Earnings per Share Forecasting: Accuracy of Random Walk and Random Walk with Drift Models

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ABSTRACT

The research aims to compare the forecasting power for earning per share (EPS) using two models, namely the random walk model and the random walk with drift model. The study uses historical EPS data of three companies listed in the Standard and Poor's 500. The three companies are selected based on their ascending beta values from defensive, neutral, and aggressive stock categories. The ascending beta values for these three companies, namely NextEra, Oracle, and FedEx, are 0.16, 1.0 and 1.3. The three companies have EPS data for 30 years between 1990 and 2019. For the respective defensive and neutral stocks of NextEra (Beta = 0.16) and Oracle (Beta = 1.0) companies, the results show that the random walk model has better forecasting power measured by both the mean absolute error (MAE) and the mean square error (MSE) forecasting accuracy dispersion measures, but with higher positive bias measure of the average error (AVE). For the aggressive stock of FedEx company (Beta = 1.3), conflicting results are found where the random walk with a drift model performs better in terms of MAE dispersion measure and the random walk model performs better in terms of MSE dispersion measure. In terms of AVE bias measure, the random walk model has a slight positive bias whereas the random walk with a drift model has a high negative bias. Additionally, the forecasting power for EPS gets worse as the beta of stock increases for the case of these three companies.

Keywords: forecasting, earnings per share, beta, accuracy

ÖZ

Bu araştırmanın amacı rastgele yürüyüş modeli ve rastgele yürüyüş sapma modeli olmak üzere iki model kullanarak hisse başına kazanç (HBK) için tahmini gücü karşılaştırmaktır. Bu çalışmada, Standard ve Poor's 500 listesinde yer alan üç şirketin verisi kullanılmıştır. Üç şirket, savunmacı, tarafısız ve agresif hisse senedi kategorilerinden artan beta değerlerine göre seçilmiştir. NextEra, Oracle ve FedEx isimli üç şirket için artan beta değerleri 0.16, 1.0, ve 1.3'tür. Üç şirketin, 1990 ve 2019 yılları arasında 30 yıllık verisi bulunmaktadır. Araştırmanın sonucu, NextEra (Beta= 0.16) ve Oracle (Beta= 1.0) sirketlerinin, ilgili savunma ve tarafsız hisse senetleri için rastgele yürüyüş modelinin hem ortalama mutlak hata (MAE) hem de ortalama kare hata (MSE) tahmin doğruluğu dağılım ölçüleri ile ölçülenlerin daha olumlu tahmin gücüne sahip olduğunu, ancak ortalama hatanın (AVE) daha yüksek bir olumlu önyargı ölçümü olduğu görülmüştür. FedEx (Beta= 1.3) şirketinin agresif hisse senedi için retgele yürüyüş sapma modelinin ortalama mutlak hata açısından daha iyi performans sergilediği ve rastgele yürüyüş modelinin ortalama kare hatası dağılım ölçü açısından daha iyi performans gösterdiği gibi çelişkili sonuçları olduğu saptanmıştır. Ortalama hata önyargı ölçüsü açısından, rastgele yürüyüş modeli hafif olumlu sapmaya sahipken, rastgele yürüyüş sapma modelinin yüksek olumsuz önyargıya sahip olduğu görülmüştür. Ayrıca, bu üç şirketin durumu için hisse senedinin betası arttıkça, HBK için tahmin gücünün daha da kötüleştiği belirlenmiştir.

Anahtar kelimeler: hisse başına kazanç tahmini, beta, kesinlik

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter 1

INTRODUCTION

1.1 Background

One of the most used accounting metrics is the “Earnings per Share (EPS).” It shows a company's existing earnings as well as the amount of earnings that each share is entitled to. The most controversial issue faced while studying the EPS is its forecasting accuracy (Zhang, 2008). To be able to prepare and react to future occurrences, economists and financial analysts make future predictions and forecasts. Forecasting is commonly associated with the valuation and pricing of future earnings and stocks in the accounting and finance fields. Financial analyst forecasts are meant to provide a platform for investors to use in making decisions (Zhang, 2008).

This study focuses mainly on forecasting the accuracy of the Earnings per Share. The targeted companies chosen for this study are from different industries. The companies selected represent the technology sector (Oracle), the oil sector (NextEra) and the delivery/transportation sector (FedEx). These companies were selected based on their beta which represents the systematic risk. Moreover, these firms experience exponential growth pattern. For instance, NextEra is one of the trendy oil company with market value rising to approximately $120 billion in 2019, while the technological company (Oracle) experienced rapid growth within the same time frame as well, for instance, Oracle’s market value improved by more than $160 billion within the year specified

(2019). FedEx's market value grew a lot as well, in 2019, the market value got to $39.48 billion (Thomson Reuters).

The companies were selected depending on their beta values. Beta is a measure of a stock's volatility, namely systematic risk, concerning the overall market. It is critical for any stock market analyst to have the beta available for stocks in their portfolio. According to Malkiel (1999), stock beta is adamant in keeping stock information easy to understand at first glance. What this tries to convey is that the easier it is to categorize stocks, the more efficient and simpler a decision can be made to buy them or not.

It is important to assume that the market index is the most neutral (passive) position for a portfolio that is trying to follow the average market performance. In theory, the beta of the market is equal to 1. A stock that has beta value of less than 1 is less volatile compared to the market as well as stocks with higher beta values. For example, it is expected that pharmaceutical stocks have betas less than 1 relative to betas of oil companies since oil prices are more volatile than ever (Klenton, 2021). In bearish market expectations, portfolios having betas less than 1 (i.e., defensive portfolios) will have lower negative returns relative to portfolios having betas more than 1 or equal to 1. Conversely, a stock that has beta value of greater than 1 is more volatile compared to the market as well as stocks with lower beta values. For example, it is expected that technology stocks and tourism company stocks have betas greater than 1 since they are influenced more by systematic risk factors such as pandemics, economic growth and political uncertainties (Klenton, 2021). In bullish market expectations, portfolios having betas greater than 1 (i.e., aggressive portfolios) will have higher positive returns return relative to portfolios having betas less than or equal to 1.

1.2 Statement of the Problem

In the literature, it has been observed that analysts find it difficult to make an accurate estimation of the future EPS. On this basis, this study seeks to determine how EPS could be forecasted accurately and help the management for efficient and simple decision-making process and help the investors to make correct investment decisions.

1.3 Aim and Objectives of the Study

The aim of this study is to forecast the earnings per share of the selected firms using the two models of EPS forecasting. The thesis will employ two non-seasonal EPS models. The first model represents the lagged EPS. The mentioned model consists of an autoregressive equation, where the estimated earnings per share is forecasted using only its past value. The second model represent the lagged EPS with a drift. This model differs from the first model by adding the drift term. The drift term is computed as the difference between EPS at lag 1 and EPS at lag 2.

It is also examined whether the accuracy of the EPS forecasting is affected by the systematic risk, as measured by their betas.

To this end, the specific objectives of this study would include:

- To determine whether the use of a particular EPS model would yield better forecasting accuracies.
- To check whether the beta value of the company affects the estimation of the future earnings per share.

1.4 Research Hypotheses

On the basis of the research objectives, this study is set to test the following hypothesis:

Hypothesis 1: The lagged EPS model with a drift factor is more accurate than the lagged EPS model when used to forecast earnings per share.

Hypothesis 2: The beta value of the firm affects the forecasting accuracy of these two preceding models of earnings per share.

The remaining of the thesis consists of presenting the past literature review in chapter 2. The methodology and the empirical results will be presented in chapter 3. A conclusion of the study will be presented in chapter 4.

Chapter 2

LITERATURE REVIEW

2.1 Forecasting and Earnings per Share Forecasts

It is widely understood that a lot of variables influence the market movements. When the market conditions are in a normal state; growing or in a downward spiral state, all the political and social and economic factors play key role in disrupting the flow of the market thus, making it harder to predict. Brown & Givoly (1982) found that most mistakes in estimation and forecasting are results of the stock market's rapid growth and development that render a lot of estimation futile.

Bradshaw et al., (2012) illustrated that the market forecasting through the decades change from one era to another. It is widely understood that predicting the market and its core elements such as the market prices and future earnings per share is challenging. This is to say that the position on forecasting and predicting the market's reaction can be hard to actualize or even persistently make estimations; forecasting earnings per share is a must for any organizations and portfolio managers they concluded (Bradshaw et al., 2012).

Sometimes, the environment of the study can make forecasting being hard to manage. Liljeblom (1989) studied the Stockholm stock market and found it is easier to predict in the short term. In essence, a market that has a small footprint in terms of trading

volume, market stakeholders, homogenous in terms of people trading Stockholm traders are mostly from Sweden, thus receiving and reacting for mostly internal news and information in Sweden (Liljeblom, 1989). The other studies such as Malkiel (1999) talk about how hard it is to predict the EPS. The conditions that they were studying are much different since it is on a longer schedule as well as in a more diverse and bigger market such as US stock as well as London stock exchange (Malkiel, 1999).

Forecasting EPS and estimating its value before its announcement or release date is one of the main duties of every investment analyst. Capturing EPS fast and efficiently before another investment analyst is critical in the fiercely competitive stock market and financial markets in general. Fundamentally speaking, earnings per share is the essence that directs market movement. According to Jadhav et al. (2017), EPS forecasting is one of the major problems in the financial industry. They argued that the essence is to capture EPS and consistently applying the appropriate tool with a follow up would dynamically shift the market. The solution they applied in their work used large data analysis (Jadhav et al., 2017). They applied data analysis utilizing historical data of the stock market and focused on three main analytical tools. The first one is Statistical Regression Model using Linear Regression (LR) the Neural network (NN) regression using Multilayer Perceptron (MLP) and the third Neural network regression using Radial Basis Function (RBF) (Jadhav et al., 2017).

2.2 Managers and Release of Market Information

Trueman (1986) found that managers usually are more in control of the kind of information that should be distributed. Managers should be indifferent on what kind of information they should share with the public. While this assumption is true in most cases, sometimes the type of information plays a key role in determining firms' stock

performance overall (Trueman, 1986). He therefore concluded that for managers, it is important to publish early earnings forecast for the next period. This in essence push investors to open their eyes towards the firm more and consider it as a potential destiny of their next investment, thus maximizing firm value at the same time (Trueman, 1986).

Jennings (1987) and Mercer (2002) deduced in their studies that managers apply information movement and control in two major approaches. First, the managers can give estimates with unquestionable forward-looking statements such as sales estimates to assist to legitimize and clarify their positive thinking regarding profit. The more line-item directors' figure, the more effortlessly pariahs can assess the plausibility of firms' assembly managers' profit estimates. People who are interested regularly tend to use detailed explanatory models to figure out the profit estimation. In the case where managers figure the earnings components at the side bottom-line profit, this data – in conjunction with the analysts' knowledge of the commerce, current industry patterns, financial conditions, and so forth – will help portfolio managers to assess the credibility of the profit figure and expand its credibility (Jennings, 1987; Mercer, 2002). Second, managers may apply supplementary articulations to commit themselves to a specific way of reaching and attaining profit targets. Kasznik (1999) concluded that managers sometimes oversee profit upward to meet already made administrative figures of good profit news.

However, these approaches are likely to increase the investors' skepticism for great news earnings figures and decreases the estimate validity. Particular figures are important components of earnings such as estimates of deals, net edges, successful assets rates (Kasznik, 1999). It commits directors to assemble the profit estimate in a specific

way and this decreases the chances on how they might oversee profit to attain the estimate. This will ultimately increase the investor's examination and conceivably raise questions almost the managers' capacity to oversee the firm (Trueman, 1986).

In case the directors do not meet their estimated figures; an additional point attached to the structure is going to decrease their capacity to pardon this execution after fact finding (Trueman, 1986). For example, without a particular earnings estimate, directors might clarify some missed earnings figures as being due to delicate industry demand. Also, at the point of expansion, by providing specific, irrefutable data around the business in conjunction with the figure, directors can increase investors' certainty within the managers' capacities to oversee (Trueman, 1986).

Managers and people with authority have less of an incentive to spread out bad news, a claim reinforced by Kasznik (1999). Kasznik found that supervisors do not boast about the trajectory of profits if it was going down. Multiple studies showed that administrative estimates of bad earnings news are less likely to be quantitative (Kasznik, 1999). They are made over a shorter timeline and have larger impacts on securities costs than great news figures (Skinner, 1994). This is often reliable with these figures being made to preempt negative stock price reactions to bad profit news, probably for a lawful obligation or administrative reputation reasons (Skinner, 1994).

Shebeita (1993) conducted a study on profit (earnings) estimation and profit (earnings) per share and posited that the relative volume and size of assets of companies plays a key role in estimating the profit per share amount. The methodology applied by Shebeita (1993) was budgetary articulation investigation. The focus was on three aspects;

namely, the relative altering within the long-term obligation to shareholders, the relative altering within the extent of the obligation based on the rate of ownership, and the short-term obligation rate. By focusing on these three aspects, Shebeita (1993) was able to determine the noteworthy impact of the relative size of a firm as well as the movement of assets internally on the short term and long-term profit per share forecasting.

2.3 Theoretical Framework

2.3.1 The Random Walk Theory

For many years, economists and financial analysts were interested in studying the behavior of the stock market price. The most preferable theory picked among all the others is the random walk theory. According to Kiril (n.d), the random walk theory, also known as the random walk hypothesis, is a statistical model for studying the behavior of the stock market price. Its proponents assume that the share prices in the stock market follow a random walk, which can be described as a stock movement that does not adhere to a recognized or measured trend. Malkiel (1999) posits that the random walk cannot predict the future directions taking into consideration the past values (Malkiel, 1999). In the context of the stock market, random walk is further described by Malkiel (1999) that stock prices on a short-term basis cannot be predicted. Serin (2017), while utilizing a time series analysis that focuses on the S&P 500, found that it is difficult to spot clear patterns in the movement of stock values. He also deduced that it is hard to reject the basis of Random Walk hypothesis to identify any market movement in the short term.

In Borges (2007)'s study, the weak-form market efficiency is tested in the Lisbon market (Portugal) using the random walk hypothesis. The findings indicate that the bigger

the market, the harder it gets to be predictable. The tests were conducted between 1993 and 2006 and were split between daily, weekly, and monthly, all of which indicate that since 2000, the market behavior of stock prices has been showing a random walk.

2.3.2 Technical Analysis and the Fundamental Analysis

It is essential to elucidate the two most popular approaches used to make estimations concerning the future market behavior; namely, the technical analysis approach and the fundamental analysis method (Fama, 1995). The technical analysts believe that the past values are the best predictors of the future values of the stock prices. The fundamental approach contradicts with the technical approach. Fundamental analysis examines the company's business prospects to forecast the intrinsic price.

It is widely accepted among market practitioners from brokers and investors to market insiders and portfolio managers that the stock market is unpredictable. While this is true in many regards, many rely on empirical tools and financial intuitions to bypass the problem of market unpredictability.

According to Malkiel (1999), academic and university professor, the stock market is a group of monkeys that build their stock portfolios by throwing darts at a newspaper. Many scholars did not fully accept this concept and position as they try to stand on a middle ground of understanding between full market chaos and fully accessible market. The reality of the stock markets around the globe shows that it is most likely to be in the middle of that (Malkiel, 1999).

According to the weak form market efficiency, current stock prices incorporate all previous information. The weak form market efficiency posits that technical analysis has no significance in predicting future stock values. (Dupernex, 2007).

2.3.3 Random Walk and Earnings per Share

It is accepted among financial experts and analysts that the more elements and variables that constitute or influence an element the harder is to predict and this is true for EPS (Earnings per share). Harvey (2012) maintains that today's price plus a drift term is the best predictor of tomorrow's price. The drift can be thought of as a way of determining a price trend. Given that the drift is commonly believed to be constant. The random walk behavior is also tested on earnings per share figures. In the following section, a brief literature review is carried out focusing on the behavior of earnings per share and its importance in determining the stock price.

2.4 Review of Empirical Studies

In the literature, the link between EPS and stock valuation and other elements such as dividend payout policies and others are interconnected and positively related. According to Hunjra et al., (2014), the market value and the earnings per share influence each other positively. They found out that earning per share in the Pakistani market is positively related to the stock prices as well as dividend payouts. The main finding of this paper is that the dividend irrelevance theory does not apply for the sample that they have tested, which means the stock price is strongly influenced by dividend payouts, meaning investors are taking into account dividend payout as well EPS when buying stocks. In another study done by Xiang-li and Shao-Rong (2010), in the Chinese market, they illustrated a significant relationship between stock prices and the adjusting of the EPS of the listed companies. They found that adjusting EPS rather is important in attracting investors to buy share in those companies.

Hussainey et al., (2011) conducted a study on the UK stocks. Their main findings resulted a positive relationship between dividend yield and stock price changes. However, they also found that there is a negative relation between the dividend payout ratio and the stock prices. The same authors also realized from their papers that the firm's GDP, leverage ratio, the company size, and its earnings are efficient factors that can interpret the changes and the volatility in the stock price. The mentioned elements are the major factors in determining listed firms' values on the UK stock exchange.

Liu et al. (2014) investigated how earning per share affects share price and firm value in Bangladesh. They found that many factors affect share prices and firm value in the stock market and investors' sentiment toward the market is affected by many elements outside the market, such as media pressure, general political situation, worldwide economic advancement, the movement of other stock exchange, and many externalities, not just EPS and internal elements. Liu et al., (2014) also added that EPS alone should not be the sole element to take into account when buying a stock. PE ratio, as well as dividend payout policies, should be considered as well.

In a study of shares on the Sydney Stock Exchange, Praetz (1969) came to the conclusion that the random walk hypothesis was not applicable in general. A random sample of 10 shares with daily prices was used in this investigation, and repeated testing revealed a significant amount of reliance.

Several investors tend to measure the future earnings per share using the historical value of the EPS. Al-Swiety & Musa (2017) studied the accuracy of forecasting the earnings per share using random walk and random walk with drift. Their research focused on the Jordanian banks. The results indicated that the second model was more

precise in estimating the future earnings per shares. The paper also indicated that the external factors related to the general economy of the country play a pivotal role in affecting the future EPS.

In a paper conducted by little (1962), he made the first systematic proof showing that the earnings rate growth is independent across time. His study was limited at a limited group of British Businesses. Another study done by Rayner and Little (1966) proves the results found by little (1962) even when it is conducted in a bigger sample size for British companies.

The random walk theory does not indicate that the earnings are forecasted randomly and without any significant meaning. However, the right indication of this theory is that forecasting future earnings does not take into consideration the previous earnings values. This finding is also approved by Albrecht, Lookabil, and Mckeown (1977) and by Watts and Leftwich (1977).

The fact that the earnings are not affected by previous earnings figures provides crucial inferences concerning the analysis of the financial statement. According to the random walk theory, the most important factor of forecasting is the recent figures. In addition, the random walk theory can be used as a statistical method for evaluating the precision of the analysts' ways of earnings estimation.

Brooks and Buckmaster (1976) explain the component of the temporary earnings by getting detail on extreme earning per share. This extreme earning may change positively or negatively. This mean that there is temporary effect on earnings.

Foster (1997) examine the time series of quarterly earnings. There is so much difference from the annual earnings for the same company in the same year due to the within-year production and sales seasonal that happen in many businesses. This method has three properties: (1) to obtain the earning variables, it is the difference between earnings in the same quarter of the adjacent year. (2) It allows to have regular or predictable earnings in quarterly earnings. (3) It grants positive correlation between contiguous quarters. The final estate means that the seasonally adjusted quarterly earning didn't follow a random walk model and there in no correlation between its years.

Chapter 3

EMPIRICAL ANALYSIS

3.1 Data and Sample

The sample includes three companies; namely, Oracle, NextEra and FedEx having data from 1990 to 2019. The data was retrieved from Thomson Reuters DataStream, enclosing 30 annual observations each. The companies were chosen depending on their beta level in order to study the relationship between the level of systematic risk and the forecasting accuracy.

Oracle is a computer technology company with an $11.083 billion net income in 2019. Oracle Company has a beta value close to one. NextEra is an energy company with a net income in 2019 of $ 3.77 billion. The NextEra Company has a beta value of 0.16. FedEx is in the business of delivery services having a net income of $0.54 billion in 2019. The three companies are S&P 500 index stocks. According to Davis (2021), the S&P 500 is a stock market that gauges the performance of stock market in the US. It encloses the biggest 500 American companies and is calculated by taking into consideration the market capitalization of each company.

The factors that affect the earning per share are as follows: the administrative factors (company specific or nonsystematic factors) and the external factors (systematic factors). The administrative factors which are under the jurisdiction of the management

include the management productivity, and competitiveness of the company and employees, its market share and so on. The external factors which cannot be controlled by the company management include several factors such as the inflation which is the increase in the price level over a period, the interest rate which influences the earnings per share and so on. Consequently, in order to control for the systematic risk, the sample companies are chosen depending on their beta level which is a measure of systematic risk. According to Klenton (2021), the measurement of the systematic risk is considered by using the beta value. It gauges the uncertainty of the stock in the market. When beta is equal to 1 which is the overall market beta, the stock price changes follow the average market performance. When a stock's beta is less than one, it suggests that it is less volatile than the market. NextEra stock exchange has a beta equal to 0.16. A beta of more than one suggests that a stock's price change is more volatile than the average market change. FedEx has a beta equal to 1.3 which means that it might be 30% more volatile than the average market.

3.2 Models

Seasonality is the occurrence of fluctuation that happen at a specific time interval in less than a year. Several factors affect the presence of seasonality such as holidays, vacations, agriculture. On the other hand, the non-seasonality takes place due to economic conditions and its consequences are beyond a year. It is related to the business cycle, the recession or expansion that takes place in the economy (Brooks, 2012).

This study uses the non-seasonal annual earnings per shares. In terms of measuring forecasting accuracy, two models are used; namely the random walk model and the lagged earnings per share model and the random walk model with a drift model.

3.3 The Random Walk Model

According to Yong, Evans, Niorege (2012), to apply a random walk model, it is necessarily to use the current EPS but it is unpredictable. Using this method is useful in our model since the selection bias of our estimation are simple and minimize. However, it avoids growth which discourage forecasts for growth firms. Economics use random walk model as a benchmark for the better performance of the proposed forecast model.

Model 1: $E(EPS) = EPS_{t-1}$ (1)

3.4 The Random Walk Model with Drift

Another method of forecasting is the random walk with drift. According to Ball and Watts (1972), the yearly corporate's income depends highly on submartingale process. The martingale process is a stochastic procedure that aim to present that the expected Y_{T+1}, taking into consideration all the previous values of Y, is equal to its current value. The submartingale method is the best estimate of the future annual earnings especially for samples including American firms (Ball and Watts, 1972).

A sub martingale model is expressed as follows:

$X_t = \phi X_{t-1} + \delta + \varepsilon_t$, Where $\phi = 1$ and $\delta > 0$ (2)

Note that when $\phi = 1$, $\delta = 0$ with the error term are identically independently distributed, the martingale model is said to follow a random walk model.

The following model is forecasted solely based on its lagged value and a drift term:

Model 2: $E(EPS) = EPS_{t-1} + \gamma$, (3)

Where:

EPS = the number of Earnings per Share

E (EPS) = the number of the expected Earnings per Share

γ is the drift term ($EPS_{t-1} - EPS_{t-2}$)

The drift is measured using yearly data. In this paper, the drift is calculated as the difference between EPS_{t-1} and EPS_{t-2}. When δ is positive, this indicates that the EPS_t is going to increase on average.

3.4.1 Forecasting Accuracy Measures

The forecasting accuracy of the results is the difference between the actual and the predicted value. When the forecasted error is relatively small, the used model will be more accurate. The estimation of each of the model will lead to a presence of error. The first group of indicators examines the forecast dispersion, while the second examines the forecast bias.

3.4.2 Dispersion Measures

The mean absolute error (MAE) and the mean square error (MSE) are two widely used measures of forecast error dispersion. On one hand, the MAE gauges the absolute differences between the predicted value and the actual value among the observations. It aims to measure the error magnitude of the model. On the other hand, the MSE computes the squared average of the difference between the actual and the forecasted values. The mean squared error, as the name indicates, is a squared measurement. This provides more prominence to large error estimations. All forecast errors are given equal weight using the first metric (MAE). However, according to the second measurement, the mean squared error, the forecast errors are given the most weight in the second metric.

When it comes to forecasting, accuracy generally refers to the dispersion of forecast error; the lower the dispersion, the more accurate the forecast is said to be (Foster, 1986). Both equations are presented as follows:

$$MABE_i = \frac{1}{N}\sum_{t=1}^{N} \mid X_{i,t} - E\left(X_{i,t}\right) \mid \quad (4)$$

$$MSE_i = \frac{1}{N}\sum_{t=1}^{N}[X_{i,t} - E(X_{i,t)}]^2 \quad (5)$$

Where X_{it} = the realization of the forecast variable in period for company i

E (X_{it}) = the realization of the forecast variable in period t for company i

N = the number of forecasts examined

3.4.3 Bias measures

According to Foster (1986), if the predicted value of the forecast error is zero, the forecast is said to be unbiased. In this equation, forecast errors of different signs are required to cancel each other out. The model is more concerned with the average error for all forecasts than with each individual forecast error. The average error (AVE) is calculated as:

$$AVE_i = \frac{1}{N}\sum_{t=1}^{N}(X_{i,t} - E\left(X_{i,t}\right)) \quad (6)$$

X_{it} = the realization of the forecast variable in period for company i

E (X_{it}) = the realization of the forecast variable in period t for company i

N = the number of forecasts examined

The importance of this equation is the sign of the forecasted error. When the difference between the actual and the forecasted value is negative, this indicates that the expected X_t is said to be over forecasted. If the result is positive, the actual value is higher than the forecasted value, it designates that the forecasted value is underestimated.

According to researchers, the major advantage of the forecasting error methods is that they are simple and any researcher is able to gauge these estimations. However, these

error metrics encounter some disadvantages as well. They can lead to imprecise evaluation of the results. In addition, it is impossible to choose the best appropriate metrics among them (Foster, 1986).

3.5 Empirical Results

The study focuses on forecasting the earnings per share for 3 different companies using financial statements. The annual data is from 1991 to 2018 inclosing a total of 29 observations for each company. The data are extracted from Thomson Reuters DataStream. The following section examines the empirical results.

3.5.1 Descriptive Statistics

The descriptive statistics is used as the fundamental elements of data, such as summary statistics for scale variables and data measures. The descriptive statistics can be as assessment in managing and presenting data in a summary table. The tables below present the descriptive statics of each company.

Table 3.1: Descriptive statistics for Oracle

Oracle (Beta=1)	Model 1: $E(EPS)_t=EPS_{t-1}$		Model 2: $E(EPS)_t=EPS_{t-1}+\gamma$	
	EPS(t)	EPS(t-1)	EPS(t)	EPS(t-1)
Mean	0.994321	0.885250	1.030926	1.003963
Median	0.620000	0.560000	0.680000	0.660000
Maximum	3.063000	2.421000	3.063000	2.598000
Minimum	0.005000	0.005000	0.005000	-0.270000
Std. Dev.	0.932598	0.857241	0.929640	0.960817

Skewness	0.648574	0.638669	0.607091	0.442208
Kurtosis	2.086873	1.917722	2.039744	1.694357
Jarque-Bera	2.935792	3.270073	2.685868	2.797757
Probability	0.230410	0.194945	0.259776	0.246874

The descriptive statistics are a set of brief descriptive coefficients that summarizes a given dataset. According to the above table, the yearly averages are all positive for both models which shows that the earnings per share tend to increase over time. The standard deviation measures the scattering of the values from the mean. The results of the tables show that the value of the standard deviation from both models are so close to each other. The standard deviation of EPS (t) is 0.93 for model 1 and is 0.929 for model 2. The skewness is a symmetrical measurement of the data. The EPS values for the first model 0.6 which is relatively higher that 0 which indicates that the model 1 values are positively skewed. The skewness values for the second model are also higher than 0. The kurtosis test measures the variability of the data. For both models, the kurtosis values are positive which indicates that the distribution is heavy tailed. The Jarque-Bera is a test of normality. Its results should not be significant in order to prove that the residuals are normally distributed. This means that the probability value should be higher than 0.05 to not reject the null of normality at the 5% level. The descriptive statistic shows that the probability value of Jarque-Bera for Oracle's EPS is equal to 0.23041 which is higher than 0.05 for the first model so it is statistically insignificant mean that it is normally distributed and the same finding also holds for Model 2.

Table 3.2: Descriptive statistic for FedEx

FedEx (Beta=1.3)	Model 1: $E(EPS)_t=EPS_{t-1}$		Model 2 $E(EPS)_t=EPS_{t-1}+\gamma$	
	EPS(t)	EPS(t-1)	EPS(t)	EPS(t-1)
Mean	3.7870	3.3919	3.9327	3.8757
Median	2.9000	2.4800	3.3000	2.4550
Maximum	11.6680	10.880	11.6680	14.952
Minimum	-0.8300	-0.8300	-0.8300	-4.9600
Std. Dev.	3.1557	2.8055	3.1183	4.2082
Skewness	0.7798	0.6518	0.7755	0.5329
Kurtosis	3.1718	2.9992	3.1966	3.3798
Jarque-Bera	2.8721	1.9830	2.7501	1.4402
Probability	0.2378	0.3710	0.2528	0.4866

According to the FedEx table, the yearly EPS averages are all positive for model 1 and model 2 which shows that the earnings per share tend to increase over time. The value of the standard deviation from both models are relatively high. The standard deviation of EPS (t) for model 1 and model 2 are 3.1557 and 3.118 respectively. The standard deviation results show that the EPS values are highly dispersed from the mean. Both skewness and kurtosis tests for the two models are positive. This indicates that the distribution is positively skewed and heavy tailed. The descriptive statistic shows that the probability value of Jarque-Bera for the FedEx EPS is equal to 0.2378 which is higher than 0.05 for the first model so it is statistically insignificant which means that it is normally distributed and the same finding also holds for model 2.

Table 3.3: Descriptive statistic for FedEx

NextEra (Beta=0.16)	Model 1: $E(EPS)_t=EPS_{t-1}$		Model 2: $E(EPS)_t=EPS_{t-1}+\gamma$	
	EPS(t)	EPS(t-1)	EPS(t)	EPS(t-1)
Mean	3.533536	3.018107	3.621630	3.510259
Median	2.482500	2.382500	2.510000	3.015000
Maximum	13.00200	7.410000	13.00200	8.568000
Minimum	1.150000	-1.430000	1.150000	0.975000
Std. Dev.	2.533757	1.932991	2.537951	1.949431
Skewness	2.019163	0.310762	2.013982	0.868352
Kurtosis	7.971545	2.980797	7.911589	2.940174
Jarque-Bera	47.86173	0.451105	45.39173	3.397188

According to the descriptive statistics of the NextEra Company, the yearly EPS averages are all positive for model 1 and model 2 which shows that the earnings per share tend to increase over time. The value of the standard deviation from both models are so relatively high. The standard deviation of EPS (t) for model 1 and model 2 are 2.533 and 2.537 respectively. The standard deviation results show that the EPS data points are highly dispersed over a large range value. Both skewness and kurtosis tests for the two models are positive. This indicates that the distribution is positively skewed and heavy tailed. The descriptive statistic shows that the probability values of Jarque-Bera for the NextEra Earnings per share at time (t) for both models are equal to 0.00 which is lower than 0.05. This means that the distribution does not have a normal distribution and the histogram is not belly shaped.

In conclusion, after checking each company's descriptive statistics, we can see that FedEx Company has the highest mean value in both models. This indicates that the company that has the higher beta and is considered more volatile tends to have higher return in time. Oracle Company has the lowest mean value. FedEx Company also has the higher estimated standard deviation in both models among the 3 companies. This proves that although the company has a higher average return, however, it has a relatively high systematic since its beta value is greater than 1. Oracle Company, which presents a beta value similar to the market, has the lowest mean and standard deviation values.

3.5.2 Results for Forecasting Accuracy Measures

This section examines the results of the accuracy of the forecasting. The following tables will present the forecasting results for each company and for both models. In Table 3.4, the first model consists of making an estimation of the expected earnings per share by using its lag value. In Table 3.5, the second model involves the estimation of the expected earnings per share by using its lag value plus the drift term.

Table 3.4: Forecasting accuracy measures using the first estimation model

Model 1: $E(EPS)_t = EPS_{t-1}$				
Company name/Forecast accuracy	NextEra (Beta=0.16)	Oracle (Beta=1)	FedEx (Beta=1.3)	Average
MAE	0.2007	0.1758	2.1234	0.8333
MSE	0.1663	0.0742	12.1822	4.1409
AVE	0.5154	0.0986	0.0324	0.2155

Table 3.5: Forecasting accuracy measures using the second estimation model

Model 2: $E(EPS)_t = EPS_{t-1} + \gamma$				
Company name/Forecast accuracy	NextEra (Beta=0.16)	Oracle (Beta=1)	FedEx (Beta=1.3)	Average
MAE	0.2811	0.2212	1.6153	0.7059
MSE	0.2737	0.1492	20.6969	7.0399
AVE	-0.0482	0.02286	-0.4577	-0.1610

According to the tables above and evaluating the results for each company, we can see that the first model for NextEra also outperforms the model two using the MAE and MSE error forecasting measurements (i.e., lower forecasting errors for the first model). However, the AVE measures for NextEra indicates a higher estimation bias in the model 1 relative to the model 2 in the second model than the model 1 (0.5154 vs. -0.0482). For Oracle, the MAE and MSE forecasting accuracy measures show that the first model is better that the second one with lower dispersion values. For this reason, the first model performs better for Oracle earnings per share, but with a higher positive bias of AVE.

However, the FedEx results show conflicting results that according to the MAE, the model 2 performs better than the model 1 and according to MSE measure, the model 1 outperforms the model 2. In terms of bias, the model 1 has a low positive bias than the model 2 having a relatively high negative bias.

According to Ball and Watts (1972), the mean absolute error (MAE) measurement is the best forecasting accuracy test among all others, so it is better to use the mean absolute error to compare the two models. In short, model 1 performs better in 2 out of the 3 stocks. The model 1 performs better for the earning per shares of Oracle and NextEra companies whereas the model 2 performs better for FedEx.

According the tables above, the average results are calculated as the average of each measurement (MAE, MSE and AVE) for the three companies. The MAE and AVE average results indicate that the model 2 performs better than the model 1. However, the MSE average result shows that model 1 is better than the model 2. This evaluation should be cautiously evaluated since the sample size is very small and the average results are greatly affected by the values. In addition, precautions should be taking into consideration since some of the figures are highly affected by outliers. It can be concluded that for the NextEra and Oracle, the model 1 performs better than the model and vice versa for FedEx.

3.5.3 Forecasting Accuracy and Beta Values

A high beta supposed to be riskier but provide the potential for a higher return, and a low beta supposed to have a low risk also it reflects a lower return. As we know by definition of beta, it is a measure of a stock volatility and has 3 types (lower than one, equal to one, greater than one). Volatility represents how large an assets prices swing around the mean price so it is a statistical measure of its dispersion of return. A higher beta means a higher volatility, that lead to a riskier security. For example, if stock X has a beta of 1.5, so we would expect stock X to move on average of 50% more than the market. A volatile market conditions have led to individual and institutional investors shifting away from higher beta to lower beta to reduce the sensitivity to the market movement. After showing the beta values, we can say that market conditions can lead

the investor to better beta decision, so the investor or the institutor must take a higher or a lower beta based on the real market or we can say “adapting to the ocean conditions.

The results in Table 3.4 and 3.5 show that for the defensive stock (Beta <1) of NextEra company and the neutral stock (Beta =1) of Oracle company, Model 1 performs better in terms of dispersion measures of MAE and MSE having relatively higher biases. For the aggressive stock (B >1) of FedEx, the model 2 performs better the model 1 in terms of MAE which is regarded as the best measure. In terms of forecasting accuracy, the results show that as the beta gets higher, the worse the forecasting accuracy (i.e., higher values for MAE, MSE and AVE).

3.5.4 Correlation Results

This section presents the correlation results between EPS (t) and EPS (t-1) for each company. The correlation coefficient is a numerical representation of the correlation test which investigates the relationship between two variables. Its range is -1.0 to 1.0. A perfect positive correlation means that its coefficient takes a value of 1, implying that any change in x will have the same effect on y with the same magnitude and direction vice versa for a correlation coefficient of -1. A zero correlation denotes that the two variables are unrelated. (Frost, n.d.).

The original formula to calculate the correlation coefficient is:

$$R_j = \frac{\frac{1}{T-j}\Sigma_{t=1}^{T-j}(X_t-\bar{X})(X_{t+j}-\overline{X})}{\gamma^2} \quad (7)$$

Where $\bar{X}$the mean of the series, γ2 is symbolizes the variance, T is the number of observations.

Table 3.6: The correlation coefficient for Oracle

Oracle (Beta=1)	**Model 1: $E(EPS)_t=EPS_{t-1}$**		**Model 2: $E(EPS)_t=EPS_{t-1}+\gamma$**	
Correlation	EPS	EPS(t-1)	EPS	EPS(t-1)
EPS	1	0.953148	1	0.9604
EPS(t-1)	0.95314	1	0.9604	1

The computed correlation coefficients for Oracle Company shows that there is positive correlation between EPS_t and EPS_{t-1} in both models. The correlation coefficient between them using the first model is 0.9531 and 0.9604 for the second model. The correlation coefficients are very close to each other. Both values show a strong positive relationship which indicates that the lag value of EPS is a good estimate for the earnings per share at time t for the Oracle Company.

Table 3.7: The correlation coefficient for FedEx

FedEx (Beta=1.3)	**Model 1: $E(EPS)_t=EPS_{t-1}$**		**Model 2:$E(EPS)_t=EPS_{t-1}+\gamma$**	
Correlation	EPS	EPS(t-1)	EPS	EPS(t-1)
EPS	1	0.79127	1	0.715258
EPS(t-1)	0.79127	1	0.715258	1

This table examines the correlation coefficient between the EPS_t and EPS_{t-1} for FedEx Company. As we can see here, the correlation between EPS (t) and EPS (t-1) in the first model is equal to 0.79127 and for the model 2, the correlation between EPS (t)

and EPS (t-1) is equal to 0.7152. The results show that there is a fairly strong positive relationship between EPS_t and EPS_{t-1}. In conclusion, using the first model, there is a higher correlation coefficient than model 2 so model 1 is better in this case.

Table 3.8: The correlation coefficient for NextEra

NextEra (Beta=0.16)	**Model 1: $E(EPS)_t=EPS_{t-1}$**		**Model 2: $E(EPS)_t=EPS_{t-1}+\gamma$**	
Correlation	EPS	EPS(t-1)	EPS	EPS(t-1)
EPS	1	0.8999	1	0.8994
EPS(t-1)	0.8999	1	0.8994	1

Table 3.8 presents the correlation coefficient results of the NextEra Company. The outcomes of the correlation between EPS(t) and EPS(t-1) for the first model is equal to 0.899 that means that the EPS at time t is highly correlated with its lag value. Similar result is for the second model.

In the final analysis of the correlation results for the three companies, we can see that Oracle has the strongest correlation between EPS_t and EPS_{t-1} in both models. It has a beta value equal to the market beta and can be used as a type hedge for future investment. FedEx company's correlation results has the lower values and this company has a beta value higher than 1 which makes it a risky company. Its forecasted EPS tends to be more volatile due to having higher systematic risk. NextEra also had a strong correlation between EPS and EPS_{t-1} in both models. It has a beta lower than the market which means that this company has lower risk with lower return.

3.6 Graphical Analysis: EPS and First Difference EPS

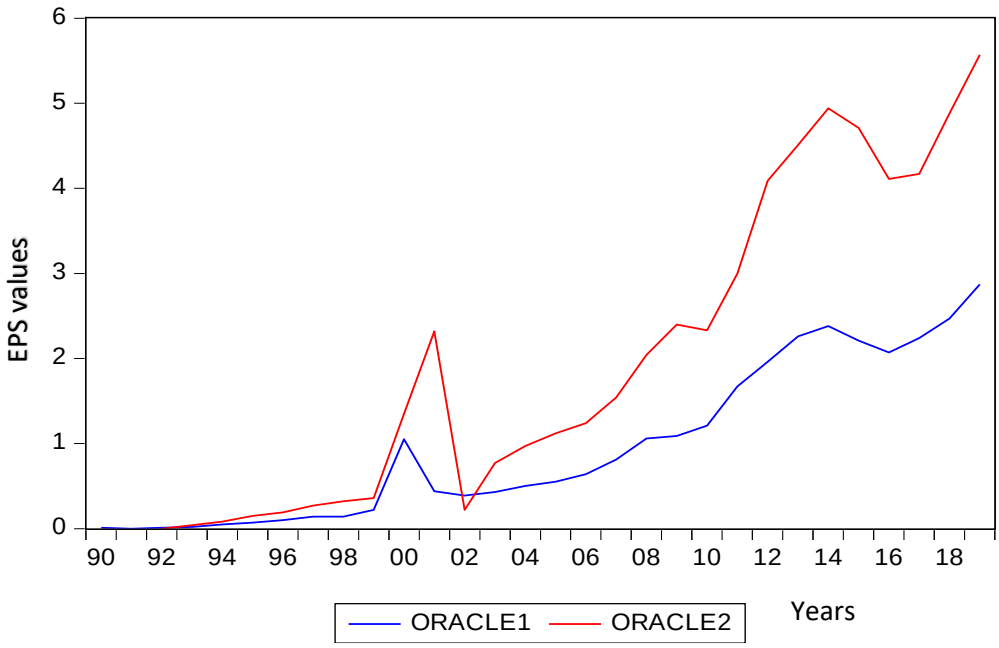

Figure 3.1: Oracle EPS and Oracle First difference

Both graphs shed the light on the relation between the level EPS and the first difference EPS for Oracle. The first difference graph models the changes between two consecutives periods in the time series. The first difference EPS is the difference between EPS_t and EPS_{t-1}.

The earnings per share were stable between 1990 and 1998. It was followed by a slight increase from year 1990 to 2000, then it decreases in year 2001. Afterwards, the EPS graph of Oracle Company shows consistent positive earnings from year 2002 to 2018. It is obvious from the graph that there was special situation happening during year 2000 and 2001. The reason behind it is the dot-com bubble that had happened in United States and affected the earnings per share of the Oracle Company. 2007 crisis affect Oracle Company positively. According to Dugan (2020), the dot-com bubble is a stock

bubble which was caused by the highly speculative internet investment in the late 1990s. Oracle lost more than 80% of its stock value. Followed by the election of a new co-president for the Oracle Company, earnings jumped by 48% in late 2010.

After 2007, the Oracle earnings are significantly increasing. It is not affected by the financial crisis happened in that year. The company tried to grow its revenue to almost $18 billion by 2007. By focusing on growing its software services key industries it went into a recession. Lots of companies left to struggle for survive due to the decreasing in the demand and increasing borrowing costs. However, Oracle used the recession to its advantage, by issuing insurance software maker Skywire Software LLC in 2008 for only $150M which helped manage insurance policies for $100M. The positive upward trend that appeared in the Oracle's earnings was more presented by the forecasting accuracy table.

The two models used in this paper are both autoregressive models of order 1. The first one is with no drift and the second is with drift. This implicates that the first difference graph will reveal the movement of the error term, since the first difference is the change between EPS_t and its lag value. According to prior researcher, it is proven that the earnings per share follow a random walk model (Ball and Watts, 1972; Foster, 1973; Beaver, Kettler, and Scholes, 1970; Albrecht, Lookabill, and McKeown, 1977; Brealey, 1969; Sneed, 1996).

The first difference graph shows that the error term was constant at the beginning. Due to the bubble case that took place in years 2000 and 2001, the error movement showed a structural break. Afterwards, the error term movement exhibited a mean reversion toward 0. Since the first difference provides more explanation about the error term

movement throughout the year, according to the forecasting accuracy table it was shown that the first model is a better forecasting measurement.

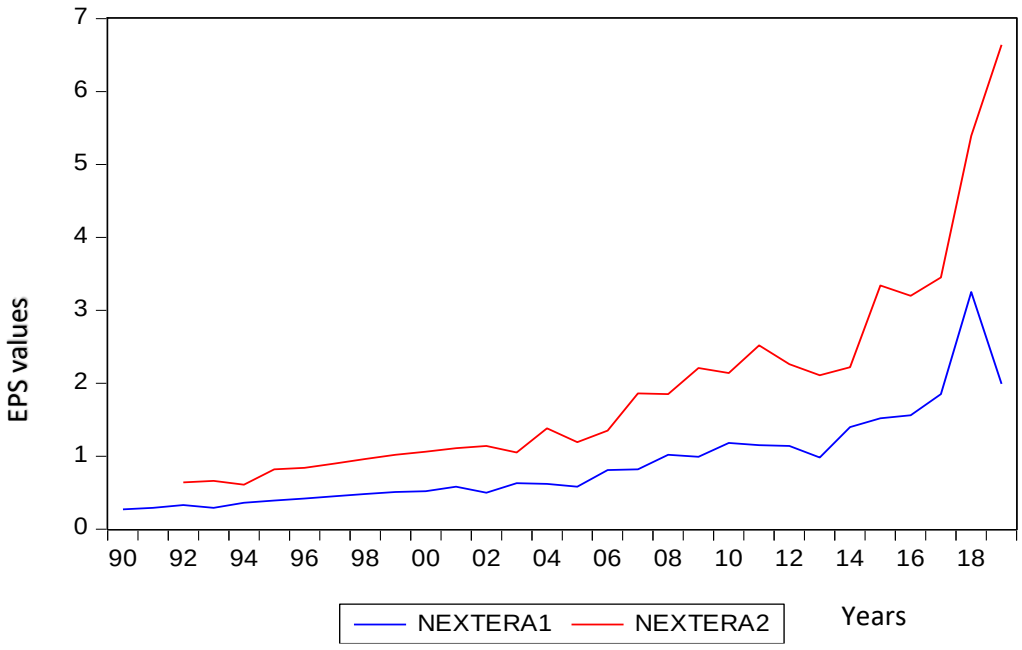

Figure 3.2: NextEra EPS and NextEra First difference EPS

The NextEra earnings per share graph seems to be consistently positive. The earnings are slightly increasing over the years especially after 2006. In addition, the graph shows that there is upward trend from 2017 and 2018. This surge increase in earnings is related to the decrease of the US deferred tax liabilities. So, if the income tax liability is lower than the income tax expenses it will lead to an increasing in the earnings. As it is presented in the correlation table, the correlation coefficient was strongly positive. This explains the movement of the Next9Era earnings.

By 2007, NextEra Energy stock are positively increasing. NextEra stock declined from a level $43 in October 2007 to 33$ in March 2009. Through the crisis, NextEra stock

use its lows to recover rising it by 19% between March 2009 and January 2010. The positive upward trend is more presented by the forecasting accuracy table.

The first difference graph shows that the changes between the two recent consecutive periods of earnings are floating around 0. This indicates that earnings are stabilized after proceeding with the first difference. This result was also explained and shown in the forecasting accuracy table, where the results presented that the best forecasting estimate was provided by the first model. The best estimation of the future earnings is its lag value.

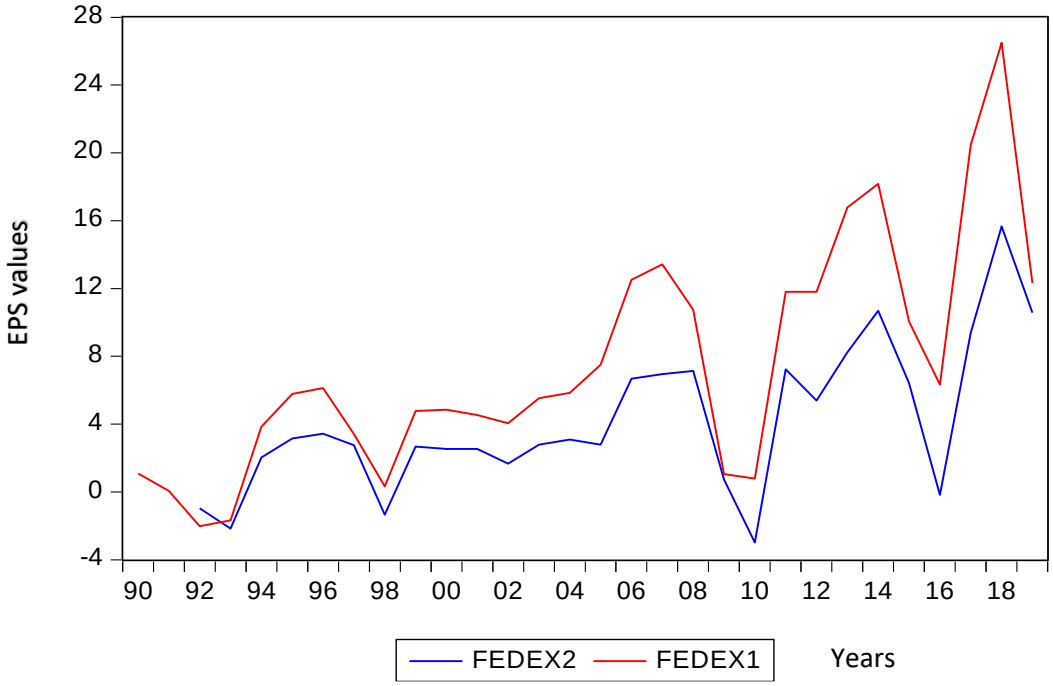

Figure 3.3: FedEx EPS and FedEx First Difference EPS

Looking at the EPS graph of FedEx Company, we can see that there is a clear upward trend. Starting year 1992 there was an upward trend for the earnings until it reached year 2007. After 2007, and due to the financial crisis that hit the United States, the FedEx earnings decreased a lot. The company tried as much as it can to rebound this

loss. That is why, after reaching its maximum loss in 2009, the earnings per share for FedEx started to increase more till 2013. In 2013, and due to changes in the shipment characteristics and the decreasing in fuel charges, the earnings decreased from $8.55 billion to $3.65 billion in year 2015. Afterwards, the earnings soared again especially after the FedEx's decision to make an acquisition of TNT Express. The positive upward trend that appeared in the FedEx's earnings was more presented by the forecasting accuracy table. The results showed that the second model is the best accurate estimate. In addition, according to the graph, it is examined that the FedEx's earnings per share follow a random walk with drift. The first difference of the FedEx's earnings per share is plotted against the time. The first difference graph does not account any trend. The positive upward trend in the earnings was eliminated after performing the first difference. However, we can see that the changes between the two consecutive years presents a major volatility in the latter years. The most convenient explanation of this issues is that the FedEx Corporation faced lower revenues due to the higher purchasing transportation rates.

Chapter 4

CONCLUSIONS

The thesis investigates the forecasting the accuracy of the Earning per Share using two prominent estimation models. The models used for our empirical analysis are the random walk model and the random walk with a drift model. The study focuses on three companies from three different industries for the time period 2019. The selected companies represent technology sector (Oracle), the oil sector (NextEra) and the delivery sector (FedEx) respectively. Those three companies are included in the S&P500 index and they are selected based on their beta values that measures the level of systematic risk for each company. Oracle, NextEra and FedEx have respective beta values of 1, 0.16 and 1.3.

From our previous results, we can see that beta values for each company affect the estimation of the future earnings per share. These two models used are biased toward minimizing their expectations. When using forecasting earning, the lagged EPS model with a drift is more accurate than the lagged EPS model. Whenever the beta of the company changes the results will change.

The descriptive statistics show us that FedEx Company has the highest mean value of EPS and has the highest standard deviation in both models, its beta is greater than 1 which led to a high profit with high risk. Oracles Company that have a beta same as the market has the lowest mean and standard deviation values. NextEra Company with

a beta lower than 1 has a high mean with a high standard deviation. For these three companies we can conclude that model 1 is better than model 2 from the level of significance and from our result (higher mean with lower standard deviation is better). The results of the accuracy of the forecasting earning show that model 2 is better than model 1 concerning the average error and the mean absolute error. However, MSE average results show that model 1 is better than model 2. This difference is caused by the number of our sample size which is small and there is no precaution are taking since we have outliers in our figure

The correlation shows the relationship between two variables. Our results show that Oracle follow a random walk model due to the explanation of the error term. For NextEra, the earnings are stabilized after proceeding the first model because the changes between two consecutive periods are floating around 0 so also NextEra is following a random walk model. However, FedEx Corporation follow a low revenue due to the higher purchasing transportation rates. Apart from this, the changes in EPS follow a random for year to year.

So we can say that opening new opportunities to any company can be done by using the beta value with some other indexes by multiplying them or mixing other equations with beta to reach a better level of data readings for any company. In addition, by increasing the sample size in our model it will increase the significant level in our model.

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