedir. Basıklık değerinde herhangi bir eğilim görülmemektedir.

Scholes Williams metoduna göre hesaplanan beta değerlerinin istatistikleri Pazar modelinden farklıdır. Piyasa betası, günlük getiri için 0.83, haftalık getiri için 0.92 ve aylık getiri için 1.07 civarında değerlere sahiptir. Bir yıllık tahmin ufku için günlük getiriye ait betaların ortalaması 0.78 ve haftalık getiriye ait betaların ortalaması ise 0.84 olarak gerçekleşmiştir. Betaların açıklığı, tahmin dönemi kısaldıkça ve getiri aralığı artmaktadır. Ortalama betanın açıklığı, 2 yıllık tahmin dönemi ve aylık getiri için yaklaşık olarak 4.65'tir. Aylık getiriye ait betaların standart sapması daha diğer getiri aralıklarına göre daha yüksektir. Ayrıca, daha uzun tahmin ufku daha düşük standart sapma demektir. Aylık getiri aralığı kullanılarak hesaplanan betalar negatif çarpıklığa sahip iken, günlük ve haftalık getiri aralıkları pozitif çarpıklığa sahiptir.

Bir yıllık tahmin süresi ile hesaplanan betaların ortalaması, günlük getiri için 0.78 ve haftalık getiri için 0.83 olarak gerçekleşmiştir. Diğer tahmin periyotlarının ortalaması her getiri aralığında daha yüksektir. Betanın dağılım genişliği ile getiri aralığının uzunluğu arasında pozitif bir ilişki bulunmaktadır. Her getiri aralığında negatif beta değerleri görülmektedir. Maksimum ortalama beta 3.21'dir. Betaların açıklığı, bey yıllık tahmin uzunluğu ve günlük getiride en düşük değerini almakta ve bu değerde yaklaşık olarak 1'dir. Betaların standart sapmaları 0.186 ile 0.667 arasında değişmekte olup getiri aralığının uzaması ve tahmin süresinin kısalması veya getiri aralığının artmasına paralel olarak artmaktadır. Aylık getiri ile hesaplanan betalar negatif çarpıklık göstermektedir. Günlük ve haftalık getirilerle hesaplanan betalar pozitif ancak sıfıra yakın değerlerde çarpıklık göstermektedir. Aynı tahmin uzunluğu için aylık getiriler daha yüksek basıklık değerine sahiptir.

Vasicek düzeltmesi uygulanan betalar, beklendiği üzere pazar modeli ile benzer istatistiklere sahiptir. Piyasa betaları, günlük getiri aralığı için 0.76 ve 0.79 arasında, haftalık getiri aralığı için 0.78 ve 0.83 arasında ve aylık getiri aralığı 0.92 ve 0.94 arasında değişmektedir. Bir yıllık tahmin döneminin diğer dönemlere kıyasla daha düşük değerlere sahip olduğu görülmektedir. Betaların açıklığı arasında, diğer

metotlardaki gibi göre göze çarpan bir fark bulunmamaktadır. Bütün periyotlar ve getiri aralıkları hemen hemen aynı açıklığa sahiptir. Vasicek düzeltmesi uygulanan betaların standart sapması, en düşük 0.171 ve en yüksek 0.246'dır. Standart sapmalar, getiri aralıkları ve tahmin periyotları arasında diğer metotlara göre daha küçük değişimler olmaktadır. Diğer metotlara benzer şekilde, aylık getiri aralığı negatif çarpıklığa, günlük ve haftalık getiriler ise pozitif çarpıklığa sahiptir. Basıklık değeri ise getiri aralığı kısaldıkça ve tahmin periyodu uzadıkça daha yüksek değere sahip olmaktadır.

Bu tahmin sonuçlarına göre bazı çıkarımlar yapılması mümkündür. Piyasa betasının, tüm metotlara göre getiri aralığı uzadıkça arttığı görülmektedir. Pazar modeli betaları ve Vasicek düzelmesi uygulanmış betalar ortalamada, Scholes Willams ve Dimson metoduna göre daha düşük değerde gerçekleşmektedir. Sadece bir yıllık tahmin ufku kullanılan hesaplamalar sonucunda elde edilen betaların ortalaması bütün metotlar için birbirine yakın değerlerdedir. Pazar modeli ve Vasicek düzeltmesi uygulanarak hesaplanan betalar birbirine benzer sonuçlar vermektedir. Vasicek düzeltmesinin Pazar modeli kullanılarak elde edilen betalara, bu model üzerinden hesaplanan istatistiklerle düzeltme uygulandığı için benzerlik olması şaşırtıcı olmamaktadır. Diğer taraftan Scholes Willams ve Dimson metotları ile hesaplanan betalarında birbirlerine yakın değerlere sahip olduğu görülmektedir. Daha önce ifade edildiği üzere, hesaplanma metotları arasındaki farklılıklar bulunmaktadır. Scholes Williams metodu üç farklı basit regresyondan elde edilen katsayıların toplamının, piyasa endeksinin birinci oto korelasyonunun bir fazlasına bölünmesi ile betaları hesaplamaktadır. Dimson metodu ise çoklu regresyon modellemesi sonucu elde edilen betaların toplanması ile betaları hesaplamaktadır. Bu benzerliğin bir açıklaması piyasa endeksinin otokorelasyonunun düşük olması olabilir. Piyasa endeksinin oto korelasyonu 110 veri seti için incelediğinde, sonuçlar bu iddiayı doğrular niteliktedir. Tek tek bakıldığında, 110 veri setinden sadece 17 tanesinin -0.1 ve 0.1 aralığı dışında oto korelasyona sahip olduğu ve en yüksek mutlak değerin 0.32 olduğu görülmektedir.

Piyasa betası tahminleri, eşit olup olmadıklarının belirlenebilmesi amacıyla hem metotlar arasında hem de getiri aralıkları arasında karşılaştırılmıştır. Karşılaştırma istatistiksel testler kullanılarak yapılmıştır. Kullanılan testler, betaların normal dağılıp dağılmamasına göre seçilmiştir. Anova ve Kruskal-Wallis testi kullanılmıştır. İlk olarak, "Farklı metotlarla tahmin edilen piyasa betaları arasında anlamlı bir fark yoktur" şeklindeki sıfır hipotezi test edilmiştir. Karşılaştırma sonucunda üç yıllık, dört yıllık ve beş yıllık tahmin ufkuna sahip 63 alt dönemin 56'sında piyasa betaları arasında istatistiksel olarak anlamlı bir fark bulunmuştur. İki yıllık tahmin sürecinde ise 27 alt dönemden 16'sında anlamlı bir fark bulunmaktadır. Son olarak, bir yıllık tahmin ufkunda ise haftalık getirilerle hesaplanan on dönemden beş tanesinde piyasa betaları arasında anlamlı bir fark bulunmuştur. Günlük getirilerde ise on dönemden 2 tanesi arasında anlamlı bir fark bulunmaktadır. Bu sonuçlar tahmin ufku azaldıkça farklı metotlarla hesaplanan piyasa betaları arasındaki farklılığın azaldığına işaret etmektedir.

İkinci olarak, "Farklı getiri aralıklarıyla tahmin edilen piyasa betaları arasında anlamlı bir fark yoktur" şeklindeki sıfır hipotezi test edilmiştir. Bir önceki hipotezde olduğu gibi Anova ve Kruskal-Wallis testi kullanılmıştır. Sadece, bir yıllık tahmin uzunluğunda iki getiri aralığına ilişkin hesaplama bulunduğu için, betaların normal dağılım gösterip göstermeme durumuna göre t testi veya Wilcoxon işaret testi kullanılmıştır. Her bir metot ayrı ayrı test edilmiştir. Üç getiri aralığının karşılaştırıldığı iki yıllık, üç yıllık, dört yıllık ve beş yıllık tahmin uzunluklarına ait 120 farklı testten sadece 3 tanesinde sıfır hipotezi reddedilememiştir. Bu sonuç getiri aralığının beta tahmini üzerinde etkisi olduğunu göstermektedir. Bir yıllık tahmin uzunluğunda yapılan karşılaştırma sonucunda günlük ve haftalık piyasa betaları arasında kesin bir yorum yapılamamaktadır.

Beta tahminine ilişkin çalışmalardan sonra betanın durağanlığına ilişkin bir araştırma da yapılmıştır. Çalışmanın bu kısmında Pazar modelinin değiştirilmiş hali kullanılarak durağanlık incelenmiştir. Pazar modeline biri alfa katsayısı için diğeri beta katsayısı için olmak üzere iki adet kukla değişken eklenmiştir. Çalışmadaki her bir hisse için veri setinin başında ve sonunda en az bir yıllık gözlem olacak şekilde

rastgele bir kırılım noktası seçilmiştir. Kırılım noktası, günler içerisinden basit rastgele örnekleme yoluyla seçilmiştir. Sadece iki yıllık dönemde bu tarih direk belirlenmiştir. Kırılım noktasından önceki sürede kukla değişken 0 değerini, sonraki sürede ise 1 değerini almıştır. Çalışmada kullanılan dönemleri uzunlukları on ila iki yıl arasında değişmektedir. On yıllık dönem 2005'ten 2014 yılı sonuna kadar olan süreyi kapsamakta olup diğer dönem uzunlukları başlangıç yılı bir ilerletilerek oluşturulmuştur. Her bir getiri aralığına ilişkin ayrı ayrı değerlendirme yapılmıştır. Durağanlığa ilişkin hipotez, binom testi ile test edilmiştir. Alfaya ilişkin sıfır hipotezi "Zaman içerisinde hisselerin alfa değerinde anlamlı bir değişim yoktur" şeklinde ve betaya ilişkin sıfır hipotezi "Zaman içerisinde hisselerin beta değerinde anlamlı bir değişim yoktur" şeklindedir.

Hipotez testi sonucunda, alfalara ilişkin sıfır hipotezi 27 alt dönem içerisinde sadece bir kez reddedilebilmiştir. Bu sonuçta alfaların zaman içerisinde pek değişim göstermediğini işaret etmektedir. Betalara ilişkin hipotez testi sonuçları alfalara ilişkin test sonucuna zıttır. Betalara ilişkin sıfır hipotezi, 27 alt dönemin 26'sında reddedilmiştir. Bu durum betaların değişken bir yapıya sahip olduğunu göstermektedir.

Çalışmada son olarak, tahmin edilen beta değerlerinin öngörü performansı karşılaştırılmıştır. 2015 yılındaki hisse getirileri, ilgili getiri aralığında önceki yıllara göre hesaplanan beta değerleri ile tahmin edilmiştir. Ortalama Mutlak Sapma (OMS) ve Ortalama Hata Kareleri (OHK) toplamı, hata ölçüm yöntemleri olarak kullanılmıştır. 2015 yılı ile ardışık olan tahmin dönemlerine ait betalar kullanılmıştır. Buna göre 2010 yılından itibaren beş yıllık, 2011 yılından itibaren dört yıllık, 2012 yılından itibaren üç yıllık, 2013 yılından itibaren iki yıllık ve 2014 yılından itibaren bir yıllık dönemlere ait betalar kullanılmıştır. Her bir getiri aralığına ilişkin öngörü sadece o getiri aralığına ait betalarla yapılmıştır.

Günlük getiri aralığında elde edilen hata istatistiklerine göre toplam OMS'nin en küçük değeri tüm metotlar için 2012 ve 2014 arasındaki üç yıllık tahmin dönemine aittir ve metotlar içerisinde en iyi performansı Vasicek düzeltmesi vermiştir. Ancak,

toplam OHK ise 2010 ve 2014 yılları arasındaki beş yıllık dönem en küçük değere sahiptir ve OMS ile benzer şekilde Vasicek metodu en iyi performansı göstermiştir. Haftalık getiri aralığında ise tüm metotlar, her iki hata ölçüm tekniği ile en düşük hata değerlerini 2012 ve 2014 yılları arasındaki üç yıllık döneme ait betalarla göstermektedir. En düşük hataya Vasicek metodu sahiptir. Son olarak, aylık getiri aralığına ait hata istatistikleri de, 2012 ve 2014 yıllarındaki üç dönemi en iyi tahminci olarak işaret etmekte ve Vasicek metodu bu dönemde de en iyi performansı gösteren metot olmuştur.

Bu tezde, hisselerin 2005 ve 2014 dönemindeki betaları incelenmiştir. Betalar, farklı metotlara, farklı getiri aralıklarına ve farklı zaman periyotlarında hesaplanmıştır. Betaların durağanlığı araştırılmış ve öngörü performansları karşılaştırılmıştır. Veriler Thomson Reuters veri tabanından alınmış olup, hisse senedi bölünmesi, temettü ödemesi gibi olaylar için düzenlenmiştir. Günlük, haftalık ve aylık zaman aralıklarında, logaritmik getiriler kullanılarak analizler gerçekleştirilmiştir. Çalışma dönemi, başlangıç ve bitiş noktaları yılın ilk işlem günü ve yılın son işlem günü olacak şekilde alt dönemlere bölünmüştür. En kısa dönem bir yıl uzunluğundadır.

Betalar dört farklı metotla tahmin edilmiştir ve yapılan inceleme sonucunda metotların uzun dönemler üzerinden hesaplanan piyasa betasına yönelik tahminleri arasında istatistiksel olarak anlamlı bir farklılık bulunmuştur. Ancak tahmin süresi kısaldıkça, metotların birbirine daha yakın tahminler verdiği gözlenmiştir. Ayrıca, farklı getiri aralıklarının farklı piyasa betası tahmini verdiğine yönelik bulgular bulunmaktadır.

Toplamda 440 farklı piyasa betası tahmin edilmiş olup, piyasa betası özellikle günlük ve haftalık getiri aralıklarında bir den küçüktür. Bu sonuç teorik piyasa betası olan bir değerinden küçüktür. Bu durum, endeks kapsamında olan ancak gözlem sayısı yetersiz olduğu için çalışma kapsamına alınmayan hisselerden kaynaklanabilir. Aksi halde, piyasa etkinliği veya hisse senedi ile ilgili verilerin tutulmasında bir hata söz konusu olabilir.

Betanın durağanlığına ilişkin Pazar modelinin geliştirilmesi ile yapılan analizlerin sonucunda, hisse senedi betalarının zamanla değişen bir yapısı olduğu sonucu bulunmuştur. Ayrıca, betaların aksine alfaların zaman içinde değişmediği bulgusu elde edilmiştir.

Çalışma da son olarak farklı beta tahmin tekniklerinin öngörü performansı karşılaştırılmıştır. Üç getiri aralığı içinde en iyi tahmin dönemi, OMS'ye göre 2012 ve 2014 dönemi olarak görünmektedir. OHK sonucu da haftalık ve aylık getiri için OMS ile aynı dönemi göstermekte iken, günlük getiri için beş yıllık tahmin dönemini işaret etmektedir. Son olarak Vasicek metodu bütün getiri aralıkları için diğer metotlardan daha iyi performans göstermiştir.

Bu tezin bulguları, literatürde yapılmış olan diğer çalışmalarla tutarlıdır. Gelecek çalışmalarda, betalar farklı data setleri ve diğer metotlarla incelenebilir. Borsa İstanbul bünyesinde yer alan diğer hisseleri de kapsayacak ve Bist 30, Bist 50 ve diğer endeksleri de değerlendirmeye dahil edecek çalışmalar yapılabilir. Özellikle piyasa betasına yönelik olarak, bir endeks ve o endeksin içerdiği tüm hisseleri kapsayan çalışmalar yararlı olacaktır. Bu tezin çıktılarından olan betanın durağan olmayan yapısına yönelik dinamik modellerin etkinliği incelenebilir. Son olarak, beta tahminlerinin performansı daha çok sayıda dönemle değerlendirilebilir.

D. TEZ FOTOKOPİSİ İZİN FORMU

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