

**Czech University of Life Sciences Prague**

**Faculty of Economics and Management**

**Department of Economics**



**Diploma Thesis**

**The Relationship Between Economic Indexes and Stock  
Market**

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## DIPLOMA THESIS ASSIGNMENT

Marko Yacoub Anwar Yacoub

Economics and Management

Thesis title

**The Relationship between Economic indexes and Stock Market.**

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### Objectives of thesis

Find quantitative relations between Economic indexes and Stock Markets.

Find technical relation between Economic indexes and Stock Markets.

Expect and put forecast for the future of the stock Markets based on the relations and the equations we get.

### Methodology

The methodology will be quantitative method based on the data i'm going to collect for using it in my analysis.

## The proposed extent of the thesis

50- 60 pages

## Keywords

gdp,unemployment, inflation,interest rate, exchange rate, S&P500.

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Abarbanell, Jeffrey S., and Brian J. Bushee. "Fundamental analysis, future earnings, and stock prices." *Journal of accounting research* 35.1 (1997): 1-24.

GANDOLFO, G. *International finance and open-economy macroeconomics*. Berlin: Springer, 2002. ISBN 3-540-43459-3.

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N. Mankiw Georgy, *Principles of Macroeconomic, USA*, Cengage Learning, 2901285165911, 7th edition 01/01/2014.

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## **Declaration**

I declare that I have worked on my diploma thesis titled "The Relationship between economic indexes and stock market" by myself and I have used only the sources mentioned at the end of the thesis. As the author of the diploma thesis, I declare that the thesis does not break copyrights of any their person.

In Prague on

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Thank you.

# The Relationship Between Economic Indexes and Stock Market

## Abstract

There are many methods of the stock market analysis which investors depend on for providing them with a clear picture for the future of the stock market and the economic status so it could lower their investing risk. For example, we have fundamental analysis and technical analysis also there are macroeconomic variables which influence the stock market as the GDP, unemployment, inflation, interest rate and exchange rate. So, in my diploma thesis I'm discussing an overview about those different types of stock market analysis also I will investigate the correlation between the mentioned macroeconomic variables and the stock market index S&P500 and how each of those macroeconomic variables influence the index.

**Hypothesis:** I assume that any change in the macroeconomic variables data (GDP, unemployment, inflation, interest rate and exchange rate) will influence the stock markets (S&P500 index is my measurement for the stock market).

By creating a polynomial equation between each of the mentioned macroeconomic variables and the S&P500 index I got the correlation between them as I found that there is a direct proportional correlation between the GDP and the stock market index. Also, there is an inverse correlation between the unemployment and the stock market index. And for the inflation I found that the stock market and the inflation rate have a direct proportional correlation until the inflation reach almost to the rate of 1.7% then this correlation started to convert to an inverse correlation. Also, I found that there is an inverse correlation between the exchange rate (EUR/USD) and the American index S&P500.

After this I wanted to gather all of those macroeconomic variables with S&P500 index in multi regression model to conclude the correlation among the macroeconomic variables and the stock market index S&P500 in one model so after doing the scatterplots and correlation test and the multicollinearity test I found that the only macroeconomic variables I could use are GDP, unemployment and the exchange rate as an independent variables with the S&P500 index as a dependent variable. Then

after getting my multi regression model curve I compared it with S&P500 index values in one chart to understand the relation between my new multi regression model curve and the S&P500 index.

All those correlations enabled me to create two indicators the first one is between GDP and S&P500. The second one is between my multiple regression model curve and S&P500 index.

As a result, now with my new technical indicators it is easier for everyone to have a general expectations for the future of the stock market with more clear picture of the economic status by connecting between the mentioned macroeconomic variables and stock market index S&P500.

# vztah mezi ekonomickými indexy a akciovým trhem

## Abstrakt

Existuje mnoho metod analýzy akciového trhu, na kterých investoři závisí, protože jim poskytnou jasný obraz o budoucnosti akciového trhu a ekonomickém stavu, což by mohlo snížit jejich investiční riziko. Máme například základní analýzu a technickou analýzu, existují také makroekonomické proměnné, které ovlivňují akciový trh jako GDP, nezaměstnanost, inflace, úroková sazba a směnný kurz. Ve své diplomové práci tedy diskutuji o těchto různých typech analýz akciového trhu a také prozkoumám korelaci mezi uvedenými makroekonomickými proměnnými a indexem akciového trhu S&P500 a jak každá z těchto makroekonomických proměnných ovlivňuje index.

**Hypotéza:** Předpokládám, že jakákoli změna údajů o makroekonomických proměnných (GDP, nezaměstnanost, inflace, úroková sazba a směnný kurz) bude mít vliv na akciové trhy (index S&P500 je moje měření pro akciový trh).

Vytvořením polynomiální rovnice mezi každou ze zmíněných makroekonomických proměnných a indexem S&P500 jsem mezi nimi získal korelaci, protože jsem zjistil, že existuje přímá poměrná korelace mezi GDP a indexem akciového trhu. Rovněž existuje inverzní korelace mezi nezaměstnaností a indexem akciového trhu. A pro inflaci jsem zjistil, že akciový trh a míra inflace mají přímou poměrnou korelaci, dokud inflace nedosáhne téměř 1,7%, pak tato korelace začala převádět na inverzní korelaci. Také jsem zjistil, že existuje inverzní korelace mezi směnným kurzem (EUR/USD) a americkým indexem S&P500.

Poté jsem chtěl shromáždit všechny tyto makroekonomické proměnné s indexem S & P500 v multiregresním modelu, abych uzavřel korelaci mezi makroekonomickými proměnnými a indexem akciového trhu S&P500 v jednom modelu, takže po provedení testu rozptylu a korelace a testu multicollinearity jsem zjistil, že jediné makroekonomické proměnné, které bych mohl použít, jsou GDP, nezaměstnanost a směnný kurz jako nezávislé proměnné s indexem S&P500 jako závislou proměnnou.



Poté, co jsem získal křivku multiregresního modelu, porovnal jsem ji s hodnotami indexu S&P500 v jednom grafu, abych pochopil vztah mezi mou novou křivkou multiregresního modelu a indexem S&P500.

Všechny tyto korelace mi umožnily vytvořit dva ukazatele, z nichž první je mezi GDP a S&P500. Druhý je mezi mým mnohonásobným regresním modelem a indexem S&P500.

Výsledkem je, že nyní s novými technickými ukazateli je pro každého jednodušší mít obecná očekávání pro budoucnost akciového trhu s jasnějším obrazem ekonomického stavu propojením mezi uvedenými makroekonomickými proměnnými a indexem akciového trhu S&P500.

## Table of Content

<b>1 Introduction</b> .....	<b>11</b>
<b>2 Objectives and methodology</b> .....	<b>13</b>
2.1 Objectives.....	13
2.2 Methodology.....	13
<b>3 Overview on fundamental and technical analysis of the stock markets</b> .....	<b>14</b>
3.1 Fundamental analysis of the stock markets.....	14
3.1.1 Earnings Per Share (EPS) .....	15
3.1.2 Price to Earnings Ratio (P/E) .....	15
3.1.3 Projected Earnings growth.....	15
3.1.4 Price to book ratio P/B ratio.....	16
3.1.5 Dividend payout ratio .....	16
3.1.6 Dividend yield .....	17
3.1.7 Return on Equity (ROE) .....	17
3.2 Technical analysis of the stock markets.....	18
3.2.1 Trendlines .....	19
3.2.2 Resistance and Support.....	20
3.2.3 Trading volume .....	21
3.2.4 Technical patterns.....	22
3.2.5 Moving Averages Indicators .....	27
<b>4 Macroeconomic Variables Effect on the Stock Markets</b> .....	<b>32</b>
4.1 Gross Domestic Product (GDP) .....	32
4.1.1 Calculating gross domestic product methods.....	34
4.1.2 Gross national product and gross national income.....	36
4.1.3 Relation between GDP and stock markets.....	36
4.2 Unemployment .....	38
4.2.1 Types of unemployment .....	38
4.2.2 Economic and social consequences of unemployment.....	39
4.2.3 Relation between stock markets and unemployment rate.....	40
4.3 Interest Rate.....	42
4.3.1 Types of interest rates.....	43
4.3.2 Main factors affect the interest rate .....	44
4.3.3 Effects of high interest rates.....	44
4.3.4 Effects of low interest rate .....	46
4.3.5 Relation between interest rate and stock markets .....	46
4.4 Inflation .....	47
4.4.1 Reasons of inflation (Inflation types) .....	48
4.4.2 Types of inflation indexes.....	50
4.4.3 Relation between Inflation and Stock Markets .....	51
4.5 Exchange Rate .....	52
4.5.1 Effects of currency depreciation .....	53

4.5.2 Effects of currency appreciation .....	54
4.5.3 Relation between exchange rate and stock markets .....	55
<b>5 The Practical Part .....</b>	<b>57</b>
5.1 The Relation between Gross Domestic Product and S&P500 index .....	59
5.2 The Relation between Unemployment and S&P500 .....	63
5.3 The Relation between Inflation Rate and S&P500.....	65
5.4 The Relation between Interest rate and S&P500.....	68
5.5 The Relation between Exchange rate and S&P500 .....	69
5.6 Multiple Regression Model.....	71
<b>6 Discussion of the Results .....</b>	<b>81</b>
6.1 Gross Domestic Product polynomial curve indicator .....	81
6.2 Multiple regression model indicator .....	84
<b>7 Conclusion .....</b>	<b>86</b>
<b>8 References.....</b>	<b>88</b>

## List of Tables

Table No 1: Data for S&P500, GDP (in Trillions), Unemployment%, Inflation%, Interest Rate% and Exchange rate (EUR/USD).....	57
Table No 2: GDP data (in Trillions) with S&P500.....	59
Table No 3: the values of the anticipated S&P500 index values up on the polynomial curve equation with GDP and the real S&P500 data .....	61
Table No 4: unemployment data % with S&P500.....	63
Table No 5: Inflation % data with S&P500.....	65
Table No 6: Interest rate % with S&P500 .....	68
Table No 7: Exchange rate values for EUR/USD and s&p500 .....	69
Table No 8: Macroeconomic variables data with S&P500 .....	71
Table No 9: The dependent variable and the independent variables for the multi regression mode .....	77
Table No 10: Multiple Regression Model in Excel .....	77
Table No 11: The real values, anticipated values of S&P500 and the residuals .....	78

## List of Figures

Figure No 1: Uptrend line.....	19
Figure No 2: Down Trendline.....	20
Figure No 3: Sideways Trend Direction.....	20
Figure No 4: Resistances and supports.....	21
Figure No 5: Trading volume .....	22
Figure No 6: Double Top.....	23
Figure No 7: Head and Shoulder pattern.....	23
Figure No 8: Falling Wedge .....	24
Figure No 9: Bullish symmetrical triangle .....	25
Figure No 10: Descending triangle .....	25
Figure No 11: Ascending triangle .....	26
Figure No 12: Inverse Head and Shoulder .....	27
Figure No 13: Triple Bottom pattern.....	27
Figure No 14: Nestle stock moving average during the period from 1/2019 until 9/2019.....	28
Figure No 15: Airbus share price with the moving average during the period (3/2018 – 3/2019).....	29
Figure No 16: Facebook share price (4/2018 – 6/2019) with moving average .....	29
Figure No 17: unemployment rate and S&P500 (2008 – 2018).....	41
Figure No 18: relation between GDP & S&P500 .....	59
Figure No 19: polynomial correlation between GDP and S&P500 .....	60
Figure No 20: Anticipated S&P500 values of the GDP Polynomial Curve with the real S&P500 index .....	61
Figure No 21: Relation between Unemployment % and S&P500.....	64
Figure No 22: polynomial curve correlation between Unemployment % and S&P500 .....	65
Figure No 23: Inflation % data with S&P500.....	66
Figure No 24: correlation between Inflation % and S&P500.....	67
Figure No 25: Interest rate data with S&P500.....	68
Figure No 26: EUR/USD with S&P500 .....	70
Figure No 27: Correlation between EUR/USD and S&P500.....	70
Figure No 28: scatterplots and correlation test with GDP.....	72
Figure No 29: scatterplots and correlation test with unemployment .....	73
Figure No 30: scatterplots and correlation test with inflation. ....	73
Figure No 31: scatterplots and correlation test with interest rate .....	74
Figure No 32: scatterplots and correlation test with exchange rate (EUR/USD). ....	74
Figure No 33: Relation between GDP and Unemployment. ....	75
Figure No 34: Relation between GDP and Exchange rate (EUR/USD) .....	76
Figure No 35: Relation between Unemployment % and Exchange rate (EUR/USD) .....	76
Figure No 36: Real S&P500 with the anticipated values .....	79

Figure No 37: Anticipated S&P500 values of the GDP polynomial curve with the real S&P500 Index values .....	81
Figure No 38: Real S&P500 with the anticipated values of the MRM.....	84

## **List of Abbreviations**

CPI – Consumer Price Index

EPS – Earning Per Share

EUR/USD – Exchange rate between the Euro and the US Dollar

GDP – Gross Domestic Product

MRM – Multiple Regression Model

P/B – Price to Book ratio

P/E – Price to Earnings ratio

PPI – Product Price Index

ROE – Return on Equity

S&P500 – Standard & Poor's 500 American stock market index

WPI – Wholesale Price Index

# 1 Introduction

There is no doubt that Economy is the most important subject we have in our life and everything happens within the economic situation affects every side in people's life.

Economy in general has many different topics under it as a subject. It has general economy, accounting, monetary policy and different kind of markets including the stock markets. And in my diploma thesis I'm going to talk about the main analysis of the stock markets as the fundamental analysis and the technical analysis also I'm going to discuss the macroeconomic variables and its effect on the stock markets.

There was a big debate if the economy is leading the stock market or if the stock market is the leader of the economic status. this is what motivated me to write my diploma thesis in this topic as I have some assumptions which assume that the economy represented in the macroeconomic variables is the leader of the stock market. so I'm going to have an overview on the fundamental analysis and the technical analysis of the stock markets also I'm going to talk about the macroeconomic variables and the effect of each of it separately on the stock market then I will try to connect between those macroeconomic variables and the stock markets to get the correlation among them then I can have a new indicators which would clarify the relation more between the macroeconomic variables and the stock market so it would also enable investors to expect the future of the stock market up on my new indicators which connect between the macroeconomic variables and the stock market.

First, we have different types of analysis for the stock markets as we have fundamental analysis which discuss the revenues and the profitability per quarters or annually of the companies. also, we have the technical analysis which discuss the history of the prices, trends, technical patterns, trading volume, moving averages indicators, lagging indicators and the leading indicators so I will present a summarized overview for both of those two types of the stock markets in the beginning of my thesis.

Stock markets prices were not that easy to be expected up on the several factors which influence it and the different economic situations. but what I tried to do is to have some mathematical methods to connect between some of the macroeconomic

variables and the stock markets up on econometric basis as a trial of providing a new methods and equations for investors to make it easier for everyone to expect the future of the stock markets and lower the risk and the uncertainty in the investing atmosphere.

I will start with an overview of the different types of stock markets analysis then I will get in the discussion of some of the macroeconomic variables (GDP, Unemployment, inflation, interest rate and exchange rate) and its influence on the stock markets. then I will explain this in detail more in my practical part using some of the econometric basis then I will apply some technical explanations on my charts and my results.



## 2 Objectives and methodology

### 2.1 Objectives

The main aim of the thesis is to discuss the different types of the stock market analysis. Also, to explain the relation between some of the macroeconomic variables (GDP, unemployment, inflation, interest rate and exchange rate) with the stock market.

The goal of the thesis is to use the correlation between the mentioned macroeconomic variables and the stock market to create new indicators which connect between the macroeconomic variables and the stock market so it could facilitate the vision of the stock market and make it easy for the investors to expect the future of the stock market.

**Hypothesis:** The mentioned macroeconomic variables have an important effect on the stock market which would enable us to expect the future of the stock market if we connect between those macroeconomic variables and the stock market.

### 2.2 Methodology

Theoretical overview will be discussed about the different types of the stock market analysis (the fundamental and the technical analysis methods) also the relation between some of the macroeconomic variables and the stock markets.

I will use also quantitative research method to gather my data for the GDP, unemployment, inflation, interest rate and exchange rate (EUR/USD) for the USA and connect it with the data of S&P500 index through the period of (2006 – 2018). Then I will use polynomial equations to connect between the mentioned macroeconomic variables and S&P500 index separately so I can get the correlation between each of them with the stock market index. Also, I will use multi regression model to connect between the GDP, unemployment and the exchange rate with the S&P500 index.

## **3 Overview on fundamental and technical analysis of the stock markets**

### **3.1 Fundamental analysis of the stock markets**

Fundamental analysis is based on checking the most fundamental financial tools. fundamental analysis also can help investors by enabling them to evaluate the company financial situation then they can evaluate its share price so they can decide if they can invest in this stock or not. it has several factors to evaluate the company financial situation as quarters or annuals revenues, assets management, loans and payables management in compare with the productivity of this business. some investors rely on fundamental analysis alone however it could be more helpful if we combine it with some other analysis tools then we can evaluate the stocks prices by more than one measurement. Evaluation of shares prices is the purpose of any investor so he can see if it worth to invest his money in this stock or not and it enables him to have clearer picture for the financial situation of this company (Malkiel, 1989).

Most of investors who rely on fundamental analysis they wait the quarter report for each company so if the company has a good revenue then it is most likely that it will have a positive reflection on the company business. so, the company can expand its business by establishing other branches in different places within the country border or even abroad so the company will have a new market with a new chance for enlarging its business and earnings in the future. also, the company can use this high revenue by giving the shareholders dividends so it will have a good impact on the share price.

On the other hand when a company revenue fall or it has a bad quarter revenue so most of investors will start to close their positions and sell what they have in their portfolio of this company's stock so we will have here high supply in compare with low demand of this company's stock for this reason the share price will decline because the company didn't achieve the expected earnings (www.thebalance.com, 2018).

Now I will discuss some of the fundamental analysis tools:

### **3.1.1 Earnings Per Share (EPS)**

We calculate the earnings per share by dividing the company's profit by its share price, so the result is considered as an important measurement of the company's profitability. so, the higher earnings per share we have the more profitability considered from this company.

we can calculate the EPS using this formula:

$$\text{Earning Per share} = \frac{\text{Net Income} - \text{Dividends}}{\text{Number of shares}} \quad (1)$$

So, as we see the earnings per share is very important because it reflects how much the market would pay for each dollar of earnings. on the other hand, it shows also how much the company would earn for each share of its stock. Then higher EPS show higher profitability for this company and a stable financial situation which would motivate investors to invest more in this company then we will have higher demand on this stock which will have a good impact on the share price (Abarbanell, 1997).

### **3.1.2 Price to Earnings Ratio (P/E)**

Investors use price to earnings ratio to determine the dollars amount which the investors would invest for receiving one dollar of its earnings. So high P/E ratio for investors would reflect the possibility of this company's growth in the future.

The average P/E ratio tends to be between 20 to 25 times earnings and basically if a company has losses then they don't have P/E ratio (Abad, 2004).

We can use this formula to calculate the P/E ratio:

$$\text{Price to Earning } P/E = \frac{\text{Market Value per share}}{\text{Earning Per share}} \quad (2)$$

(Abad, 2004)

### **3.1.3 Projected Earnings growth**

It provides investors with a good forecast of companies expected earnings growth for the upcoming years. So, it would give investors a good picture of the expectations for company's growth. then when we have a stock with better growth expectations it is

more required than the companies which have poorer growth expectations (Greig, 1992).

### **3.1.4 Price to book ratio P/B ratio**

Price to book ratio is used by investors for comparing between the market price to the book value of the stock and we calculate it by dividing the Market share price by the book value of this share.

When we talk about the book value then we mean the net assets value and to calculate this we must deduct the intangible assets and liabilities from the total assets then we will have the book value. we can also use this formula for getting the book value for any stock (total assets – total liabilities) / number of shares.

And to calculate the price to book ratio we can use this formula:

$$P/B \text{ Ratio} = \frac{\text{Market Price Per share}}{\text{Book value per share}} \quad (3)$$

When we have a low P/B ratio it means that the stock is undervalued or also it could mean that there is something fundamentally wrong in this company (Greig, 1992).

### **3.1.5 Dividend payout ratio**

The dividend payout ratio is calculated by dividing the dividends values which the company pays to the shareholders by the net income which the company keep for paying off its debts or for reinvesting this amount for enlarging the company business.

So simply this ratio shows the difference between the money which the company pay to the shareholders in compare with the earnings which the company keep for reinvesting it again for expanding its business (Investopedia 2019).

We can use this formula to get the dividend payout ratio:

$$\text{Dividend Payout Ratio} = \frac{\text{Dividends paid}}{\text{Net income}} \quad (4)$$

To interpret the result we have to put many things in consider as it depends on the level of the company, for example if we have a small company which need to expand and move to a new market to establish a new stage of development and enlarge its

expected earnings so in this case this company would reinvest all of the earnings without paying any dividends to the shareholders.

On the other hand, if we have another big company which already achieved a great success in its business over its history then it would pay some dividends to the shareholders. but it doesn't mean that any big company must pay dividends to the shareholders because it depends on the financial situation of the company and its growth plans (Investopedia 2019).

### **3.1.6 Dividend yield**

The dividend yield is the ratio which we can calculate by dividing the annual dividend price by the share price.

So, we can calculate it using this formula:

$$\text{Dividend yield} = \frac{\text{Annual Dividend}}{\text{Share Price}} \quad (5)$$

If we assume that we have a fixed dividend if the share price falls, then the dividend yield will rise and vice versa if the share price rises the dividend yield will fall.

So, investors prefer to invest in the companies which have a higher dividend yield but on the other hand when a company pays a high dividend it would mean also that this company has no plans for enlarging its business or its capital for growing so it is not preferred for the company future as well. But in general investors tend to invest in companies with dividends so they would use the revenue of those dividends again to reinvest and enlarge their winnings in the future (Investopedia 2019).

### **3.1.7 Return on Equity (ROE)**

Return on equity is the percentage we get by dividing the net income of the company by its shareholder equity.

$$\text{Return on Equity} = \frac{\text{Net Income}}{\text{Shareholder's Equity}} \quad (6)$$

Return on equity in general is used to measure the efficiency of the company in using its assets to create more profit.

There is no specific ratio which we can classify it as a good ratio for return on equity, but we can use it to compare between two companies in the same industry or sector. For example, if we have some companies in the transportation industry which have ROE around 13% and there is another company in the same industry which has a higher ROE ratio near to 18% so we can realize here that this company is higher than the average of the rest of the companies then investors would rather to choose this company to invest in (Arditti, 1967).

So in general as we mentioned there is no specific ratio for using this percentage but it depends on the company industry but on the other hand some indicators consider the ratio of 14% as an average ratio and if the ratio is lower than 10% then it would be considered as poor percentage.

So, I was talking about some of the fundamental tools briefly which the investors use to analyze the share prices and now I will move to the technical analysis part (Investopedia 2019).

### **3.2 Technical analysis of the stock markets**

Technical analysis of the stock markets is considered as an art more than to be a science and some analysts don't believe in this kind of analysis. but in general every analyst has his own analysis which he relies on for example, some investors just rely on the fundamental analysis as we mentioned before and they don't really believe in any other kind of analysis as they think that the most important thing in analyzing any company is the revenues and the analysis of the balance sheet, income statement, cash flow, and the important ratios as we mentioned in the previous part. Some other investors don't really think that it is enough to rely on the fundamental analysis without paying attention to the history of the prices and the trading volume and here we got what is called the technical analysis of the stock markets.

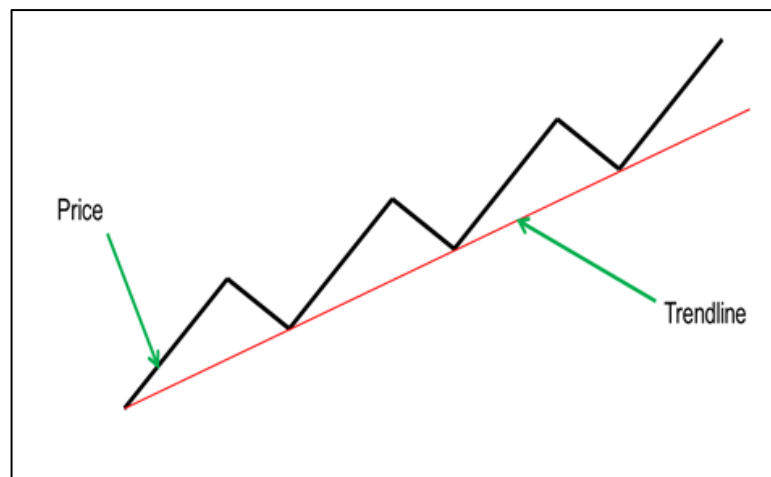
Technical analysis of the stock markets relies on the history of the prices and it uses many tools as trends, resistance and support, trading volume, patterns, moving averages indicators, Elliot wave and Japanese candles and some other tools which I can't mention all of it as it is a big topic however I can explain briefly the main tools of the technical analysis of the stock markets.

### 3.2.1 Trendlines

We have three types of trend lines the first of them is the uptrend when the price is moving upward and the second one is the downtrend when the price is moving downward and the third one is the sideways trend when the price is moving within the same average of the prices and we will clarify the difference more of those three types of trends (Murphy, 1999).

As we see here in figure (1) the uptrend line is connecting the bottoms of the prices and it creates a support line. So, we can identify the uptrend line as it is peak higher than peak and bottom higher than bottom.

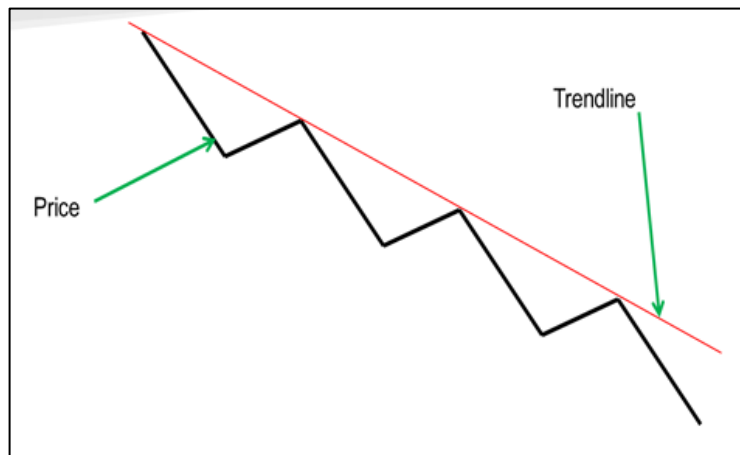
**Figure No 1: Uptrend line**



(Source: investarindia.com, 2019)

As we see in figure (2) the downtrend line is connecting the peaks of the prices and it creates a resistance line. So, we can identify the downtrend as a peak lower than a peak and a bottom lower than a bottom (Schabacker, 2005).

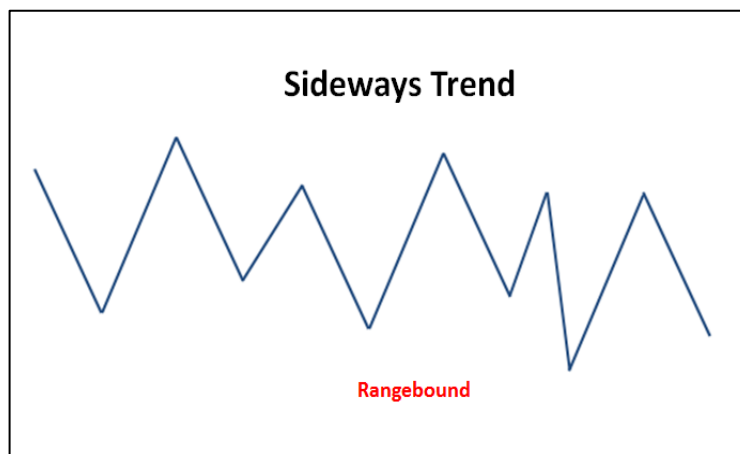
**Figure No 2: Down Trendline**



(Source: investarindia.com, 2019)

As we see here in figure (3) the sideways trend happen when the price is moving within the same range of the prices.

**Figure No 3: Sideways Trend Direction**



(Source: optionalalpha.com, 2019)

### **3.2.2 Resistance and Support**

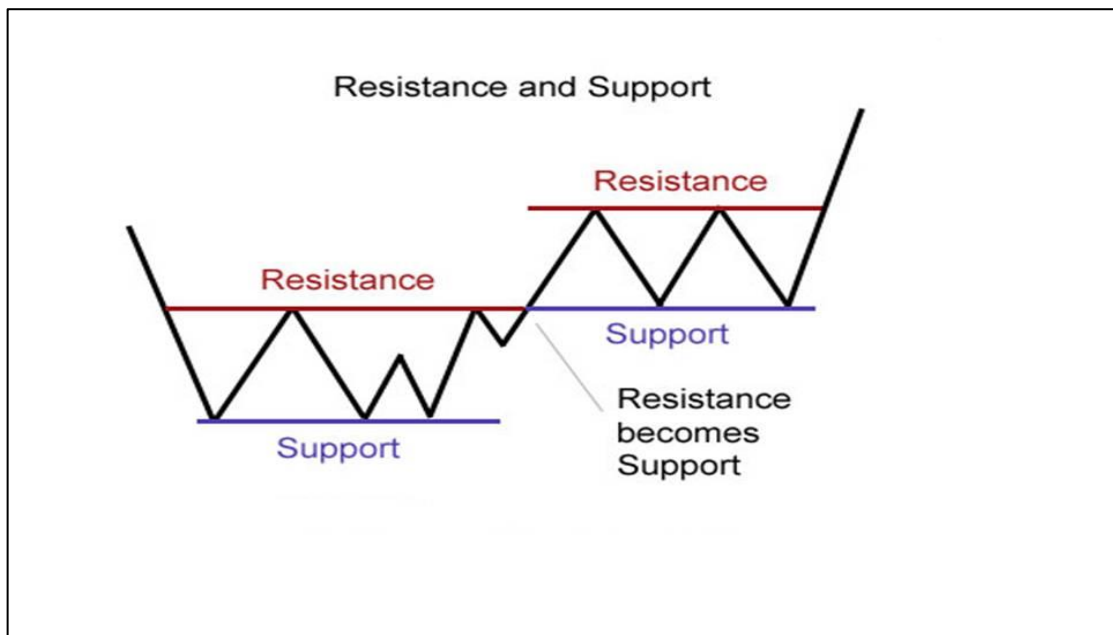
The share price depends on demand and supply of the stock so when the demand is higher than the supply the price goes up and when the supply is higher than the demand the price falls down. this is the interpretation of resistance and support because the resistance is the area when the sellers start to appear after the price move upward for gaining their profits or to open short sell positions so they can get their profit if the price fall down. And the support is the area when the buyers start to appear to buy the stock and to prevent the price to fall more down because they believe that



this is a good or cheap price level to buy the share then they can sell it in a higher price and make profits (Murphy, 1999).

Here in figure (4) the resistances and the supports area and it has a converting rule which means after the price succeed to break the resistance the resistance line will convert to be a support line for the price. Also, after breaking the support line the support line will convert to be a resistance line as well (Murphy, 1999).

**Figure No 4: Resistances and supports**

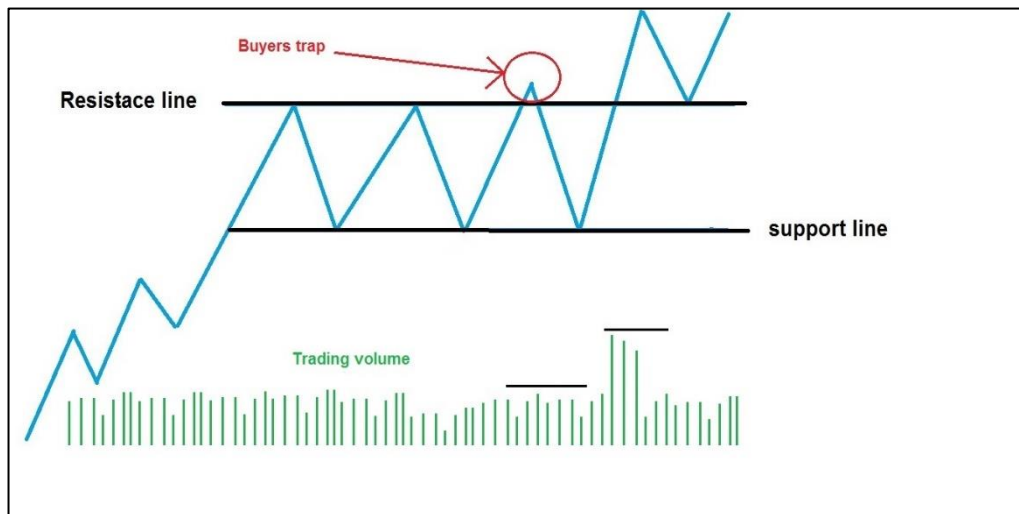


(source: samcheekong.blogspot.com, 2019)

### 3.2.3 Trading volume

Trading volume is very important for any technical analyst because it shows the real strength of the price movement. For example, when the price breaks an important resistance with a high volume then it shows the strength of the buyers in this market to transfer the price to another stage above its previous resistance (the current support). On the other hand, if there is a break for an important resistance without a high volume then there is a doubt that it could be a buyer's trap or a fake break of this resistance level as it is mentioned in figure (5) (Pagano, 1989).

**Figure No 5: Trading volume**



(Source: own painting, 2019)

As it is mentioned in figure (5) when we have a false breaking for the resistance the price has a normal trading volume within the average of the previous volume trading. But when the price breaks the resistance after this the trading volume was more than the average of the previous trading volume as I clarified in the figure (5).

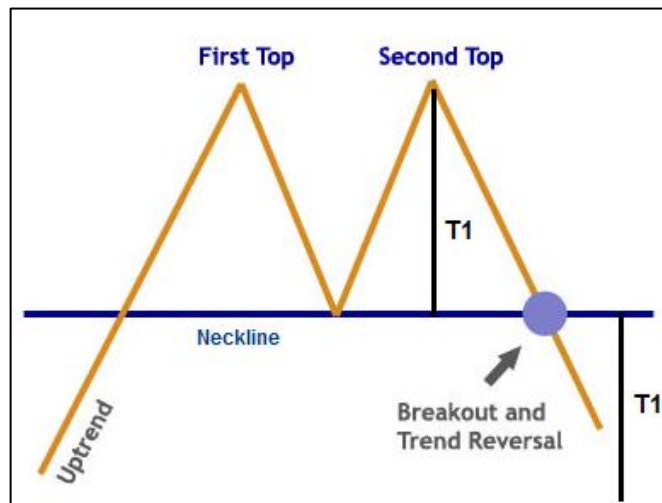
### **3.2.4 Technical patterns**

There are some technical patterns in the stocks charts which have a historical importance and it has a target and technical analysts rely on it to guide them for expecting the future of the prices and set a guidance target of it. I will mention some of the most important technical patterns here but not all of it (Schabacker, 2005).

#### **Double Top**

In this technical pattern when the price breaks the neckline the target will be the same height of the highest peak. I can't say that this pattern is double top until the price break the neckline. Also, I would like to mention that the target in any technical pattern is just used as a guidance target, but it doesn't mean that the price must reach this target. In technical analysis world if the price reach at least 70% of its target so it's acceptable but in general it is not mandatory to reach 100% of the target because the big investment institutions most likely to start to close their open positions before the price reach 100% of its expected target (Murphy, 1999).

**Figure No 6: Double Top**



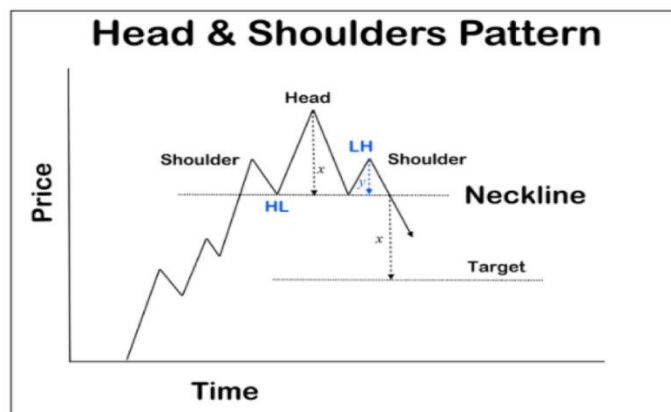
(source: optionalpha.com, 2019)

### **Head and Shoulder**

In this pattern when the price breaks the neckline then it is most likely that the price will move downward to the target which we can consider it as the same height of the head peak as we see in figure (7).

This pattern most likely to appear in the end of uptrend so we can consider it as a reverse pattern for the prices (Murphy, 1999).

**Figure No 7: Head and Shoulder pattern**



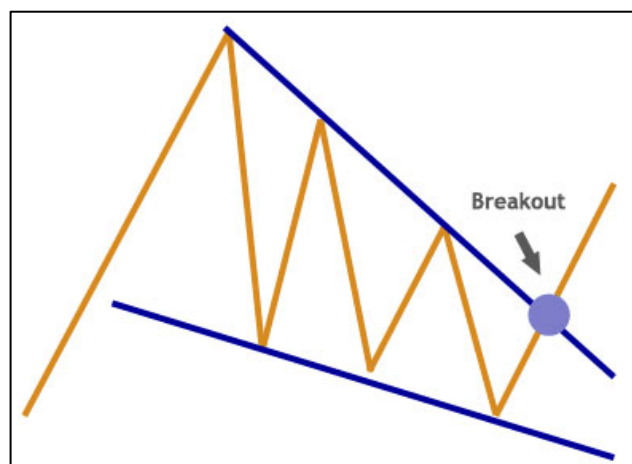
(source: www.thebalance.com, 2019)

## Falling Wedge

In this pattern in figure (8) when the price breaks the resistance line which connecting the peaks it is most likely that the price of this stock will have a tremendous increasing so investors like this technical pattern a lot.

It is most likely that this pattern would appear in the end of downtrend and it is considered in the technical analysis as a seller's trap because it looks like the downtrend (Murphy, 1999).

**Figure No 8: Falling Wedge**



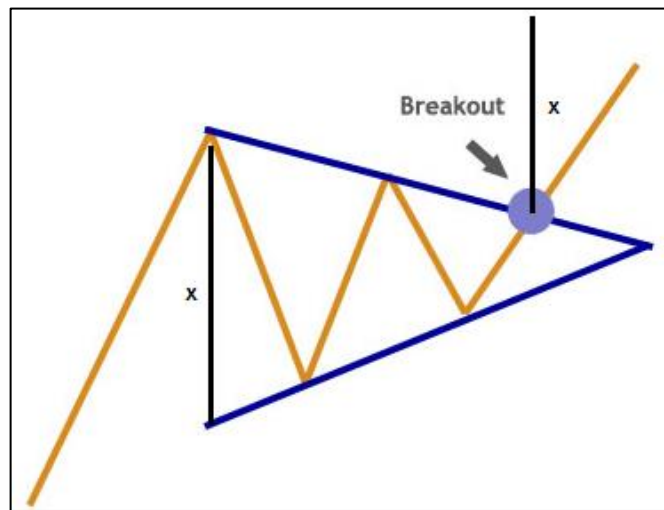
(source: optionalalpha.com, 2019)

## Bullish symmetric Triangle

In this pattern in figure (9) when the price breaks the upper band of the triangle then the price most likely that it will have a target which equal to the distance between the highest peak and the lowest band of this triangle.

We can classify this pattern as a continuous pattern which most likely to occur during the uptrend. we can even interpret this as a relaxation period for the buyers to take a breath and to get some profits before continuing in the uptrend (Schabacker, 2005).

**Figure No 9: Bullish symmetrical triangle**

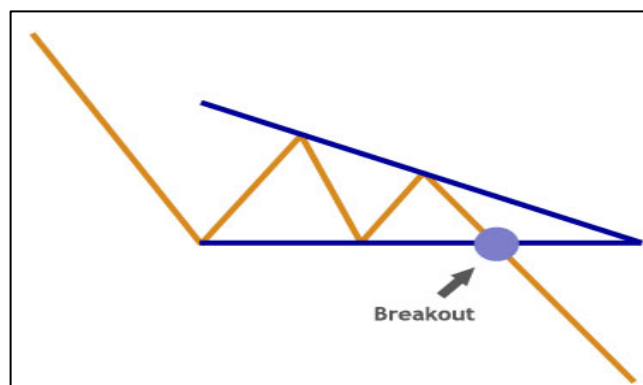


(source: optionalalpha.com, 2019)

### **Descending Triangle**

In this pattern in figure (10) when the price breaks the support line of this triangle it is most likely that the prices would go more downward. we can use also the distance between the support line to the highest peak of this pattern as a target for the prices but also as I mentioned before it is not a rule that the price could decline more than the expected target up on the strength of the sellers in this market. we can classify this pattern as a continuous pattern which most likely to occur during the downtrend (Murphy, 1999).

**Figure No 10: Descending triangle**



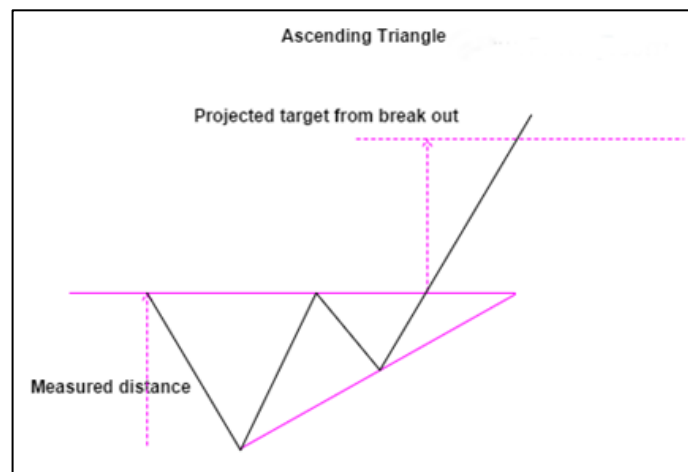
(source: optionalalpha.com, 2019)

## Ascending triangle

As we see in this pattern in figure (11) the price is moving between the horizontal resistance and the uptrend support so when the price breaks the resistance it is most likely that the price would reach to the target which equal to the distance between the horizontal line (the previous resistance) of the triangle and the lowest bottom of the triangle.

This pattern most likely to occur during the uptrend and sometimes it could occur in the end of the downtrend as well (Murphy, 1999).

**Figure No 11: Ascending triangle**



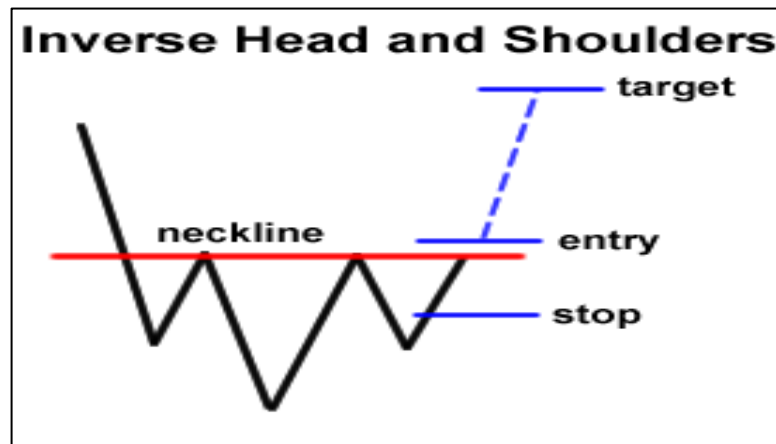
(source: medium.com, 2019)

## Inverse Head and Shoulders

In this pattern in figure (12) when the price breaks the neckline above then it is most likely that it would move upward with a target of the distance between the neckline and the lowest bottom (or the head).

The most possibility for this pattern to appear in the end of downtrend (Schabacker, 2005).

**Figure No 12: Inverse Head and Shoulder**



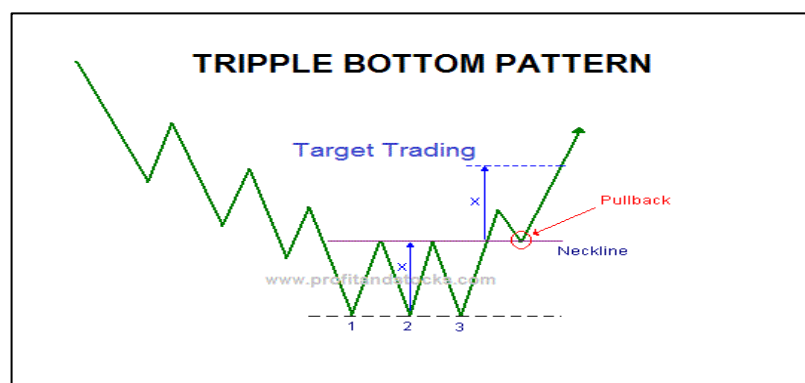
(Source: pinterest.com, 2019)

### **Triple bottom pattern**

As we see in this pattern (figure 13) when the price breaks the neckline it is most likely that the price would test the neckline again as a support then it would reach to the target which equal to the distance between the neckline (the previous resistance) and the lowest bottom we have in the three bottoms (the previous support).

Also, this pattern most likely to appear in the end of the downtrend but as I mentioned before we can't consider this pattern as a triple bottom pattern without breaking the neckline (the resistance) (Murphy, 1999).

**Figure No 13: Triple Bottom pattern**



(source: profitandstocks.com, 2019)

### **3.2.5 Moving Averages Indicators**

Moving average indicators are considered one of the most important indicators which used by investors for taking decisions of buying or selling stocks. One of the

advantages of the moving averages that it reduces the noise of the fluctuations of the price's movement and it make the direction of the price clearer for investors. We can calculate it by counting the average of the stock price for a specific time period (for example 14 days or 30 days) (Schabacker, 2005).

It could be used by many methods one of those methods is to use it as a support or resistance. Then now we can identify the uptrend when the moving average is moving under the price and working as a support. also, we can identify the downtrend when the moving average moves above the price and working as a resistance. as it is mentioned in figure (14) the moving average is working as a support for the price (Murphy, 1999).

**Figure No 14: Nestle stock moving average during the period from 1/2019 until 9/2019**



(source: investing.com, 2019)

Also, there are other trading strategies for the moving averages indicators. it could be used for giving a buying or selling signals. For example when the price breaks the moving average and moves above then it could be considered as a buying signal and when the price breaks the moving average down and moving under it then it is a selling signal as we see in figure (15) (Schabacker, 2005).



**Figure No 15: Airbus share price with the moving average during the period (3/2018 – 3/2019)**



(source: investing.com, 2019)

There is another strategy I would like to mention. this strategy is based on that we have two moving averages one of them for a long period (for example 30 or 50 days) and the other one for a short period (for example 9 or 14 days). So, if the short period moving average breaks the longer period moving average up then it is considered as a buying signal, and when the short moving average breaks the long one down then it is a selling signal as it is mentioned in figure (16).

**Figure No 16: Facebook share price (4/2018 – 6/2019) with moving average**



(source: investing.com, 2019)

I would like to mention also the main three types of the moving averages and the differences between them.

### **Simple Moving Average**

Simple moving average is calculated by adding the closing prices for a number of periods (hours, days, weeks, months,) and dividing them by the number of this periods. For example, when we need to count the moving average for 10 days then we need to add the closing prices for those ten days then divide them by ten (Kannan, 2010).

Here I will mention the formula for the simple moving average

$$\text{Simple Moving Average} = \frac{P_1 + P_2 + P_3 + \dots + P_n}{n} \quad (7)$$

When: (P1) is the closing price of the first period (day or week or month)

(n) is the number of periods (days, weeks, months, years)

### **Weighted Moving Average**

The simple moving average is not giving importance for the recent days, so it deals with the recent dates as it deals with the old days. Then technical analysts were trying to find some moving average which would give more importance for the recent dates. Then they created the weighted moving average and its advantage that it gives a relative importance for the recent periods in compare with the old periods as days (Investopedia 2019).

Here is the formula of the weighted moving average

$$\text{Weighted Moving Average} = \frac{p_1 * 1 + p_2 * 2 + p_3 * 3 + \dots + p_n * n}{1 + 2 + 3 + \dots + n} \quad (8)$$

When: (P1) is period 1 or first day and we can count it until (n days).

### **Exponential Moving Average (EMA)**

The exponential moving average is giving more importance to the latest day closing price and it reacts faster than any other moving average for the changes in the price (Kannan, 2010).

The formula:

$$\text{EMA} = (\text{last Price} \times K) + \text{EMA} (\text{previous day price}) \times (1 - k) \quad (9)$$

When:  $N$  = number of days.

$$K = 2 / (N + 1), \text{ (Investopedia 2019).}$$

## **4 Macroeconomic Variables Effect on the Stock Markets**

In the beginning we had an overview for fundamental and technical analysis for the stock markets but we still look for some other more accurate analysis method which would gather between the fundamental and technical analysis for giving more clear picture of the stock market and to enable investors to expect the future of the stock market and the future of the prices. so we start to think about the economic indexes which every country has as gross domestic product (GDP), unemployment, inflation, interest rate and exchange rate to investigate its effect on the prices of the stock markets then I can create some kind of more accurate indicators using this macroeconomic variables which would reflect the real status of the economic situation in any country and connect it with the stock market indexes.

So now I will discuss in detail some of the macroeconomic variables and its effect on the stock markets indexes.

I will start with gross domestic product then I will talk about unemployment, inflation, interest rate and exchange rate.

### **4.1 Gross Domestic Product (GDP)**

Gross domestic product is the total production value for all goods and services which have been produced through a specific period within a specific border of some country and it is very important index as it determines the real economic productivity in any country and shows the real volume of the economic activity in this country. So basically, every industry product or every service which is produced within a specific county border it has a share value in the whole economy and we accumulate this value with the gross domestic product value for the country (Callen, 2008).

Gross domestic product is considered as one of the most important measurements which measure the economic stability and growth. In other words when the GDP increases then it means that the economic activity is increasing as well then it will reflect on the gross national income in the country and the standard of living as it will

affect the gross domestic product per capita and the standard of living for people who live in this country (Kulhánek, 2012).

when the gross national income increases then it means that the economic growth is expanding as well. So it will have a good impact on investing and it will motivate the investors to establish more projects in this country then it will reduce the unemployment rate so when everyone will have a job and salary then it will increase the consumption rate for individuals and make them consume more products and services.

On contrary in case of lower GDP then it means that we have lower gross national income then we don't have real new projects or investments then we have higher unemployment so it will have bad impact on the consumption rate for individuals. So, it will be considered as a bad indication for investors and for the economic growth in this country (Callen, 2008).

For those reasons GDP is considered as the economic compass for any country and It motivates investors to invest more in this country or to escape with their capital to somewhere else.

William Petty is the first one who came with the concept of gross domestic product as his rule against the landlord high taxes. It happened during the war between the English people and the Dutch. Then it has been developed by Simon Kuznets for the report he prepared for the US congress. After 1944 gross domestic product became the most important indicator for estimating the economic status in any country. Most countries switched from the gross national product (GNP) to gross domestic product since 1991 because it is more realistic, and it represents the real economic productivity within the country border. Also, the gross domestic product played an important role in the world war two which motivated many countries to use it after this (Nikkinen, 2006).

Gross domestic product is determined for different time periods for example, it could be calculated quarterly after every three months, also it could be calculated for the whole year.

Also, we have many types of gross domestic product measurements as:

- **Nominal Gross Domestic Product** and here to clarify the difference between the nominal gross domestic product and the real gross domestic product. The nominal gross domestic product measures the value of the produced goods and services within a country border but with the current prices without taking in consider the inflation or deflation factors which would influence the prices of goods and services.
- **Real Gross domestic product** on the other hand the real gross domestic product takes in consider the inflation or deflation which would affect the prices of goods and services.
- **Gross domestic product per capita** when I need to know the average standard of living for people in a country then the gross domestic product per capita is one of the best indicators which shows me the final value of the produced goods and services within a country divided by the population of this country. Then we have the final total GDP per capita which reflects the real standard of living in this country (Nikkinen, 2006).

Now I will discuss three methods for calculating the gross domestic product.

#### **4.1.1 Calculating gross domestic product methods**

##### **Calculating Gross domestic product by expenditures method**

In this method we count consumption, government spending, investment and total exports after deducting the value of the imports. So, we have this formula for this method.

$$GDP = C + G + I + NX \quad (10)$$

When: C = total consumption

When we talk about consumption here, we mean the consumption value which spent by customers for buying goods and services. consumption represents 70% of the total gross domestic product value so it is one of the most important factors which affect the gross domestic product. Also, it reflects the confidence of customers in other words when the customers have a confidence in their economy then the tendency for spending is higher than the tendency for saving their money. When people don't have enough confidence in their economy or their market then they prefer to save more

than spending because they don't guarantee the economic situation or their needs in the future (Kulhánek, 2012).

G = Government spending

Government spending here refers to the money spent by the government on the infrastructure as the governmental official buildings, paving the roads, building public schools, universities, hospitals and maintaining the transportation system as extending the metro lines to far areas for improving the transportation network system. The importance of the government spending always appear in the recession's times after the decline of individual consumption and the total investment in the country (Callen, 2008).

I = Investment in the country (within the country borders)

Investment also considered as an important component because when big investors or big companies tend to invest in some country then it means that there will be a new job opportunities for people so they will have their salaries which will be spent (high consumption as we mentioned before). Also, those companies or investors would start to buy lands or machines for their projects then it will be considered as consumption as well. For this reason, we consider investment one of the foundation stones for good economies (Nikkinen, 2006).

NX = total net exports minus imports

Here we count the total exports value minus total imports because when any country exports its products and services more than importing then it will have a good impact on the total gross domestic product then it would boost the productivity in this country. and if we have imports more than exports then it is most likely that it could cause a deficit in our budget (Callen, 2008).

### **Calculating gross domestic product by production value**

In this case we determine the gross domestic product by counting the total value of the production without taking in consideration the cost of the production process. Then it gives us a different point of view for the GDP.

## **Calculating GDP by income method**

In this method we rely on income because theoretically when we were relying on expenditures or consumption then it means that this money was going to someone else. So here when we talk about income then we mean salaries which employees get from their companies, or the cost of the products which were being bought then this cost is considered as a revenue for the vendors. So, when we add all those incomes and revenues, we would have the gross domestic product value as well (Nikkinen, 2006).

### **4.1.2 Gross national product and gross national income**

Gross national product is the total value of products and services produced by some country citizens in their country or abroad with excluding the foreign individuals or foreign companies. So, it depends on the nationality of the person or the company. So, the gross national income is the total income value which earned by some country citizens in their country or abroad. gross national income is used to show how much the country is investing abroad. in other words, if we have a country with big investments abroad then it will reflect on its gross national income. and when we have a country with no big difference between gross domestic product and gross national income then it means that most of the country investments are domestic. we can exclude the taxes which the foreign companies or individuals pay within the country border from the gross national income as it is related to the nationality as we mentioned before. as a result, in the global economy the analysts prefer to use the GNI because there are some countries which they get most of their income withdrawn by their citizens and companies abroad (Investopedia 2019).

### **4.1.3 Relation between GDP and stock markets**

In general, the GDP reflect the economic situation in any country because if there is economic growth then it means the GDP is increasing as well. So, most of the companies will have a good revenue so it will reflect on the share prices of those companies so it will motivate investors to invest more in those companies to increase their profits. Then it will have a good impact on the stock markets.

In contrary if it is expected that the economy would get in a recession then it will have a negative impact on the share prices because it means that those companies will have



lower revenues then it will have a negative effect on the dividends for those companies and maybe even some companies would announce their bankrupt if their financial situation went worse and this is the worst news for any investor (Kulhánek, 2012).

But I need to admit that it is not a general rule because sometimes the markets are doing very well in the recession's times and vice versa. The reason behind this that stock markets represents the expectations of the investors for the economic activity. In other words if it's expected that the economy will get in a recession then the stock markets would react up on this bad news but when the prices decline most of the investors would get rid of their stocks which means that it reaches to its bottom (very strong supports) after this the supply on the shares at this time would not be so sharp as before which will give the buyer the chance to appear again in the market to take advantage of the cheap prices for the stocks. So, in this case the stocks will not have any other direction other than going upward (Investopedia, 2019).

Also, the stock markets influence the economic growth. The best example we have for this the stock market collapse which happened between 1973 and 1974 then the equity value of the shareholders declined by 43% of its original value. this huge collapse in the stock markets had a negative effect on the investor's confidence in the economic growth for this reason it was one of the longest recession periods.

Some analysts don't rely on GDP data because it is kind of late and it happens as a result for the economic conditions but on the other hand some other analysts look at the GDP as an important indicator which would lead them or lead the country for taking the most appropriate monetary policy decisions for example it could be useful for the monetary policy makers to decide if they would take the path of the expansionary monetary policy or the contractionary monetary policy which will have its effect on the prices (Kulhánek, 2012).

I found that GDP in general would help us in our study as one of the biggest factors which tell us about the country's economic situation so if I succeed to connect between gross domestic product and stock markets indexes then we would have a good relation which would help investors in their stock market analysis and make the picture more clear for them to take decisions related to the market.

## 4.2 Unemployment

The definition of the unemployment that when we have someone who wants to work, and he-she is capable to work but he-she doesn't have the opportunity although looking for a job for some time. Of course, I can't consider that everyone is not working as an unemployed person for example students, disabled people, pensioners, people under 18, people who really doesn't need to work, we can't consider them as an unemployed people (Clark and Oswald, 1994).

We can also mention that the reasons behind the unemployment could be several reasons as the unorganized labor market and this could happen as a result of not creating the suitable environment for attracting foreign investment in the country so investors and businessmen will not be able to invest because of the discouraging atmosphere in the country or even the bad political or social situation.

We can also mention that the unemployment rate would occur as a result of the real interaction between investing and the labor market policy of the country. In other words, if the country has an organized labor market system then it means that it has a good atmosphere for many new projects which could be established and would provide some job opportunities (Layard, Nickell, and Jackman, 1994).

### 4.2.1 Types of unemployment

**Fractional unemployment:** it is not really represent a big rate of the unemployment as it represents the people who leave a job for looking for another job and due to the searching time and the recruitment process it takes time then it is considered as a kind of unemployment but it is not that important real unemployment.

**Structural unemployment:** basically, it happens when the new technology come in force. For example, when the factories start to rely on the machines so it would lead those factories to get rid of some workers because of the new technology, and of course the new technology will be more accurate and save time and money for those factories owners more than the workers. Also, it could imply on the situation of getting rid of the workers to get different skilled workers who would be more trained and productive for the new factory technology or the new machines (Fortin and Araar, 1997).

**Cyclical unemployment:** it occurs in the economic recession times when many companies have losses in their revenues then they will start to shorten their staff and their spending to compensate the losses by saving some costs. Also, it occurs when the prices of the raw materials start to become more expensive so the factories will start to get rid of some workers to compensate their losses in the raw material expenses.

**Institutional unemployment:** it happens mostly because of the working rules in any country for example when the country raises the minimum age for working then it will restrict the companies to hire more people. Also, the licensing procedures for both companies and workers sometimes it could restrict the hiring process and it would take long time which will have a bad impact on the unemployment rate (Clark and Oswald, 1994).

#### **4.2.2 Economic and social consequences of unemployment**

- It affects the economic security. In other words when the worker loses his last income resource it would expose him to the pain of poverty and the shortage of the basic needs. Also, it would cause social and psychological suffering because of the deprivation of the basic needs.
- It would lead the unemployed individuals to addict alcohol and drugs then it would reach to depression.
- It would increase the rate of violence and the crimes.
- It affects the gross domestic product of the country.
- It would also increase the deficit rate in the country public budget as a result of paying the social security aids for many unemployed people.
- Because of the high supply of the labor market then it will reduce the wages then the workers will not have a fair standard of living. So it will affect the individuals consumption because workers don't have a lot of money to spend and on the other hand they will try to save some money because they know if they lose their job it will be hard for them to find another job then it will lead to a lower gross domestic product which will affect the value of the gross domestic product per capita which reflect the standard of living in any country.
- Also, it could cause some instability in the political level because maybe it would lead the unemployed people to start to protest and make demonstrations

against the governments as a result of their bad situation (Fortin and Araar, 1997).

- It would motivate many of the high qualified, trained, and skilled work force to immigrate to another country with a better conditions and better salaries. Then it will have a bad reflection on the economy of this country because most of the talented people already immigrated to another place.
- Also, it would increase the rate of the illegal immigration which will have a bad impact on the security and the stability of different countries.
- It will increase the corruption and nepotism between people because everyone will try to get a job by any way.
- In some countries it would lead to some illegal actions as forcing kids to work because their parents are not providing them with the basic needs they need to have in their life (Clark and Oswald, 1994).

So, all those consequences affect the economic stability, so it is important for any investor needs to make sure of the economic health to check the unemployment rate because as we mentioned it has many negative economic consequences if the unemployment is very high.

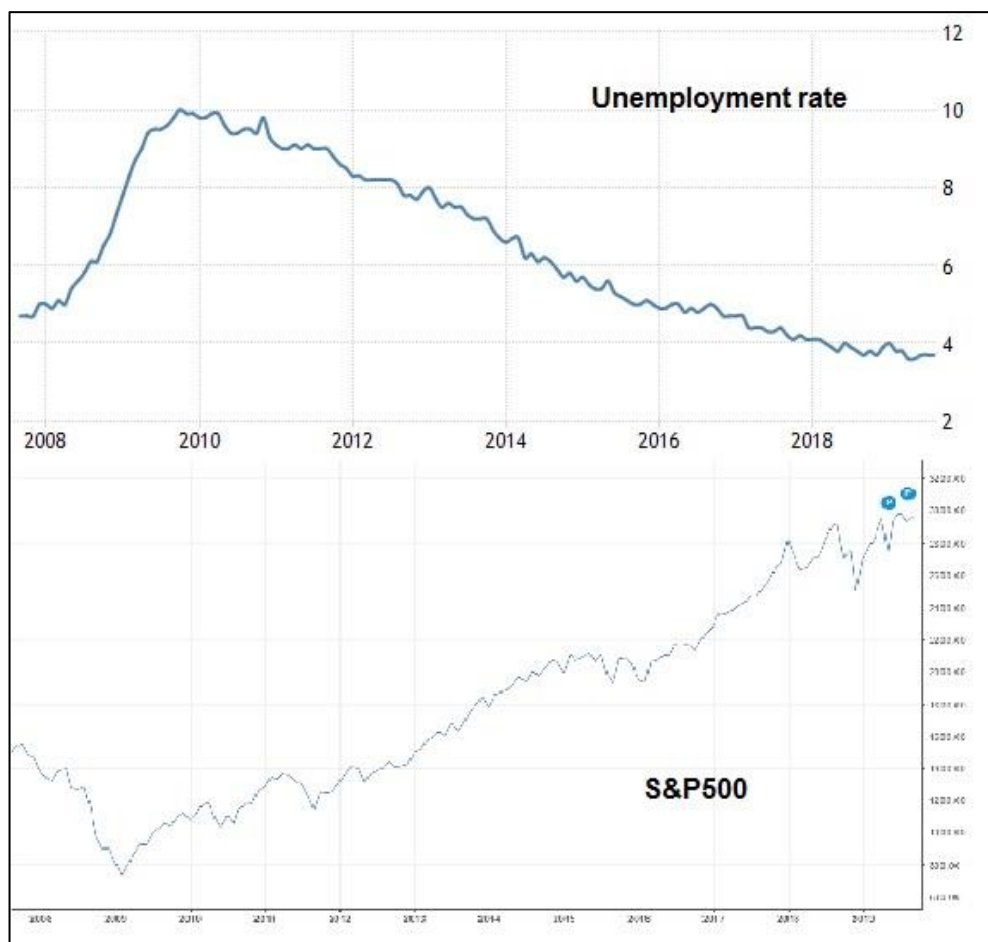
#### **4.2.3 Relation between stock markets and unemployment rate**

- I can say that there is indirect relation between the unemployment rate and the stock markets, but it is effective. As I can say if we have high unemployment then it means that there is high percentage of the population doesn't have salaries so they can't spend much money so it will affect the demand of the company's products then it will have a negative impact on their revenue then this will affect the share price in a negative way directly. But on the other hand we have to differentiate between the luxury products and the basic needs for example we can say the companies which would be affected by the high unemployment times are the technology companies and the luxury stuff companies as jewelry and gold producers because people in those hard times will not have enough money for this luxury stuff (Fortin and Araar, 1997).
- Also as I mentioned before it would affect the economic situation in the country because the unemployed people would force the government to afford paying their social security benefits for the unemployment so it would create

kind of deficit in the public budget of the country. Also, the country will not be able to get enough taxes which considered one of the most important resources for the national income. so, it would force the country to borrow money from other countries or from the international monetary funds for paying its debits (Loungani, Rush, and Tave, 1990).

- Also when we look at the correlation between the unemployment and the stock markets we can see as in figure (17) when the stock market's decline the unemployment rate goes up and when the stock markets perform well then the unemployment goes down and this is a logic correlation because when the people work and get their salaries and pay their taxes and consume their money then it will have a positive impact on the economy and the stock market as well and vice versa (Fortin and Araar, 1997).

**Figure No 17: unemployment rate and S&P500 (2008 – 2018)**



(Source: investing.com / tradingeconomics.com, 2019)

There is another motivation for the stocks to go up after the periods of high unemployment rates. Theoretically I can say during the period of high unemployment many unemployed people lost their savings which they kept during their working time so it will force them to go back to work in other companies after this to compensate their losses and to have their basic needs. So, it will reflect on the revenues of those companies (Clark and Oswald, 1994).

It seems that when we have low unemployment it is great for the economic health but if we get more deep in this we will find that it is not that ideal or simple relation because if we assume that we have a very low unemployment then it means that the companies will start to offer more wages to motivate workers to work. Then it will have two bad consequences the first consequence is when the companies will give up some of its revenues for paying big salaries then it will affect the company's expansion of their business's activities. The companies will not have enough money to expand its business which could really create more profitability for the company and let it to move to a higher stage. The second bad consequence is that the inflation as when the people will have more money then, it could create higher inflation in the economy which will raise the prices. so we can realize that the very low unemployment is not healthy for the economy as well (Fortin and Araar, 1997).

Now I will move to another factor which considered one of the most important factors which affect the stock markets.

### **4.3 Interest Rate**

The interest rate is the cost of borrowing some asset. This asset could be home (mortgage), car, credit, building, consumer goods or funding a project or establishing new business or paying tuition fees. Most of the companies rely on the loans they get from the banks to expand their business or developing their systems, so the interest rate value is very important for them because it represents the cost of the money they get. The interest rate value also must be set for a period as 1 year or more or less up on the agreement between the lender and the borrower. So basically, the interest rate represents the cost of the borrowed asset for the borrower and the benefit or the rate of return for lending this asset for the lender (Woodford, 1994).

When the interest rate is high then it is higher risk for the borrower and with high benefits for the lender. And when the interest rate is low then it is with low risk for the borrower and with low benefit for the lender as well.

Interest rate always has fixed or variable rate up on the lender terms and conditions. This lender could be a bank or financial institution which would help the borrowers who need to establish a new business for example or to get something and pay the money back with its interest rate which considered the cost of their service (Lucas and Stokey, 1985).

### **4.3.1 Types of interest rates**

**Simple interest rate:** it is a percentage of the principle borrowed amount for example if someone borrow \$2000 with interest rate 5% for 1 year then he will have to pay \$2100 next year.

**Compound interest rate:** the compound interest rate means that every year the interest rate will be considered with the whole principle amount to count the next interest rate for example if you have a bank account with interest rate %5 and you have a saving of \$1000 so for the first year you will get \$1050 and for the second year you will get \$1102.5 because we count the whole amount you got for the first year plus the interest rate and we added the interest rate for the whole amount. And most of banks use this kind of interest rate for the money you save or borrow (Hamdan, 2014).

**Fixed interest rate:** in this type of interest rate we have the same percentage of the borrowed money as an interest rate even if the interest rate goes up or down , the borrower will remain pay the same interest rate which he had the deal for. So basically it would be more profitable with the lender in the low interest rate times but on the other hand it will be without any benefit in the high interest rate times because it is fixed and it doesn't relate to the fluctuations of the real current interest rate.

**Variable Rate:** in this type of interest rate the lender can raise or lower the interest rate during the loan time and it doesn't have to be up on the interest rate fluctuations. But in general, it is good for the borrower in the low interest rate times and it is risky for the borrower in the high interest rate times.

**Amortized rates:** it is usually used with mortgages or car loans, and it always start with a little amount of the principle amount and a large interest rate amount. Then after this the principle amount will keep increasing and the interest rate amount will remain the same up on the principle paid amount every time (Woodford, 1994).

**Prime rate:** it is the basic interest rate which is set by the central banks and the banks use this rate with each other or with its important and valuable customers like large corporations. The normal loans and mortgages are affected by the value of the prime interest rate.

**Discount rates:** this type of interest rate imply by the federal reserve bank in lending some financial institutions and it is based on the cash flow analysis for this financial institution and also it put in consider the time value the risk level for this kind of loan (www.pocketsense.com, 2019).

#### **4.3.2 Main factors affect the interest rate**

Actually, it is based on the demand and supply for loans from banks which means that when we have a higher demand on the loans then it will lead to a higher interest rates and when we have lower demand then it will force the central banks to lower their interest rates. Also, when we have a higher interest rates then it will motivate individuals to save their money in this bank to get the profit of those high interest rates. As a result, the supply will be higher than the demand of this money so the interest rates will go down after this. On the other hand, when we have a low interest rate environment then the individuals will not be motivated to save their money in this bank so the supply of money will be affected and the banks will have to raise the interest rate so I can say it is a kind of a closed circle (Woodford, 1994).

#### **4.3.3 Effects of high interest rates**

- It will have many consequences as increasing the cost of assets borrowing. for example, the credit cards and loans or mortgages will become more expensive so the people will be discouraged to get more loans or credit. Also, the people who already have loans they will pay more in those high interest rates so they will spend most of their income on their loans which will affect their consumption power because their purchasing power will be affected.



- It will attract people to save money more than spending it because they will get more money above their principle money up on the high interest rate they have (Hamdan, 2014).
- It will affect also the currency value because it will attract more people to buy this currency and to keep their savings in because of the high interest profit they will get so basically it will appreciate the currency value up on the demand and the supply rule.
- It will affect also the exports and imports of this country because it will be hard for foreign countries to import from this country which have an appreciated currency so it will have a bad impact on the exports of the country but on the other hand it will be positive for the imports because the same currency will have more purchasing power than what it got used to have before.
- It will have a bad influence on the economy and companies because it will be hard for many companies to borrow money with this high interest rate so they will not be able to expand their business or develop it or create additional job opportunities.
- It will not motivate foreign investments to get in the country for the same reasons we mentioned and also because high interest rates mean that we will have high taxes as well which means that we have lower revenues for the companies.
- It will reduce the confidence of both of customers and companies. And the companies will not be motivated to have any risk with any more investments (Hamrita, Essaied and Trifi, 2011).

So based on all of what I mentioned I can say that it will have a negative effect on economy because it will reduce the aggregate demand so it will influence the consumption then it will have a negative effect on the gross domestic product and the whole economy plus it will raise the unemployment rate because as I mentioned every company will not be willing to borrow bank loans or expand its business. And it will slow down the economic growth.

#### **4.3.4 Effects of low interest rate**

- It will discourage people to save money as they will not get high return with this low interest rate.
- It will encourage individuals and the firms to get bank loans because it will be cheap to pay it back with the low interest rate then, they will be able to expand and develop their business which will be good for the economy and it will motivate foreign investments to get a place in this healthy economic atmosphere. Also, it will create job opportunities.
- It will lower the expenses of mortgages which will let the household has more money to spend which will be positive for consumption and the gross domestic product which will create a healthy economic environment.
- It will raise the consumer confidence in the economy which will reflect on his spending.
- It will discourage people to have this currency and they will look for another currency with a higher interest rate so it will affect the demand of the local currency then the currency will depreciate in compare with the other foreign currencies. Also, it will be positive for the exports because it will make our products cheaper with our depreciated currency. But on the same time, it will make the imports more expensive.
- The negative effect will be on inflation because of the high supply of money then it will reflect on the prices and at some point it will affect the consumer purchasing power but we can say that it is advanced level after many stages of the low interest rate and long time (Hamrita, Essaied and Trifi, 2011).

Up on what is mentioned I can say that low interest rate is more positive for the economy and for the gross domestic product than the high interest rate. But on the other hand, it will have a negative effect on the inflation. So, it has to be not so low interest rate. It must be balanced and for some time because the continuity of the low interest rate will create a high inflation.

#### **4.3.5 Relation between interest rate and stock markets**

So, I can summarize the effect of high interest rate on the stock market as higher interest rate will cut some revenues from the companies winnings then it will affect

their revenues so it will have a negative impact on the share price. So, investors would lose their desire for investing in the stock market after increasing the interest rate.

On the other hand I have to clarify one more thing that not all of the stock market sectors would have a negative impact by increasing the interest rate because the banking sector will have more revenues from this discount rate and also the insurance sector, mortgage real estate companies and the brokerage companies and of course it will reflect on those companies or banks share prices (Hamdan, 2014).

For the effect of low interest rate in this case the companies will have the option to get more loans and expand their business so it will reflect on their revenues and it will be good for the economic status in the whole country as well.

But what I need to mention here that sometimes it is not that ideal correlation between the interest rate and the stock markets because if the central or the federal bank doesn't lower the interest rate by the same expected low interest rate for example, if it is expected that the bank will lower the interest rate by 50 points and it reduces it only by 25 points then it will have a negative impact on the stock markets for a short term. The reason behind this that there is no direct relation between the stock markets and the interest rate, but the stock markets reflect only the expectations of the investors for the stocks markets prices future. Then I can conclude that it is very important to look at the interest rate as an important factor but on the other hand it is not the only factor which could be used for stimulating the economy (Hamdan, 2014).

Now I will move to another important factor which affect the stock markets.

#### **4.4 Inflation**

Inflation is an economic term which express the price increasing for goods, services and assets in a specific period. Inflation affect the purchasing power for example if you have the same income for 3 years and there is annual inflation by 3% then it means you lost some of your purchasing power for the same goods or services you get by 3%. It is so general explanation because of course not all of the goods will have the same increasing rate. but I can make it more simple if I say if you get the unit of any product by \$1 then the price of the same product increased by \$0.03 so your purchasing power will not be the same as it was if you have the same salary (Kaldor, 1976).

So I can say that this inflation rate will affect the consumer consumption and it would have a bad impact on the country because it will reduce the purchasing power of people and discourage them to spend more and reduce their confidence in the economic health which will be reflected on the economic growth slow down.

#### **4.4.1 Reasons of inflation (Inflation types)**

We have three main economic reasons for the inflation.

- Demand pull inflation: This kind of inflation occur when the main demand is more than the supply of the goods or services. For example, if we have the same amount of production but the demand for this production is going up so here, we have a fixed supply, but we have an ascending demand which will have a consequence of increasing in the product price.  
also, it happens when the government print big amount of money more than the economic growth so the people will have more money in their hands and we almost have the same amount of the production. This will cause increasing in the prices (Firth, 1979).  
There are also some products which their producers intend to reduce its production supply for keeping its price in some level like the petrol prices. Or when some crisis or war happens and because of this the suppliers of oil will be influenced then it could cause inflation as well.
- Cost push inflation: This kind of inflation occurs when the production cost increases. In other words if the producing company is willing to develop better producing system or paying more salaries for the employees or for the raw material then the production became more expensive so the company will have to raise the price of its products to compensate their loss.
- Expected inflation: If there is expectation that the prices will go up for example if the interest rate increase so it will affect the people income by paying more mortgages or paying more money for their credit cards. so, the employees will demand to get higher salaries to meet their basic needs.
- The national dept of the country: When a country has high national dept then the government will have to impose more taxes, and this will force the companies to raise the prices of their products or their services. So, it will increase the money supply, and this will create a high inflation (Bruno, 1993).

- Exchange Rate: Some people would think that the exchange rate is not a big effective factor for the inflation rate. But on contrary it is considered one of the most effective factors because when we have a relative depreciated currency more than the other foreign currencies then it means that our goods and services will be cheaper for the foreign customers and it will raise the profitability of our companies abroad so it will raise the supply of money and on the other hand it will make the imported goods and services more expensive for the local consumers. So, when we have less valuable currency then it could raise the inflation as well ([www.thebalance.com](http://www.thebalance.com), 2019).

In general inflation could be positive for some people and negative for some other people as it depends on which category of people we are talking about. For example, the people who invest in commodities they would like to see some inflation which will make their commodities become more valuable and for the people who prefer to save their money more than spending it the inflation will be like their enemy who erases the value of their savings gradually and reduce their purchasing power. However in the healthy economy it is good to have an optimum rate of inflation because if the inflation rate is equal to zero then it means that keeping the money almost equal to investing it so it will not motivate people to invest so as a result it will have a negative impact on the whole economy.

On the other hand, if we have a high rate of inflation (hyperinflation) then it means that the prices are not stable enough to motivate investors or companies to invest in our country. The reason behind this that in the high rate of inflation or in the prices raise panic the prices will keep going up in a high rate which will not allow any investor to have a stable budget for his investment or for his project. Also, it will motivate people to try to buy as much as possible of their basic goods and needs and keep it so this could raise the demand on those goods and raise the prices more and more (Bruno, 1993).

So, I can conclude that the very low inflation near to zero is not positive for the economy because there is no motivation for people to invest. Also, the very high inflation rate is not positive for the economic stability. Then it must be with an optimum level which will not be with a harmful effect on the economy and motivate people to invest as well.

Basically, the interest rate is considered one of the most factors which affect the inflation rate of the country. As when we have high interest rate then it will not motivate the companies to get many loans because it will be so expensive to pay those loans back and it will be hard to raise the employee's salaries. So we can say the money is expensive in this case and vice versa when we have low interest rate then most of the companies will get loans to expand their business and the money will be more in people hands so it will raise the inflation rate as It has been mentioned before.

For this reason, the monetary policy planning is very important to draw and plan the country economic stability by targeting the estimated inflation rate in the country because almost every country has an estimated inflation rate up on its economic atmosphere (Bruno, 1993).

#### **4.4.2 Types of inflation indexes**

There are many inflation indexes and each of them has a different category of goods or services. I will mention the most three popular indexes.

##### **Consumer Price Index (CPI)**

This inflation index is basically for the basic goods and services as food, medicines, health care and transportation fees. And this index is calculating each of those items based on their relative weight in a basket of the basic goods and services. Then it takes the average of the prices change up on their relative weight in this basket of goods and services. And it is considered one of the most important inflation indexes as it measures the cost of living in any country. And it has a monthly update (Investopedia, 2019).

##### **Wholesale Price Index (WPI)**

This inflation index has the category of the raw materials and most of the materials before using it in the manufacturing stage. So, it is basically important for the companies and the factories for calculating the change of the raw material expenses so they can determine the cost of manufacturing and their products prices in the future.

## **Producer Price Index (PPI)**

Producer price index is calculated by a group of indexes which measure the change in the prices of some goods and services but this time it is from the side of the sellers not from the side of the buyers as the consumer price index (CPI).

Now I will discuss a simple example to explain how inflation could affect the value of the money and the people purchasing power.

If we have \$100 at 1980 and we need to know the difference between the purchasing power for this \$100 between 1980 and 2018. so, for example using CPI index if the index value at 1980 is 50 and the CPI index value at 2018 is 200.

The inflation =  $200/50 = 4$  so it means that we have inflation rate of 400% and when we need to imply this inflation rate on our \$100.

Then we can determine by adding the principle amount to the inflation rise.

The value of \$100 at 2018 =  $100 + (100*4) = \$500$ .

So, the value of \$100 at 1980 is equal to \$500 at 2018 (Investopedia 2019).

### **4.4.3 Relation between Inflation and Stock Markets**

In general, the central banks are always concerned about the inflation rate because if there is high rates of inflation then it will affect the consumption and it will slow down the economic growth because investors in this case will not be able to make any stable budget for any expected investment as the prices are not stable. Also, there is kind of direct relation between the inflation rate and the stock markets. And to get deep in this I need to differentiate between the anticipated inflation and the sudden inflation because the effect of the anticipated inflation will not be so harmful for the companies and the individuals as the sudden one. For example, if the companies know that there will be a rise in the prices for some reason then they can adjust their budgets for this earlier and take all of the steps which can help them to reduce the harmful effect of the high prices. Also, for the people it is very important because if a sudden inflation occurs then it will make them not able to adapt easily with the sudden increasing in the prices and their consumption will be influenced so it will influence the whole economic growth. And it will have a negative impact on the stocks prices because as it has been mentioned the people consumption will be influenced so it will affect the

revenues of the companies as a result of the demand decrease of their products (Firth, 1979).

Also the inflation rate level is very important because as I mentioned before if we are talking about suitable inflation rate for example up to 3% then it is good for the companies as I explained before that the inflation couldn't be zero because it will equalize between the people who invest and the people who don't invest which will have a negative impact on the whole economic sectors. So, the historical data show that the companies in their best performance and their best revenues with inflation up to 3%. But above this it could start to have a negative impact on the company's revenues as they will lose some of their revenues in the higher prices of the raw material so it will influence the stock market prices in a negative way (Firth, 1979).

Also, I would like to mention that the history is full of the hyperinflation examples which was destroying the economies and make any investor escape out of the hyperinflation atmosphere.

Now I will move to another important variable of the real effecting variables which influence the stock markets

## **4.5 Exchange Rate**

Exchange rate is the value of any country's currency in compare with the value of some other country's currency. For example, if we have \$1 USD so it means that in 8/5/2019 we have 22.94 Czech Koruna.

Some countries set a fixed range for its currency and keep it connected to some other foreign currency. For example, Hong Kong has a fixed range of 7.75 – 8.75 of the local currency as a value for the USD.

Also, there are some countries which have a currency domestic value within the country borders and another international value outside the country borders for their currency and china is the best example for this (Devereux, 2003).

In general, the currency value is very effective with the economic status of the country. So, most of the governments keep its currency value under control but in different ways for example some countries control the value of their currencies and some other



countries try to behave in a specific monetary policy to control the value of their currency but in indirect way as controlling the interest rate (Gavin, 1989).

Also, every currency has two values the spot value and the forward or the future value. in other words, if a country has a specific value for its currency and taking steps to increase its interest rate then it means that the currency will be appreciated for some time because as I explained before that it will motivate people to keep their savings in this currency and for the foreign investors to keep their savings in this currency as well which will raise the demand of this currency, and it will not be easy for the companies to get loans from the banks. Also, if there is a company is going to send money transaction to some other country and convert the local currency then they must put in consider the expected future value of this currency not only the current value (www.economicshelp.org, 2019).

Now I will discuss in detail the consequences of the currency appreciation and depreciation.

#### **4.5.1 Effects of currency depreciation**

- Currency depreciation has a good effect on exports volume as the local products will be cheaper for the foreign countries. Also, it will be cheaper for any foreign investor to buy any local asset here in the country. On the other hand, the imports will be more expensive. And it will discourage people to import their needs from abroad. so, when we have more exports than imports then it will be good for the economic growth and it would increase the aggregate demand and the GDP.
- The companies will find that it is cheap to export so they would tend to spend more money to raise the efficiency of their manufacturing system. so, it will increase the job opportunities. Also, the migrants will tend to look for some other country with more appreciated currency so the local companies will be forced to push the salaries to motivate workers to remain working here in the country so it would create kind of inflation. But we have to keep in mind that if the inflation is higher than the wages raise then it means that the salaries would lose a part of its purchasing power which would affect the consumption of people (Bergin, 2006).

- It could reduce the public budget deficit as we would export more than importing so we will basically get more than what we pay.
- If we have an economic recession in the global economy, then the currency depreciation would not be enough to increase the demand on exports. On the other hand, if we have a strong economic growth then the currency depreciation could increase the exports demand. However, we have to keep in mind that it might convert to high level of inflation in the strong economic growth times.
- If the imports are inelastic then it would be very expensive for the importers and it would force people to accept those expensive prices so the demand will not be influenced a lot. But if the imports are elastic then the importers would lose a lot because the demand on their imported products would fall.
- It could refresh the tourism in the country because the expenses would be cheaper for foreigners. But on the other hand, it will be expensive for the local citizens to spend their vacation abroad so it could be good as well to push their spending to the local resorts and hotels.
- It will have a negative impact on the employees who still have a fixed salary as it will influence their purchasing power (Bergin, 2006).

#### **4.5.2 Effects of currency appreciation**

- The prices of the exports will become more expensive for the foreigners so we could expect a fall in the demand for the local exports. On the other hand, it is expected to see an increase in the imports quantity as it will become cheaper.
- As we would have increase in the imports more than the exports so it could have a negative impact on aggregate demand and the GDP so it could slow the economic growth.
- It could lower the inflation.
- It will courage the manufacturers to cut manufacturing costs for keeping their position in the market so they can keep their competitive capability.
- If the demand of exports is inelastic then it could cause a small fall in the demand and it could increase the value of the exports revenues. But if the demand of the exports is elastic then it is expected that there will be huge fall in the exports demand in the other countries so in general, I can say that the

demand for imports and exports depend on the elasticity of the imported or exported products (Bergin, 2006).

### **4.5.3 Relation between exchange rate and stock markets**

There were some arguments between the stock markets analysts about which market is leading the other market, as they were wondering if the stock market is leading the exchange rate market or the exchange rate market (forex) is leading the stock markets.

Some of the analysts were believing that when the stock market is performing very well then it will motivate the investors to convert their currency to the local currency so they can invest in the local stock market so this will increase the demand for the local currency which would cause currency appreciation and vice versa (Gavin, 1989).

On the other hand there were some analysts believe that the exchange rate market (forex) would lead the stock markets and their theory is when the local currency get depreciated then it will be easier for most of the local companies to export their products abroad in a cheap prices for the other nations which would have a consequences of getting more revenues. So, it will have a good impact on the local companies share prices.

The most popular example for this is FTSE 100 (index which express the relative weight for 100 English companies in UK) as UK has many companies which having their activities abroad in USD so they get their profits in USD so when they have weaker British pound (GBP) then the revenues amount in USD will be converted in higher revenues in GBP.

But we must keep in mind that the relation between the exchange rate and the stock markets is not that simple and it could be interpreted in many other methods. Because it depends on if most of the country companies are performing their business operations within the country borders or abroad and they get their revenues in which currency. So, the relation between the exchange rate and the stock markets is exist, but we can't rely on it as an indicator for trading in the stock market or the foreign exchange market (Gavin, 1989).

Also, we must keep in mind that when the government has a strong control on stock markets and the currency value then it is very hard to find a relation between the

currency value and the stock markets. For example, in china the government has a strong dominance on the currency value and the stock markets as well. For example, it is not available in china for the shareholders to sell in a big amount to prevent the any panic or slump in the stock market prices. Also, the government there has many requirements and regulations which distort the picture of the stock market and make it doesn't reflect the reality of the demand and supply on the stock markets (Ajayi, 1998).

## 5 The Practical Part

I gathered my data for the macroeconomic variables of gross domestic product, Unemployment, Inflation, Interest rate and exchange rate (EUR/USD) in USA through the years of (2006 – 2018) to compare it with the S&P500 stock market index which reflect the performance of 500 companies stocks in USA stock market. Then I can find the correlation between each of the mentioned macroeconomic variables and the S&P500 stock market index then it could enable me to understand the correlations among them and expect the future of the stock markets prices.

The following table show the gathered data for S&P500 stock market index and the rest of the mentioned macroeconomic variables from 2006 until 2018.

**Table No 1: Data for S&P500, GDP (in Trillions), Unemployment%, Inflation%, Interest Rate% and Exchange rate (EUR/USD)**

Year	S&P500	GDP (tr)	Unemployment %	Inflation %	Interest Rate %	Exchange Rate EU/US
2006	1288.43	13.037	5.083	3.393	4.97	1.2153
2007	1416.79	13.815	4.623	3.226	5.02	1.2936
2008	1398.01	14.452	4.622	2.853	1.92	1.4777
2009	890	14.713	5.784	3.839	0.16	1.3573
2010	1136.62	14.449	9.254	-0.356	0.18	1.4351
2011	1274.3	14.992	9.633	1.64	0.1	1.3308
2012	1274.3	15.543	8.949	3.157	0.14	1.2709
2013	1475.91	16.197	8.069	2.069	0.11	1.3358
2014	1839.98	16.785	7.375	1.465	0.09	1.3621
2015	2046.86	17.522	6.168	1.622	0.13	1.1736
2016	1934.64	18.219	5.28	0.119	0.39	1.0882
2017	2276.32	18.707	4.869	1.262	1	1.0459
2018	2777.94	19.485	4.355	2.13	1.79	1.2142

(source: investing.com, data.worldbank.org, macrotrends.net, 2019)

For S&P500 I got the value of the index for the first day of the years (2006, 2007, ...) for example in the year 2006 we have the index value of S&P500 at 1/1/2006 (investing.com 2018).

For the gross domestic product (GDP), I got the average value of the previous year for each year. For example, in the year 2006 I got the average value in trillions of the GDP for the whole quarters in 2005. The reason behind this to help me to have all the available data in the beginning of each year because at 1/1/2006 we still don't have

the GDP data for 2006 but we have the average value of the GDP at 2005 (data.worldbank.org, 2018).

For the unemployment I got the average data of the unemployment growth by percentage for the previous year. For example, the unemployment in the table for the year 2006 I got it for the average of the unemployment percentage values at 2005 because as I mentioned before in the beginning of the year 2006 I still don't have the values of the unemployment for this year yet (data.worldbank.org, 2018).

For the inflation I got the average of the inflation growth percentage values during the previous year. For example, in 2006 I have the average of the inflation rates values at 2005. The reason for this that we still in the beginning of year 2006 and I don't have the data of the inflation for 2006 yet so I got the average of it for the previous year to help investors to have all of the available data at this time (data.worldbank.org, 2018).

For the interest rate I got the interest rate value in the first day of the year. For example, in 2006 I got the interest rate percentage value at 1/1/2006 (www.macrotrends.net, 2018).

For the exchange rate I got the exchange rate for EUR/USD in the first day per each year. For example, for 2006 I got the value of the exchange rate for EUR/USD at 1/1/2006 (investing.com, 2018).

Now I will discuss every macroeconomic variable correlation with S&P500 separately then I will combine what available from them to be in one model for a multi regression model to investigate its effect on the stock market S&P500 index.

## 5.1 The Relation between Gross Domestic Product and S&P500 index

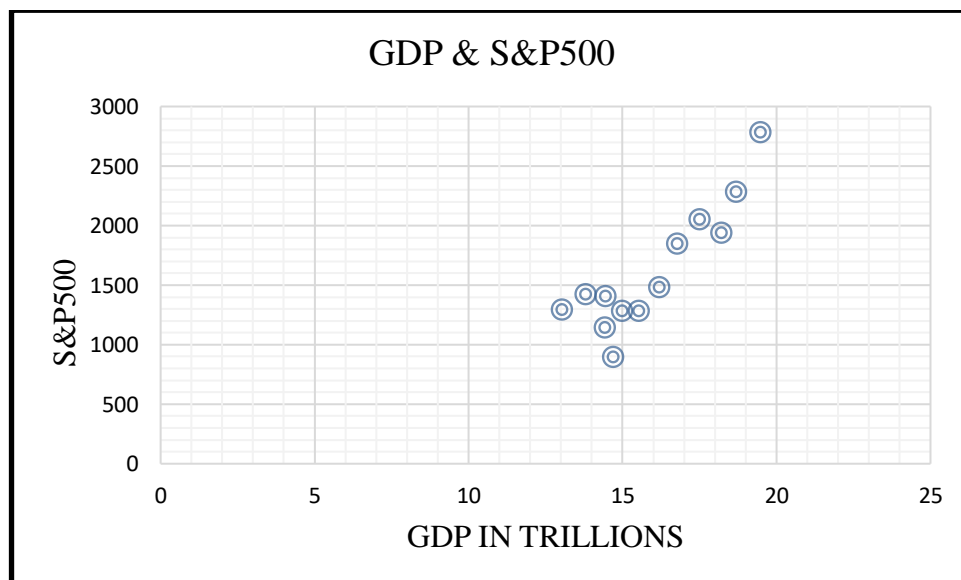
**Table No 2: GDP data (in Trillions) with S&P500**

Year	GDP (tr)	S&P500
2006	13.037	1288.43
2007	13.815	1416.79
2008	14.452	1398.01
2009	14.713	890
2010	14.449	1136.62
2011	14.992	1274.3
2012	15.543	1274.3
2013	16.197	1475.91
2014	16.785	1839.98
2015	17.522	2046.86
2016	18.219	1934.64
2017	18.707	2276.32
2018	19.485	2777.94

(Source: data.worldbank.org, investing.com, 2019)

As we see here, we have the data for the gross domestic product in trillions since 2006 until 2018. And I will plot it on a chart using excel to try to realize the correlation between the gross domestic product and S&P500 index in USA.

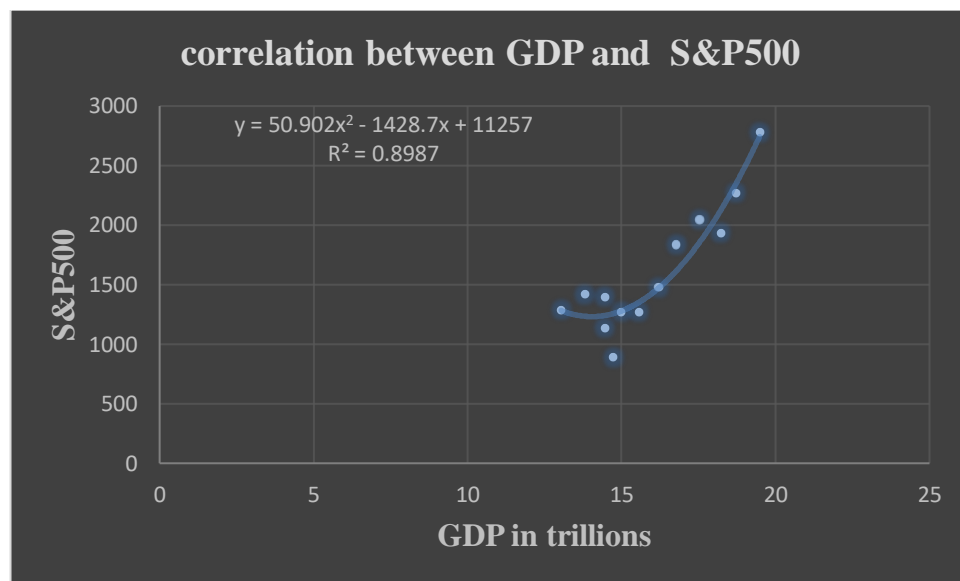
**Figure No 18: relation between GDP & S&P500**



(source: own calculation, 2019)

As we see here in (Figure 18) there is a direct proportional correlation between the gross domestic product and S&P500 index. And this is a logic correlation because when we have a good gross domestic product then it means that the economic state is performing well, and most of the companies get a high revenue which will reflect on their share prices. So, I will use excel to draw the polynomial equation curve to help me to find more accurate correlation between the GDP and S&P500 as it is mentioned in Figure 19.

**Figure No 19: polynomial correlation between GDP and S&P500**



(source: own calculation, 2019)

As we see here in figure 19 we have a high correlation ( $R^2 = 0.89$ ) so I can take advantage of this high correlation by creating a new indicator using the same polynomial equation to draw the curve equation and compare it with S&P500 index, then I can get an indicator which would help me to expect the future of S&P500 index.

### **Using GDP polynomial curve as an indicator**

Now I will plot the values of my anticipated S&P500 index values up on the GDP polynomial equation curve I got with the real S&P500 values and use this curve as an indicator. I will take the values from table 3 after calculating it using excel.

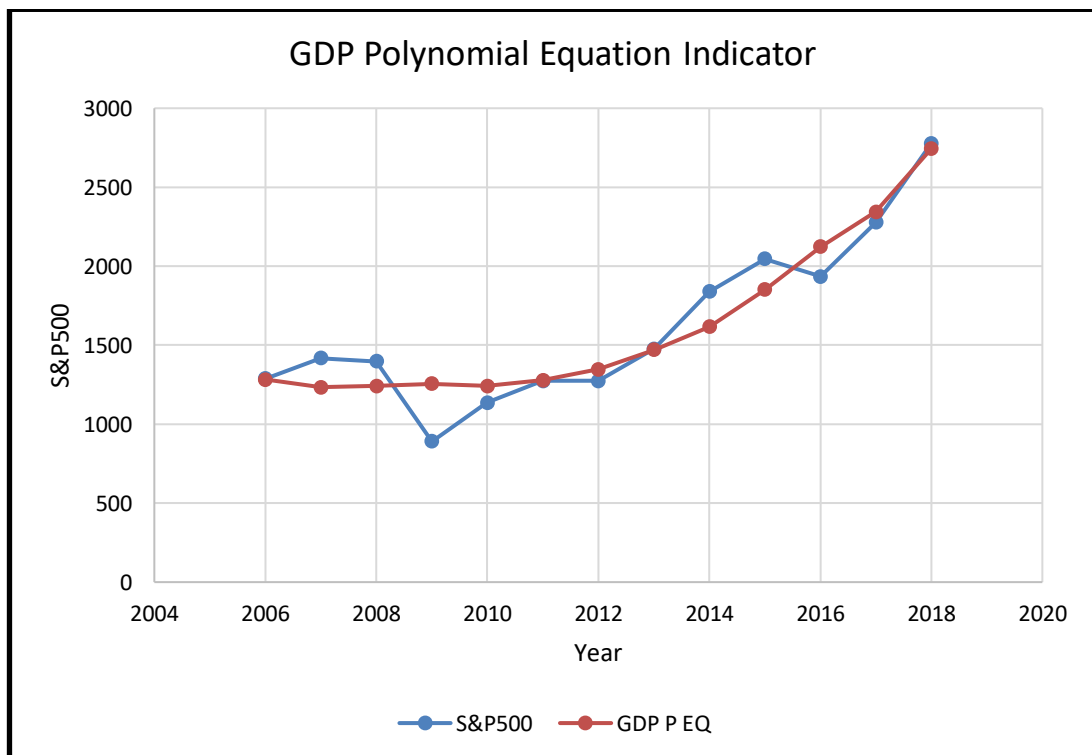


**Table No 3: the values of the anticipated S&P500 index values up on the polynomial curve equation with GDP and the real S&P500 data**

Year	GDP (tr)	S&P500	Anticipated S&P500 values up on GDP polynomial curve
2006	13.037	1288.43	1282.514
2007	13.815	1416.79	1234.371
2008	14.452	1398.01	1240.835
2009	14.713	890	1255.413
2010	14.449	1136.62	1240.708
2011	14.992	1274.3	1278.666
2012	15.543	1274.3	1347.868
2013	16.197	1475.91	1470.12
2014	16.785	1839.98	1617.208
2015	17.522	2046.86	1851.275
2016	18.219	1934.64	2123.515
2017	18.707	2276.32	2343.558
2018	19.485	2777.94	2744.5

(Source: data.worldbank.org, investing.com, own calculation, 2019)

**Figure No 20: Anticipated S&P500 values of the GDP Polynomial Curve with the real S&P500 index**



(source: own calculation, 2019)

As we see here in figure 20, I assumed in the beginning that the GDP is influencing the stock market index. So, when my GDP polynomial curve breaks S&P500 up then it is a positive signal for the stock market index and when GDP polynomial curve breaks S&P500 index down then it is a negative signal for the stock market index. So, I'm basically assuming that the GDP polynomial curve is leading S&P500 index. I will discuss it more in detail in the following examples. When my GDP polynomial curve breaks S&P500 index line up in the beginning of 2009 (the economic crisis time 2008-2009) it was a signal that the S&P500 value went lower than the real value which it supposed to reach (theoretically it has to be on the GDP line which reflect the real economic growth strength by GDP) so it was a positive signal for investors to get rid of the panic state they had at this time and to start to come back to invest in the stock market again. So, it was a positive signal for investors and during this year of 2009 the S&P500 index achieved profit of 27.5% from 1/1/2009 till 31/12/2009.

Also, I can see another positive signal in the beginning of 2012 and S&P500 achieved profit of 16.8% from 1/1/2012 until 31/12/2012.

There are two negative signals when the GDP polynomial curve broke S&P500 down since the beginning of 2014 till the beginning of 2015 which means that we don't have to rely on this indicator directly once we see a negative signal maybe it could take long time until it has a reflection on the stock market as we see the market was doing well at 2014 but after the beginning of 2015 with the continuity of my negative signal it started to reflect on the index and the index lost %6 of its value from 1/1/2015 till 31/12/2015.

Then there was a positive signal in the beginning of 2016 and the index had a profit of 17.9% during this year from 1/1/2016 till 31/12/2016.

So, as we see I have a good indicator which could help me and investors as well to check the status of the stock markets in compare with the GDP level and use it to take investment decisions.

## 5.2 The Relation between Unemployment and S&P500

Table No 4: unemployment data % with S&P500

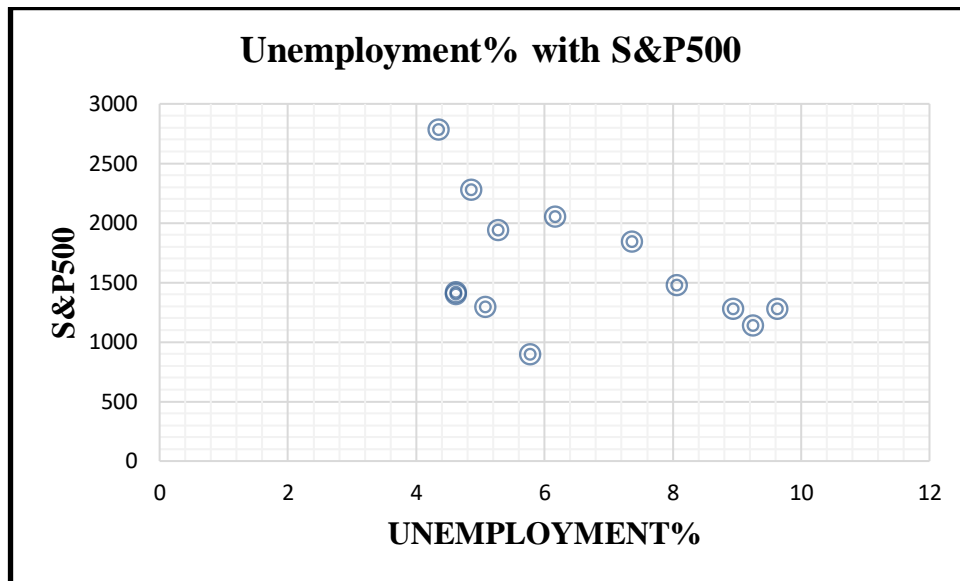
Year	Unemployment%	S&P500
2006	5.083	1288.43
2007	4.623	1416.79
2008	4.622	1398.01
2009	5.784	890
2010	9.254	1136.62
2011	9.633	1274.3
2012	8.949	1274.3
2013	8.069	1475.91
2014	7.375	1839.98
2015	6.168	2046.86
2016	5.28	1934.64
2017	4.869	2276.32
2018	4.355	2777.94

(Source: data.worldbank.org, investing.com, 2019)

As we see here in (Table 4) we have the data for unemployment rate per each year. But we have to keep in mind that I have the data for the first day per each year, for example I have the first day of year (1/1/2006) value of S&P500 index but because I still don't have the unemployment rate for this year at this time so I used the average of the unemployment rates in 2005.

Now I will plot it on a chart to try to realize the correlation.

**Figure No 21: Relation between Unemployment % and S&P500**

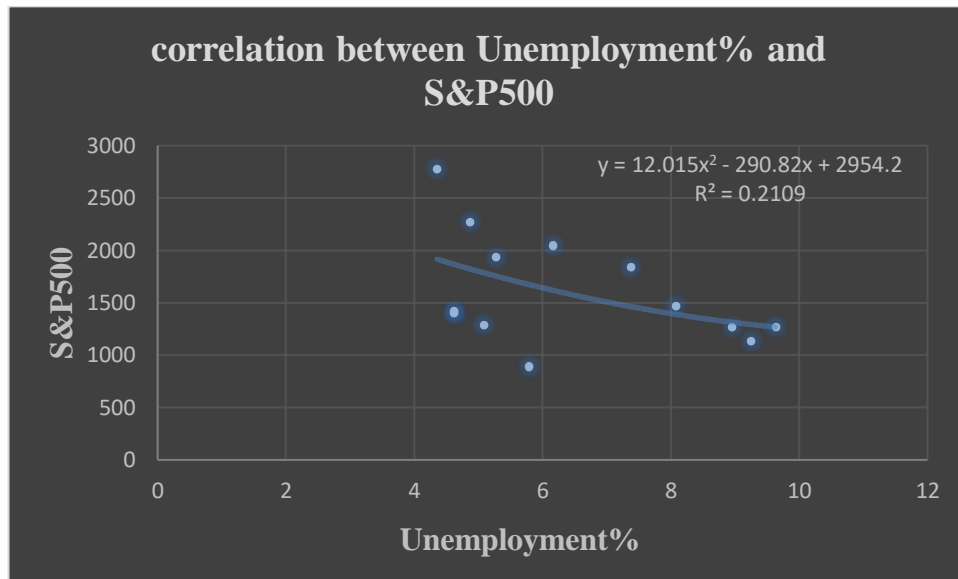


(Source: own calculation, 2019)

As we see here in Figure 21 there is an inverse correlation which I will clarify more in Figure 20 by plotting the curve of this correlation. And it is logic to have this inverse correlation because when we have low unemployment then it means that most of people are working and paying their taxes and they will have a high consumption as well which will have a good impact on the economic growth and also it will reflect on the revenues of the companies and the share prices and vice versa when we have a high unemployment.

As we see here is Figure 22, we have an inverse proportion correlation between the unemployment and S&P500 index so when we have a high unemployment, we have a lower index value.

**Figure No 22: polynomial curve correlation between Unemployment % and S&P500**



(Source: own calculation, 2019)

### 5.3 The Relation between Inflation Rate and S&P500

**Table No 5: Inflation % data with S&P500**

Year	Inflation %	S&P500
2006	3.393	1288.43
2007	3.226	1416.79
2008	2.853	1398.01
2009	3.839	890
2010	-0.356	1136.62
2011	1.64	1274.3
2012	3.157	1274.3
2013	2.069	1475.91
2014	1.465	1839.98
2015	1.622	2046.86
2016	0.119	1934.64
2017	1.262	2276.32
2018	2.13	2777.94

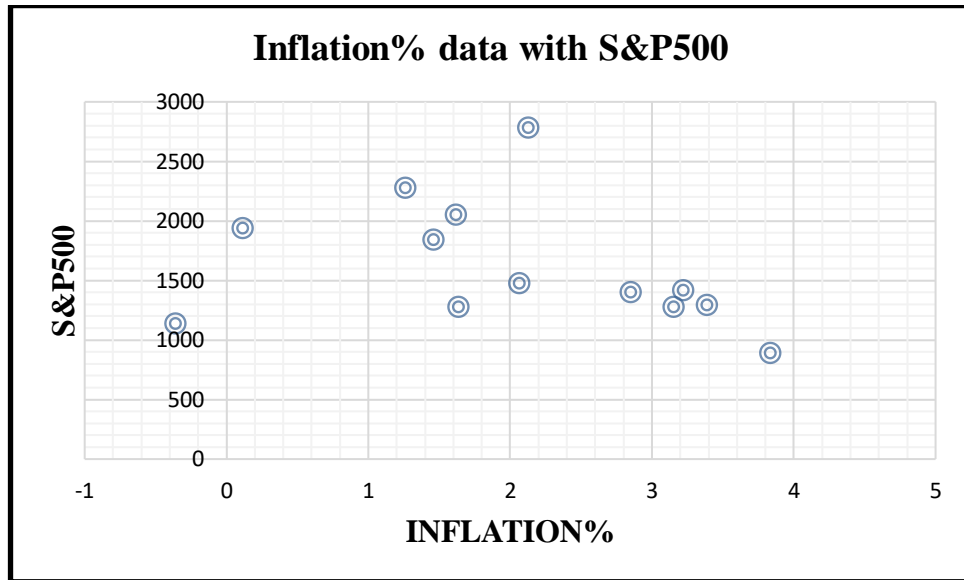
(Source: data.worldbank.org, investing.com, 2019)

As we see here in table 5 we have the inflation data for the years (2006 – 2018) and we have the annual rates of the inflation and as I mentioned before I have the data for the first day per each year which means that I have the average of the inflation for the previous year. For example, in 2006 we have S&P500 index value for the first day at

1/1/2006 so we have the average value of the inflation rates of the previous year (2005).

Now I will plot this data on the chart using excel as you see in the figure 23.

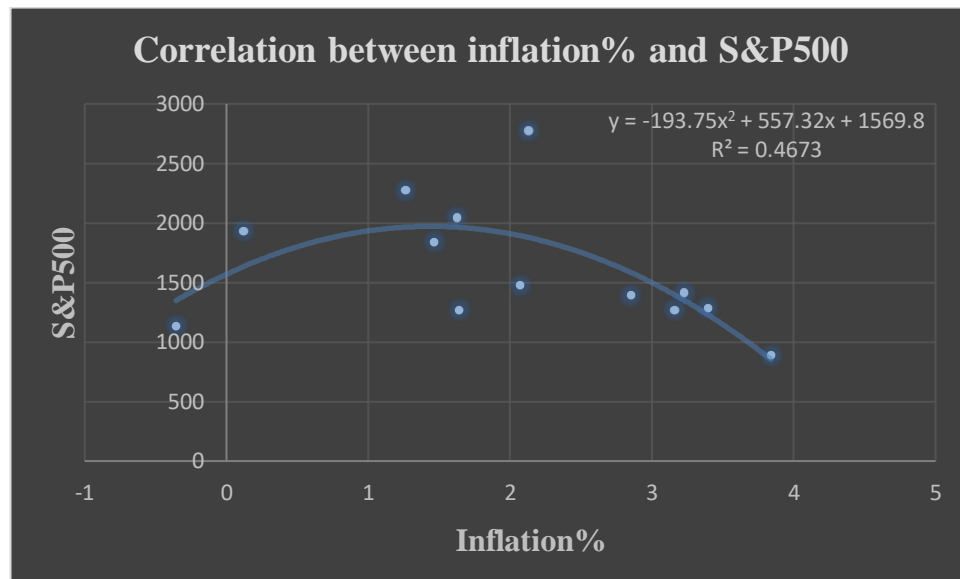
**Figure No 23: Inflation % data with S&P500**



(Source: own calculation, 2019)

As I see here the data is kind of confusing and it doesn't show inverse correlation or direct correlation. So, I will use excel to plot the polynomial curve so it would help me more to recognize the relation between the inflation rate and S&P500 index.

**Figure No 24: correlation between Inflation % and S&P500**



(source: own calculation, 2019)

Now as we see here in figure 24, it became more clear that the inflation has a direct proportional correlation with S&P500 index until some point (inflation of 1.7%) then it converted to be an inverse correlation and the reason behind this that it is healthy for the economy to have a low rate of inflation as this is what motivate people to invest because if the inflation rate is zero then it means that there is no difference between investing and keeping the money then it could cause a drop in the economy because investors will not be motivated in this case to invest so it has to be at least a little rate of inflation and the stock market index with performing very well with the inflation until it reached to 1.7%. But on the other hand as we know when the inflation rate get higher so the prices will start to become more expensive so it will influence the demand and affect the revenues of the companies so it will have a negative impact on the shares prices for this reason we saw the inflation curve after some point (after 1.7%) started to convert to an inverse correlation with S&P500 index which means that the higher inflation we have the lower S&P500 started to be.

## 5.4 The Relation between Interest rate and S&P500

**Table No 6: Interest rate % with S&P500**

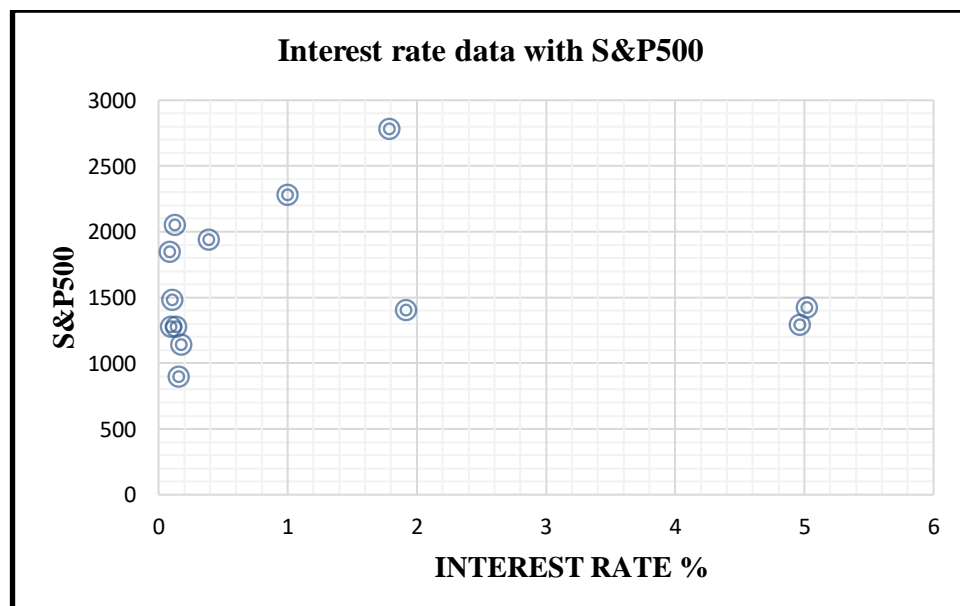
Year	Interest Rate %	S&P500
2006	4.97	1288.43
2007	5.02	1416.79
2008	1.92	1398.01
2009	0.16	890
2010	0.18	1136.62
2011	0.1	1274.3
2012	0.14	1274.3
2013	0.11	1475.91
2014	0.09	1839.98
2015	0.13	2046.86
2016	0.39	1934.64
2017	1	2276.32
2018	1.79	2777.94

(Source: www.macrotrends.net, investing.com, 2019)

As we see here in table 6, I gathered the interest rates for the years (2006-2018). So basically, in this table I have the recorded S&P500 data in the first day per each year with the recorded interest rate value also in the same day.

Now I will plot it on chart using excel.

**Figure No 25: Interest rate data with S&P500**



(Source: own calculation, 2019)



As we see here in figure 25 the data is not organized in any way which couldn't help me to get any kind of correlation between interest rate and S&P500 index. So, I will not rely on this chart to get any correlation but on the other hand it is known that the interest rate has an indirect relation with the stock markets as it influences the inflation rate as I explained before.

## 5.5 The Relation between Exchange rate and S&P500

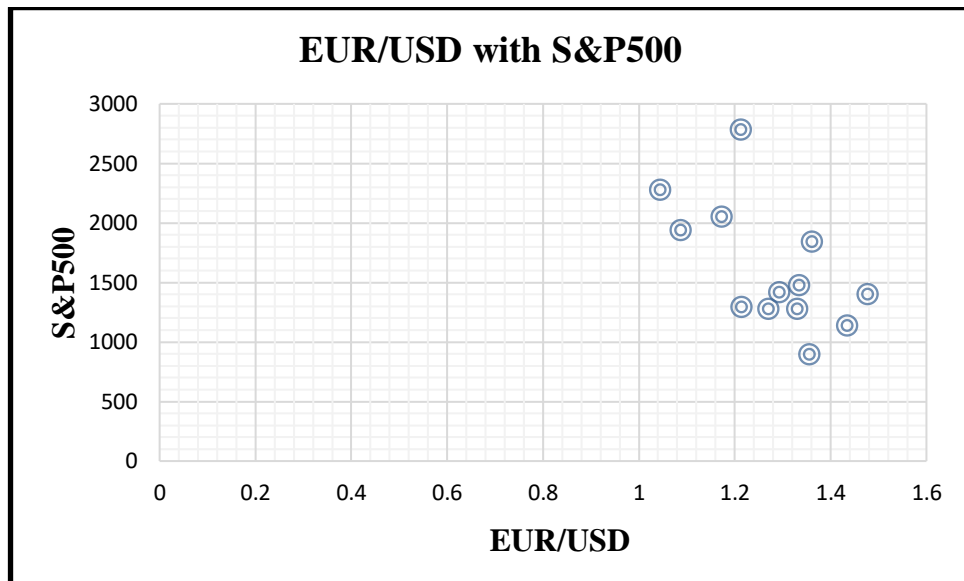
**Table No 7: Exchange rate values for EUR/USD and s&p500**

Year	Exchange Rate (EUR/USD)	S&P500
2006	1.2153	1288.43
2007	1.2936	1416.79
2008	1.4777	1398.01
2009	1.3573	890
2010	1.4351	1136.62
2011	1.3308	1274.3
2012	1.2709	1274.3
2013	1.3358	1475.91
2014	1.3621	1839.98
2015	1.1736	2046.86
2016	1.0882	1934.64
2017	1.0459	2276.32
2018	1.2142	2777.94

(Source: investing.com, 2019)

As we see in table 7, I gathered the data for the values of the first day per each year. For example, in 2006 I got the S&P500 index value and the EUR/USD exchange rate value at 1/1/2006. And I will plot it now using excel on the chart to get the correlation between the exchange rate (EUR/USD) and S&P500.

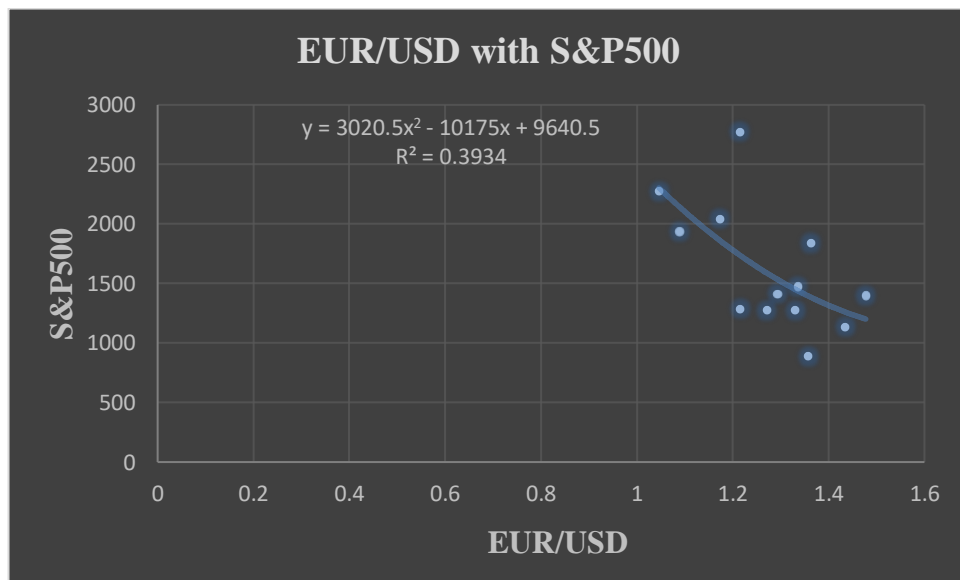
**Figure No 26: EUR/USD with S&P500**



(Source: own calculation, 2019)

As we see in figure 26, I have an inverse correlation in the chart and now, I will plot the polynomial equation using excel to help me to get the curve equation of this correlation.

**Figure No 27: Correlation between EUR/USD and S&P500**



(Source: own calculation, 2019)

As we see here in figure 27 there is an inverse correlation in the chart between the exchange rate of EUR/USD and S&P500. And this is a logic relation because when the USD currency become more depreciated then it will influence the value of the

shares prices and also some of the foreign investors would not tend to keep their investments in this country with this depreciated currency because they would rather to look for some other country with more appreciated currency to keep the value of their money then when they make profits they can avoid the loss of changing it to their appreciated currency and loose the difference for converting the currency.

## 5.6 Multiple Regression Model

Based on what I mentioned there is no doubt that every variable of the macroeconomic variables I mentioned has a direct or indirect relation with the stock market index. But now I will take advantage of this by trying to gather the macroeconomic variables I had before in a multi regression model to help me to get a concluded correlation between S&P500 index and my macroeconomic variables.

I will use excel to help me to get this multi regression model.

First, I will mention all the data I'm going to use in my multi regression model as it is mentioned in table 8.

**Table No 8: Macroeconomic variables data with S&P500**

Year	S&P500	GDP (tr)	Unemployment %	Inflation %	Interest Rate %	Exchange Rate (EUR/USD)
2006	1288.43	13.037	5.083	3.393	4.97	1.2153
2007	1416.79	13.815	4.623	3.226	5.02	1.2936
2008	1398.01	14.452	4.622	2.853	1.92	1.4777
2009	890	14.713	5.784	3.839	0.16	1.3573
2010	1136.62	14.449	9.254	-0.356	0.18	1.4351
2011	1274.3	14.992	9.633	1.64	0.1	1.3308
2012	1274.3	15.543	8.949	3.157	0.14	1.2709
2013	1475.91	16.197	8.069	2.069	0.11	1.3358
2014	1839.98	16.785	7.375	1.465	0.09	1.3621
2015	2046.86	17.522	6.168	1.622	0.13	1.1736
2016	1934.64	18.219	5.28	0.119	0.39	1.0882
2017	2276.32	18.707	4.869	1.262	1	1.0459
2018	2777.94	19.485	4.355	2.13	1.79	1.2142

(source: investing.com, data.worldbank.org, macrotrends.net, 2019)

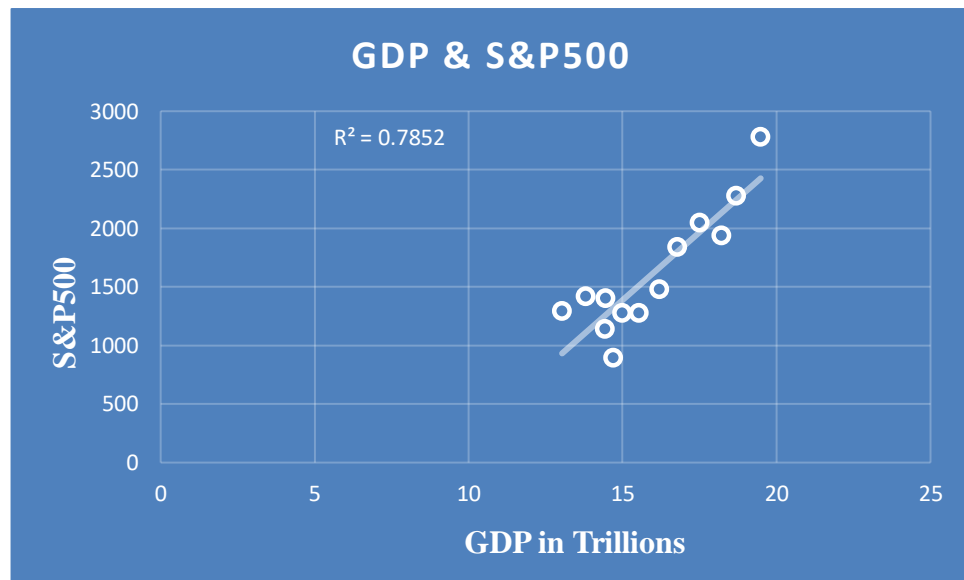
So, in this multi regression model S&P500 index is my dependent variable and GDP, unemployment, inflation, interest rate and exchange rate are my independent variables.

## Scatterplots and correlation test

First, I will assume that coefficient of determination above 0.4 is relatively strong and coefficient of determination between 0.4, 0.2 are relatively moderate and I will exclude the independent variables with a coefficient of determination lower than 0.2 as I will consider it as a weak correlation.

- **GDP:** As it is mentioned in figures 28 there was a strong coefficient of determination in the scatterplots and the linear regression model curve between the GDP and S&P500 index ( $R^2 = 0.78$ ). So, it is accepted to check it for the multi collinearity test.

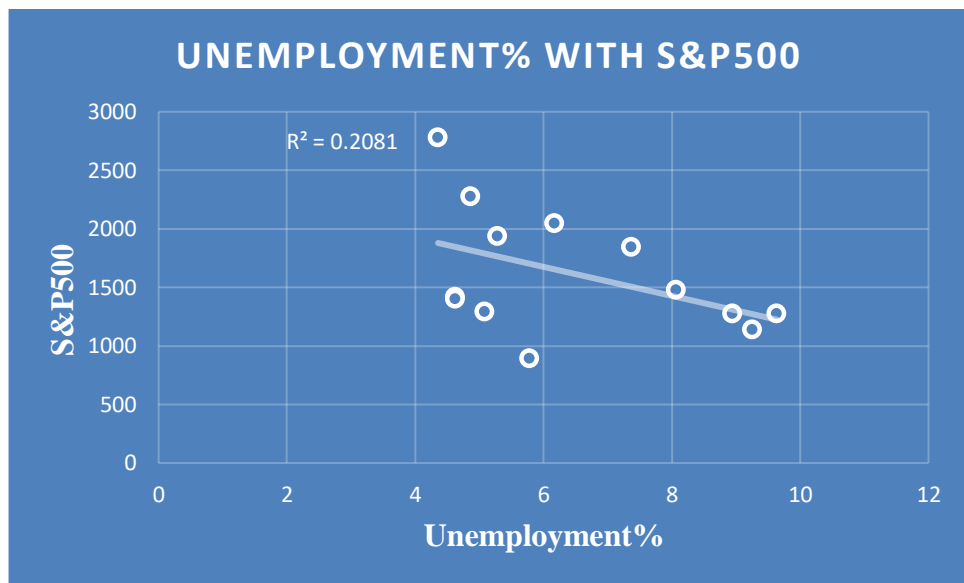
**Figure No 28: scatterplots and correlation test with GDP**



(Source: own calculation, 2019)

- **Unemployment:** also, as it is mentioned in figure 29 there was an inverse correlation between the unemployment and S&P500 index with an accepted coefficient of determination ( $R^2 = 0.21$ ). So, it is accepted to check it for the multi collinearity test.

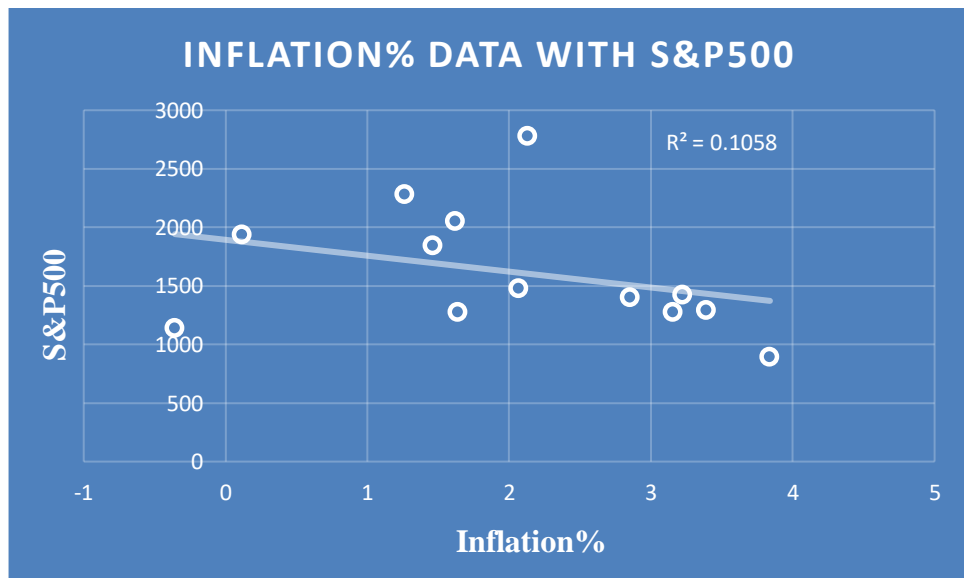
**Figure No 29: scatterplots and correlation test with unemployment**



(Source: own calculation, 2019)

- **Inflation:** as it is mentioned in figures 30 there is a weak inverse correlation between the inflation % and S&P500 with a coefficient of determination ( $R^2 = 0.1$ ). so, I will exclude this weak correlation from my multiple regression model.

**Figure No 30: scatterplots and correlation test with inflation**

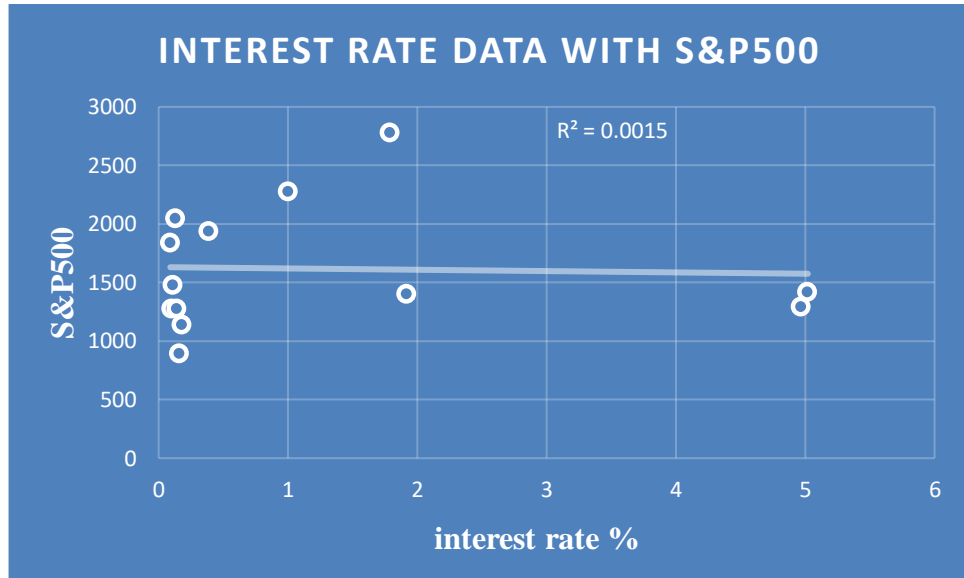


(Source: own calculation, 2019)

- **Interest rate:** as we see in figure 31 there is no clear correlation between the interest rate and S&P500 index with a weak coefficient of determination ( $R^2$

= 0.0015), so I will exclude the interest rate data from my independent variables for this multiple regression model.

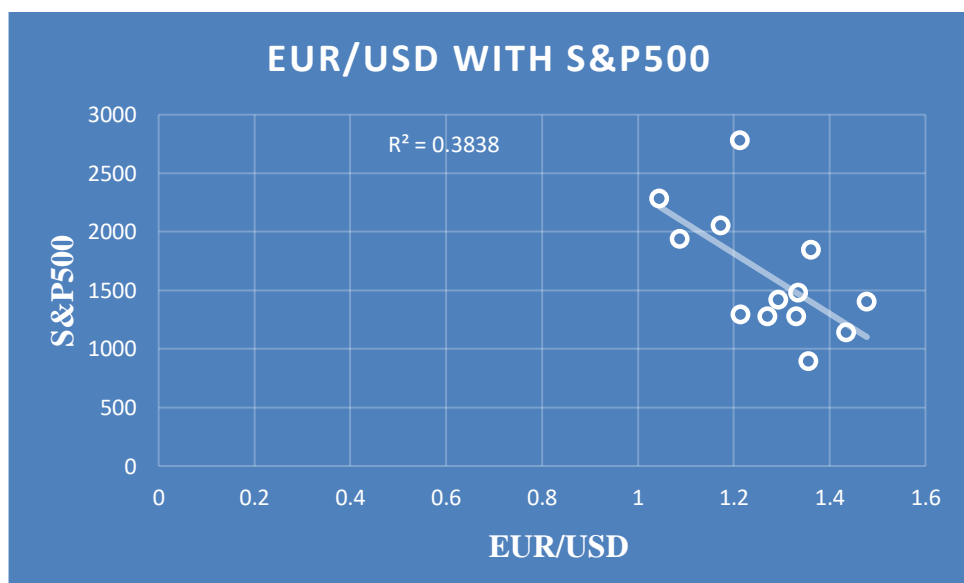
**Figure No 31: scatterplots and correlation test with interest rate**



(Source: own calculation, 2019)

- **Exchange rate (EUR/USD):** as it is mentioned in figures 32 there is an inverse correlation between the values of EUR/USD pair with S&P500 index with a coefficient of determination ( $R^2 = 0.38$ ). So, it is accepted to be checked for the multicollinearity test.

**Figure No 32: scatterplots and correlation test with exchange rate (EUR/USD)**



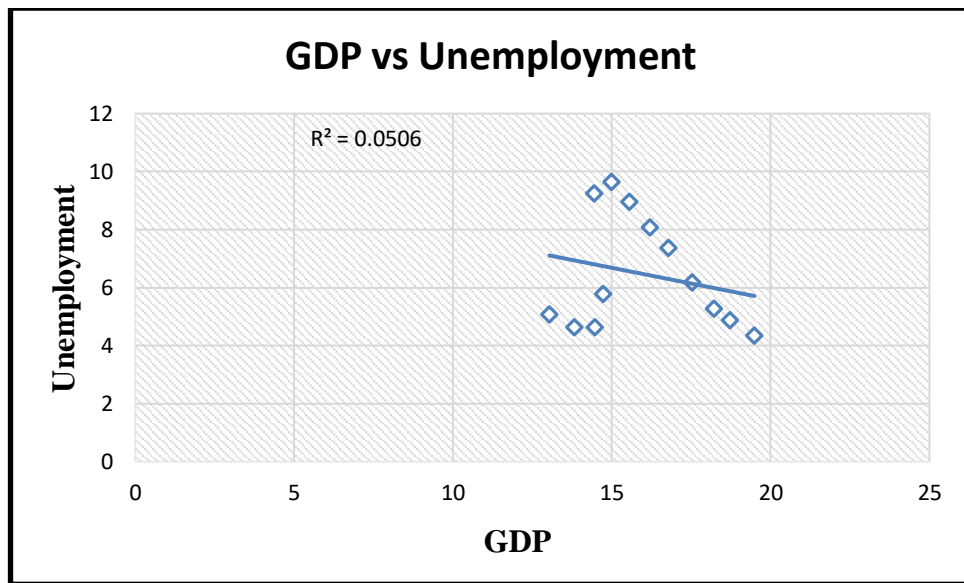
(Source: own calculation, 2019)

Now I will move to the multicollinearity test to check that there are no strong correlations among the independent variables with each other so I can make sure that results I will get will not be distorted by high multicollinearity.

### Multicollinearity test

I will assume that multi collinearity among the independent variables must not exceed 0.8 for not distorting my results of the multi regression model.

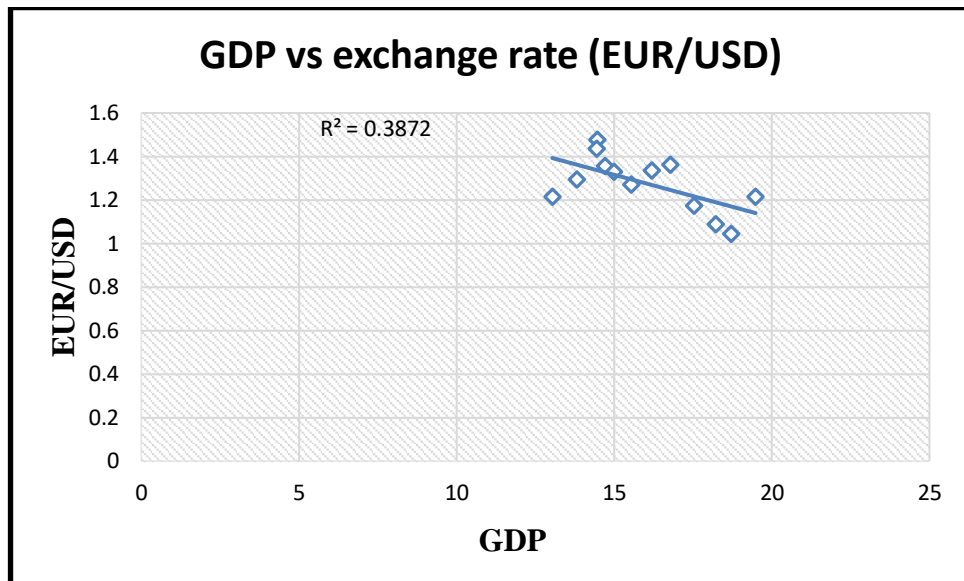
**Figure No 33: Relation between GDP and Unemployment.**



(Source: own calculation, 2019)

No multicollinearity

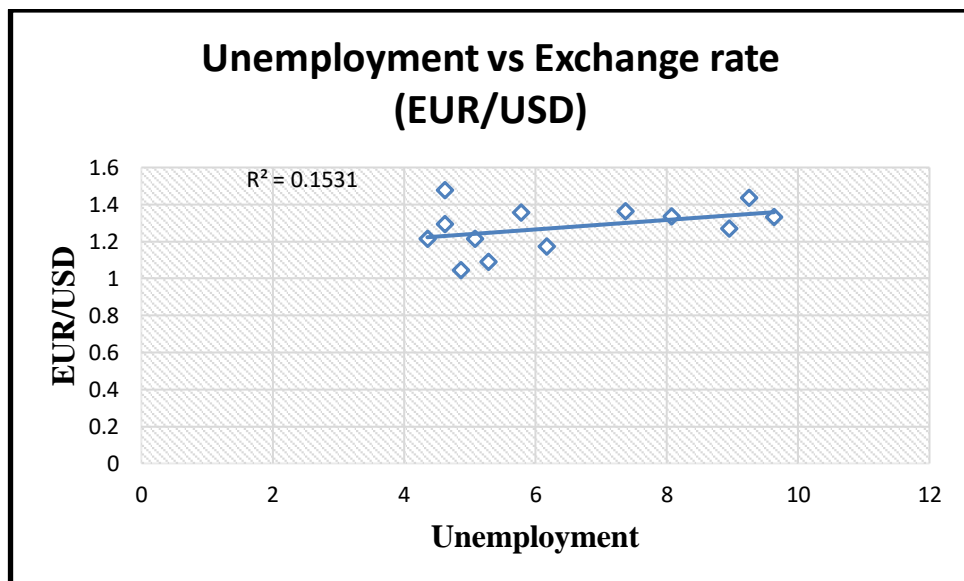
**Figure No 34: Relation between GDP and Exchange rate (EUR/USD)**



(Source: own calculation, 2019)

No multicollinearity

**Figure No 35: Relation between Unemployment % and Exchange rate (EUR/USD)**



(Source: own calculation, 2019)

No multicollinearity

As we see there is no high multicollinearity among the available independent variables so it is ok to use those macroeconomic variables in my multiple regression model and I don't need to be worry for the results I will get.



So now based on the results I got I will use the dependent variable of S&P500 index values with the independent variables of GDP, Unemployment and the Exchange rate (EUR/USD) as it is mentioned in table 9.

**Table No 9: The dependent variable and the independent variables for the multi regression mode**

Year	S&P500	GDP (tr)	Unemployment %	EUR/USD
2006	1288.43	13.037	5.083	1.2153
2007	1416.79	13.815	4.623	1.2936
2008	1398.01	14.452	4.622	1.4777
2009	890	14.713	5.784	1.3573
2010	1136.62	14.449	9.254	1.4351
2011	1274.3	14.992	9.633	1.3308
2012	1274.3	15.543	8.949	1.2709
2013	1475.91	16.197	8.069	1.3358
2014	1839.98	16.785	7.375	1.3621
2015	2046.86	17.522	6.168	1.1736
2016	1934.64	18.219	5.28	1.0882
2017	2276.32	18.707	4.869	1.0459
2018	2777.94	19.485	4.355	1.2142

(Source: data.worldbank.org, investing.com, 2019)

Then I will use those data to get my multiple regression model with excel and this is my multiple regression model details:

**Table No 10: Multiple Regression Model in Excel**

SUMMARY OUTPUT					
<i>Regression Statistics</i>					
Multiple R	0.924452				
R Square	0.854612				
Adjusted R Square	0.806149				
Standard Error	231.8636				
Observations	13				
<i>ANOVA</i>					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	3	2844112	948037.4	17.63438	0.000414
Residual	9	483846.7	53760.74		

Total	12	3327959						
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	-1357.8	1392.856	-0.97483	0.355117	-4508.66	1793.064	-4508.66	1793.064
GDP (tr)	215.8835	42.49959	5.07966	0.000663	119.7427	312.0242	119.7427	312.0242
Unemp %	-73.4736	37.55308	-1.95653	0.082102	-158.425	11.47741	-158.425	11.47741
EUR/USD	-1.66845	713.8262	-0.00234	0.998186	-1616.46	1613.119	-1616.46	1613.119

(Source: own calculation, 2019)

So, as we see my new multiple regression model equation is:

$$Y = 215.8835X_1 - 73.4736X_2 - 1.66845X_3 - 1357.8 \quad (11)$$

When: Y = S&P500, X<sub>1</sub> = GDP, X<sub>2</sub> = Unemployment %, X<sub>3</sub> = Exchange rate (EUR/USD)

Also, as we see we have high correlation in this multi regression model with a coefficient of determination ( $R^2 = 0.85$ ) which means that 85% of our anticipated results for S&P500 index values through this equation will be matching with the real S&P500 index values. So, we can take advantage of this to plot this multiple regression model on a chart with the real S&P500 index values to use it as an indicator as I did before with the GDP polynomial equation curve.

So, using this equation we got the anticipated data of S&P500 index values from the multiple regression model also I mentioned the residuals (the difference between the real S&P500 index values and the anticipated values we got from the regression model) as it is mentioned in table 11.

**Table No 11: The real values, anticipated values of S&P500 and the residuals**

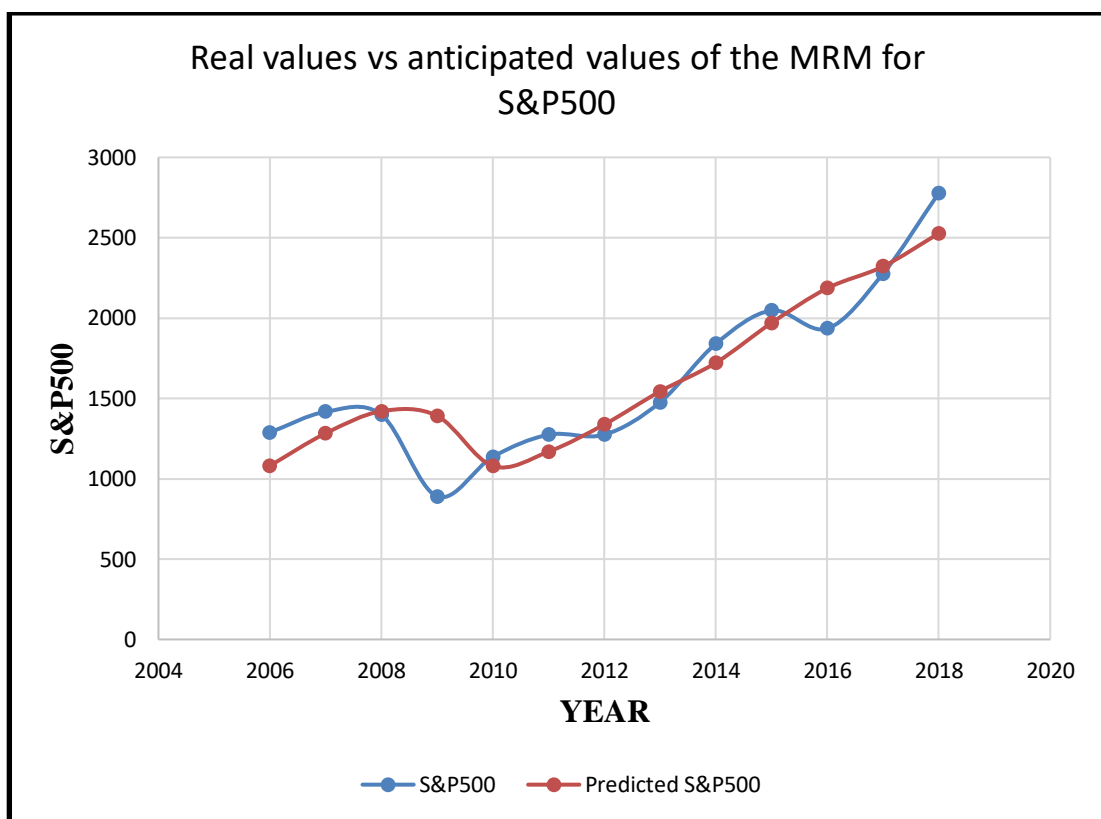
Year	S&P500	Predicted S&P500	Residuals
2006	1288.43	1081.183	207.247
2007	1416.79	1282.808	133.9825
2008	1398.01	1420.092	-22.0816
2009	890	1391.262	-501.262
2010	1136.62	1079.185	57.43456
2011	1274.3	1168.738	105.5623
2012	1274.3	1338.045	-63.7453
2013	1475.91	1543.782	-67.8716
2014	1839.98	1721.668	118.3122

2015	2046.86	1969.771	77.08894
2016	1934.64	2185.629	-250.989
2017	2276.32	2321.248	-44.9282
2018	2777.94	2526.69	251.2499

(Source: investing.com, own calculation, 2019)

Now I will plot the real values of S&P500 index and the anticipated values I got from the multiple regression model on a curve using excel so I can use the multiple regression model curve as a leading indicator for the real S&P500 index values as it is mentioned in figure 36.

**Figure No 36: Real S&P500 with the anticipated values**



(Source: own calculation, 2019)

As I mentioned I will use my multiple regression model curve as a leading indicator so when my MRM curve breaks the real S&P500 index up then it is a positive signal and when it breaks the index down then it is a negative signal. So, I can observe that when my MRM curve broke S&P500 index up in the beginning of 2009 during the economic crisis it was a positive signal and this is what really happened as we know S&P500 index had an average profit of 27.6% during the period since 1/1/2009 till 31/12/2009.

Also I would like to mention that when my MRM curve is near to S&P500 index or almost touches it (as we see in 2010) then it means that the anticipated index value by the MRM curve is equal to the real index value (which means my residual value could be neglected (near to Zero) then at this point I can't expect what would happen in S&P500 index as there is no clear indication in this case because my indicator is only useful when there is a big difference between the real value of S&P500 and the anticipated value of S&P500 up on my multiple regression model curve as the MRM curve has a magnetic power to pull the index line towards it.

So, I can summarize the previous point as if I have my curve near to the index or touching the index then I will not rely on this even if my curve is a little bit lower or above the index.

But when there is a big difference between the index and the curve then I can put in consider the signal I have. As we see in the beginning of 2016 there was a positive signal when the MRM curve broke S&P500 up and this is what reflected on the performance of S&P500 index during the period from 1/1/2016 until 31/12/2016 as the index got a profit of 19.7% during this year.

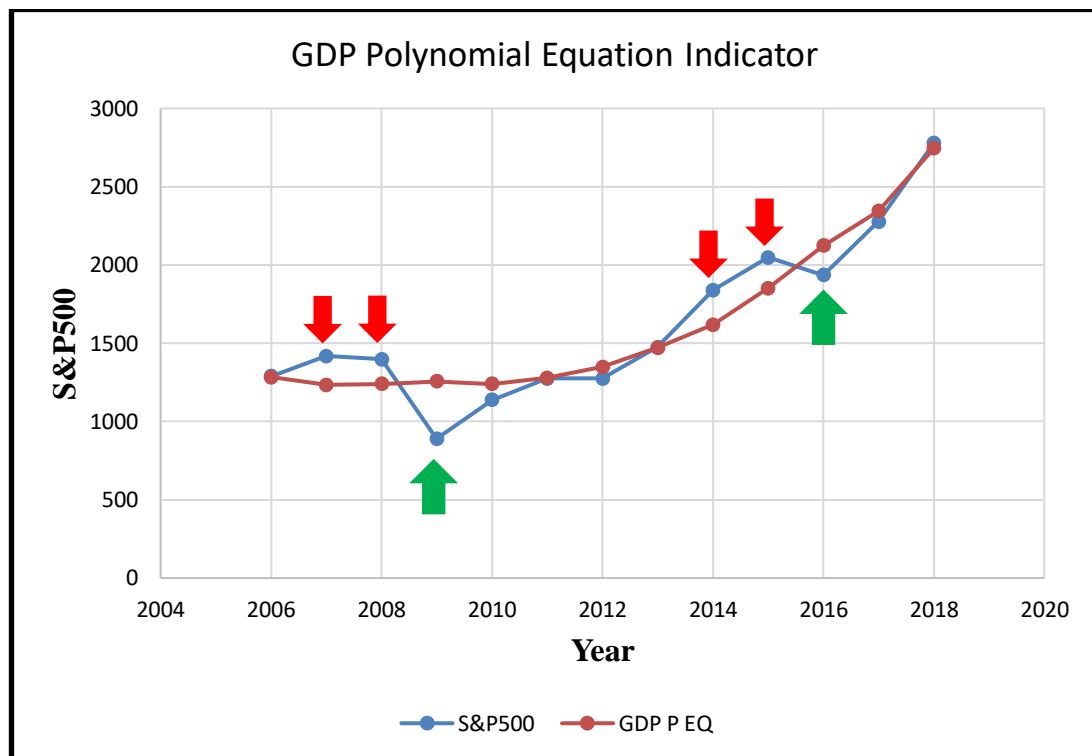
We have also a negative signal in the beginning of 2018 when the MRM curve broke S&P500 down so this is what reflected on the performance of S&P500 index during 2018 from 1/1/2018 till 31/12/2018 and the index lost 5% of its initial value in the beginning of the year.

## 6 Discussion of the Results

I will get deeper in discussing the results and interpreting the charts and the indicators I got from the polynomial curve of the GDP and the multiple regression model curve.

### 6.1 Gross Domestic Product polynomial curve indicator

**Figure No 37: Anticipated S&P500 values of the GDP polynomial curve with the real S&P500 Index values**



(Source: own calculation, 2019)

As we see in figure 37, This is my anticipated S&P500 values up on the polynomial curve which I got from the relation between the GDP and S&P500 index and to interpret this curve more we have to understand that by creating this polynomial equation (the orange curve) it gives me the capability to compare between the real S&P500 index and the anticipated values of S&P500 index up on my new polynomial curve which represent the relation between the GDP for USA and S&P500 index. So now I have a real connection between the stock markets and one of the most important macroeconomic variables.

As long as the GDP is reflecting the strength of the economy and S&P500 index which reflects the strength of the stock market then we have a real direct indicator which would show the economic strength and compare it with the stock markets activity.

As I explained before when my anticipated S&P500 values of the GDP polynomial curve breaks the real S&P500 index curve up then it is a positive signal and the reason behind this that this curve connect between the GDP and S&P500 so when this polynomial curve breaks the real S&P500 index curve up then it means that it was expected for the real S&P500 index to reach higher level or perform better in terms of the relation between the GDP and S&P500 index we have. also, it means that the GDP value was supposed to cause a stronger performance in the S&P500 index than the real activity of the stock market which already happened during the previous year. In this case also the performance of the anticipated S&P500 values reflect that it is expected for the revenues which already represented by the good GDP level to be represented in a better performance in the real S&P500 index so the real S&P500 index didn't express this very well in the previous year because as we see the index of the real S&P500 is still lower than the expected value of the S&P500 of the polynomial curve which connection between the GDP and the index. So, in this case investors would realize that there is still chances for the share prices to increase more to express the real status of the economy and the level of the GDP. So, I can interpret this in my curve by the tendency of the anticipated S&P500 curve to pull the real S&P500 index towards the polynomial curve as we see in the mentioned arrows in my figure.

This is what happened after the positive signal in the beginning of 2009 which reflected on the market after this as the index had a profit of 27.5% approximately from 1/1/2009 till 31/12/2009. It is important also to mention that the fundamental reason behind the good performance of the index at 2009 that many banks and many countries started to take real steps to avoid getting in another crisis as what happened in the end of 2008 and the beginning of 2009 (BBC, 2019).

Also, it happened in the beginning of 2016 then it reflected on the index winnings as the index had a profit of 17.9% during this year from 1/1/2016 till 31/12/2016. also here it is important to mention that the fundamental reason behind the good performance of the index at 2016 that after the American election at 2016 many stock

markets sectors started to perform very well which cause this increase in the stock market index (Reuters, 2019).

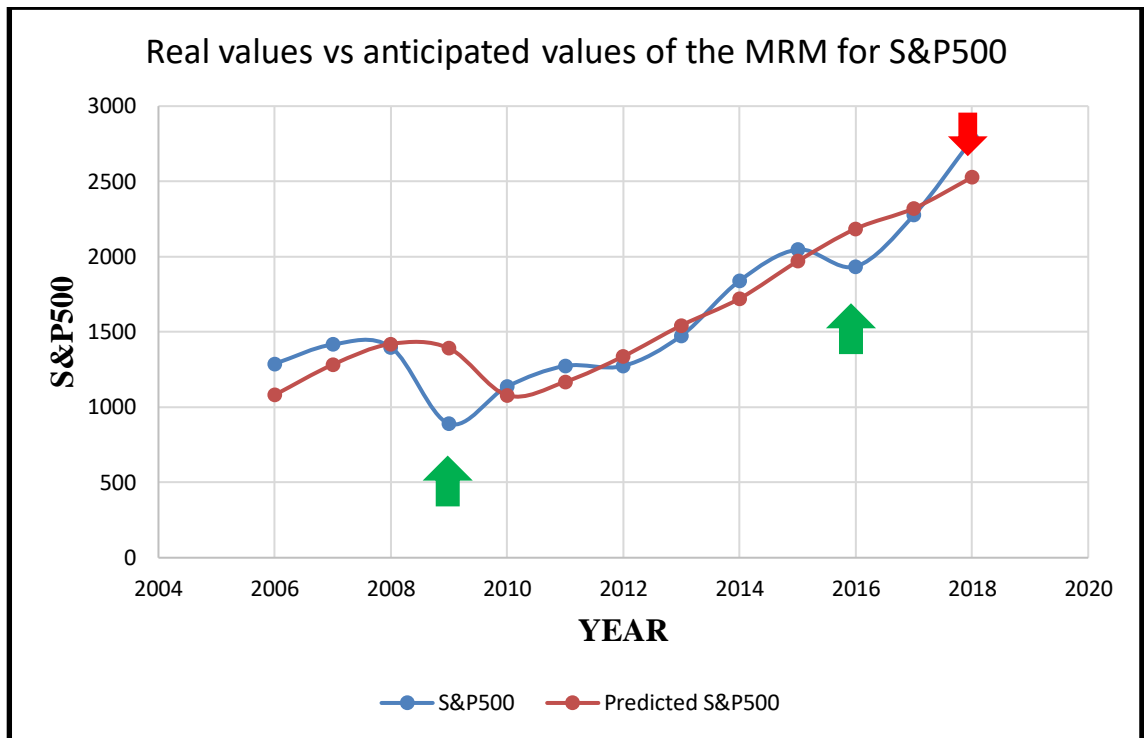
On the other hand when the expected S&P500 value of the GDP polynomial curve is lower than the real S&P500 index so it would be considered as a negative signal as it means that the activity in the stock market and is much higher than the real revenues of the index companies in terms of the GDP of the previous year so as a result of this it would cause a negative impact on the stock market index after this. Also, what I need to mention as an observation that every time the anticipated S&P500 value of the GDP polynomial curve is lower than the real S&P500 for two years respectively then the real S&P500 index will perform bad after those two years. For example, as we see in the beginning of 2007, 2008 (where the red down arrows plotted) the anticipated S&P500 value of the GDP polynomial curve was lower than the real S&P500 index (negative signal) which affect the index after this during 2008 until the beginning of 2009. I have to mention also that the fundamental reason behind the economic crisis of the end of 2008 and the beginning of 2009 that it happened as a result of the policy of expanding in mortgages in the same time that the speculations about mortgages were high which caused increasing in the properties prices. this created a big gap between the salaries and the mortgages which caused the collapse of 2008 when the people who have mortgages started not to be able to pay their mortgages back (www.historyextra.com, 2019).

Also, the same signal was in the beginning of the years 2014, 2015 which influenced the real S&P500 index from the beginning of 2015 until the end of this year as the index lost %6 of its value from 1/1/2015 till 31/12/2015. And the fundamental reason for the bad performance of the index during 2015 that the prices of the stocks were very expensive as it has 5 years of respective increasing which discourage investors to buy more at this high levels of prices and this what caused also a loss in S&P500 index by about 6% (money.cnn.com, 2019).

Again I need to mention and explain that when the anticipated value of S&P500 of the GDP polynomial curve touches the real S&P500 index or very near to it then it couldn't provide me with any expectation for the stock market index future as the anticipated value of the index is equal to the real value of the real index.

## 6.2 Multiple regression model indicator

Figure No 38: Real S&P500 with the anticipated values of the MRM



(Source: own calculation, 2019)

Here we have the multi regression model curve for the S&P500 index as a dependent variable with the all of the GDP, unemployment % and the Exchange rate (EUR/USD) as an independent variables. Let's keep a rule for this chart when the anticipated values for the S&P500 of the multiple regression model curve for the mentioned macroeconomic variables is above the real index then it is a positive signal for the stock market. The reason behind this that when my MRM curve is above the real index then it means that it was expected for the real S&P500 index to be at this higher level but the real S&P500 didn't represent the real status of the economy (represented by the three mentioned macroeconomic variables) in terms of the correlation between the index and the three mentioned macroeconomic variables. So, I assume that the tendency for the stock market to move towards the direction of the MRM curve which has a magnetic power for the real S&P500 index curve. So it tells me that the index most likely will move up and this is what happened in the beginning of 2009 as we see we had a positive signal in the beginning of 2009 and this is what reflected on the good performance of the index from 1/1/2009 till 31/12/2009 as the index has an average profit of 28.7% of its initial value in the beginning of the year 2009. Also as



I mention before the fundamental reason for the good performance at 2009 was many banks and many countries started to take real steps to avoid getting in another crisis as what happened in the end of 2008 and the beginning of 2009 (BBC, 2019).

Also, we have a positive signal in the beginning of 2016 when the MRM curve broke the index up then it reflected also on the performance of the real S&P500 index since 1/1/2016 until 31/12/2016 as the index had an average profit of 17.9%. also, as I mentioned before it was supported by the increasing of the different sectors of the stock markets after the American elections at 2016 (Reuters, 2019).

And when the MRM curve breaks the index down then it is considered as a negative signal as it means that the expected point for the real S&P500 was supposed to be lower than its current value up on the correlation between the S&P500 and the three mentioned macroeconomic independent variables. And we have a negative signal in the beginning of 2018, and this is what reflected on the performance of the index during this year from 1/1/2018 till 31/12/2018 as the index almost lost 5% of its initial value. Also, I have to mention that the fundamental reason behind the bad performance of the index at 2018 is the beginning of the trade war between china and USA after imposing higher tariffs on the imports from china to USA. (CNBC, 2019).

Also I need to mention that when the MRM curve touches or near to S&P500 index then it means that the real value of the index is near to the anticipated value (the residual is near to zero) so it couldn't provide me with any indication for the stock market index future and this is what we have during the years of 2010, 2011, 2012, 2013, 2014 and 2015.

## 7 Conclusion

Connecting between some of the macroeconomic variables and the stock market index S&P500 helped for creating a new kind of equations and charts which reflect the real relation between the macroeconomic variables and the stock market index.

There is a direct proportional correlation between the GDP and the stock market so the higher GDP we have the more positive influence on the stock market we can expect as the GDP reflect the real economic productivity so it has a good reflection on the company's revenues then its share prices. and this relation helped me to develop a new technical indicator by plotting the anticipated S&P500 index values of my new GDP polynomial equation which represent the relation between the GDP and the stock market index S&P500 which has a magnetic power for the real S&P500 index line so it could help the investors to expect the future of the stock market index.

There is an inverse proportional correlation between the unemployment rate and the stock market S&P500 index so the higher unemployment we have the more negative effect it could cause in the stock market.

The interest rate in general has an indirect effect on the stock market so the lower interest rate is more profitable and useful for the stock markets and for stimulating the economy in general but this effect just has a short term on the stock markets because if it has been kept so low for long time then it would cause high inflation.

There is a direct proportional correlation between the inflation and the stock market until a certain point which is (1.7 %) in my calculations for the years 2006 – 2018 and after this the relation will convert to be an inverse correlation because it will start to affect the prices of the products and the services so it will affect the purchasing power of the people and their demand so it will have a negative impact on the revenues of the companies then there share prices.

There is an inverse proportional correlation between the exchange rate (EUR/USD) and the stock market and this relation is logic because the more depreciated currency we have the more negative effect it could cause to the stock market. as most of the foreign investors would change their investing destination to avoid the loss they get

after getting their money converted to their local currency and also, they would tend to keep their savings in some other appreciated currency.

After creating the new multiple regression model which gathered the GDP, unemployment and the exchange rate (EUR/USD) as an independent variables and S&P500 index as a dependent variable it creates a chart which reflected the real relation between the stock market index S&P500 and the new MRM for the anticipated values of S&P500 and this helped for using it as a technical indicator which has a magnetic power for the real index line which could facilitate and help the investors to expect the future of the value for S&P500.

Finally, the same analysis could be applied on other stock markets which could help investors everywhere to have their investment decisions in the light of connecting their decisions with the mentioned macroeconomic variables.

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