Impact of macroeconomic variables on stock prices in Austria

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AFFIDAVIT

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ABSTRACT

The relationship between macroeconomic variables and the stock market has been the focus of study for many years. However, whether macroeconomic variables determine stock market prices is still open to debate. Additionally, research has suggested that some macroeconomic variables influence others. As a result, it aims to analyze the relationship between stock market prices and macroeconomic variables in Austria. The stock market is represented by the Austrian Traded Index (ATX) and 10 individual stocks within the index. Moreover, the key macroeconomic variables in this study are four different categories of unemployment and inflation.

A correlation analysis, time-series analysis, and Granger causality analysis have been conducted to show whether there is a link between these variables in the long and short run. Figures suggest that unemployment for women and inflation have a long-run relationship with stock prices. The same applies mostly to all other macroeconomic variables, whereas it always applies to the ATX index. Hence, it holds true for the Austrian market as a whole. Furthermore, figures suggest that only a few of the individual stocks have a short-run relationship with the macroeconomic variables. In addition, a Granger causality test has shown that macroeconomic variables do not Granger cause stock prices in general.

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LIST OF ABBREVIATIONS

AMS	Public Employment Service Austria
ANDR	Andritz AG
ATX	Austrian Traded Index
CAI	CA Immobilien Anlagen AG
CPI	Consumer Price Index
EBS	Erste Group Bank AG
OMV	OMV AG
POST	Österreichische Post AG
RBI	Raiffeisen Bank International AG
TKA	Telekom Austria AG
VAR	Vector autoregression
VECM	Vector Error Correction Model
VIG	Vienna Insurance Group AG
VOE	voestalpine AG
WIE	Wienerberger AG

1 INTRODUCTION

The relationship between macroeconomic variables and the stock market is an interesting as well as a debatable topic. However, unemployment and inflation seem to have the highest degrees of interest. The reasons are quite simple. Corporations need a healthy and stable economy, where it is possible to limit uncertainty. To keep purchases up individuals are needed to buy products. This is at risk if unemployment gets up and people start saving. Sector-specific unemployment indeed has a higher effect on stocks in the same field. Still, overall purchasing capacity will decline and thus will also influence the performance in other sectors.

Inflation has many influences. First and foremost, it tells us to which extent products get more expensive or cheaper. Hence, it influences our buying behavior in a way that we make some purchases earlier or wait a little bit longer. On the other hand, employees will seek for higher salaries to compensate their losses in case of inflation, at the same time companies will increase their prices even further in order to keep the same profitability as before.

The observation period was taken to minimize the influence of crises such as the financial crises or the COVID-19 pandemic. Furthermore, monthly data was most accurate as it even out daily volatility and provides enough observation points to receive trustworthy data in statistical tests such as time series analysis.

Focusing solely on Austrian data might not be completely accurate as listed corporations act also internationally. However, most of the companies that are part of the ATX have a strong focus on Austria. That is why Austrian indicators should provide the most accurate results.

2 LITERATURE REVIEW

Investment strategies involve cross-disciplinary insights from finance, economics, and business (McGee, 2015). Economics provides many insights as it covers a wide spectrum including the business cycle and the macroeconomy, which affects monetary and fiscal policies. Moreover, an asset manager must consider macroeconomic factors because it gives a first indication of how a market should perform on certain assets (Ang, 2014). In general, it can be seen that risky assets perform poorly and show higher volatility during periods of low economic growth (Wharton, 2004).

This thesis focuses on two macroeconomic factors: unemployment and inflation. Research suggests that unemployment should influence inflation and subsequently inflation influences stock returns.

Both factors are well studied and therefore provide models, which help to interpret the results. Nonetheless, the theory holds not always true as well as changes over time. That is why researchers include new variables in order to provide new insights and takle economic and social changes.

2.1 Unemployment

Definitions about unemployment vary, due to many reasons, but it always occurs when a person who is actively searching for employment is unable to find work. The reasons for unemployment are diverse and will be explained later in more detail. Even though unemployment is usually not a highly discussed topic it provides much information and thus can be seen as a measure of the health of the economy. For example, high rates of unemployment might be a sign of economic distress, which in the worst-case leads to social crises and political tensions.

2.1.1 Types Of Unemployment

Unemployment can have many reasons. Many people just distinguish between voluntary and involuntary, but this is definitely not accurate enough. To explain the unemployment situation, it is crucial to understand various types of unemployment.

It is true that based on literature an undefined number of types exist. However, this thesis focuses on the three main types, one additional type (considered as a big factor in Austria) and explains natural unemployment.

2.1.1.1 Cyclical Unemployment

Cyclical unemployment is caused by economic upturn and downturns. During a recession, the demand for goods and services falls dramatically, and unemployment rises at the same time. In

contrast, during a period of economic growth unemployment declines due to higher demand for goods and services. (Amadeo, 2020)

It is crucial that the government makes use of policy tools such as stimulus packages. Otherwise, the economy is running into a downward spiral, where demand is shrinking because of the lack of money to purchase goods and services. (Amadeo, 2020)

2.1.1.2 Frictional Unemployment

Frictional unemployment occurs when people leave their job without having found a new one, so it naturally takes time to find another employment. Furthermore, students who just graduated and search for their first job are counted to frictional unemployment. (Amadeo, 2020)

This type of unemployment is usually just for a short time even though the whole requiring process might take some time these days. However, the benefit of frictional unemployment should not be ignored. It allows everybody to move jobs and pursue their career goals. Hence, the overall productivity increases as the majority works in the field they are looking for. (Amadeo, 2020)

2.1.1.3 Structural Unemployment

Structural unemployment results from technical changes and therefore mismatch between the skills of people and the skills needed by employers. Such changes are common and visible in close to every industry. A typical example is the replacement of machinery workers with robots. (Amadeo, 2020)

In many cases, a long recession creates structural unemployment. As longer people are unemployed the more likely it is that their skills are outdated. Thus, they may stay unemployment even when the economy recovers, if they are not willing to take training or accept to take a job, which does not require substantial knowledge or expertise. (Amadeo, 2020)

The Austrian government invests heavily in retraining for unemployed people organized by the AMS. However, retraining is difficult to organize, costly, time-consuming, and leads to long-time unemployment. Furthermore, there is no job guarantee after the training and oftentimes employees start again at the beginning of their career.

2.1.1.4 Seasonal Unemployment

Seasonal unemployment results from regular changes in the seasons. There are jobs, which are basically only exist during a specific season, such as ski instructor or ice cream vendors. Many unemployment calculations exclude seasonal unemployment because it gives a more accurate estimation of unemployment. (Amadeo, 2020)

In Austria, many sectors are affected by seasonal unemployment even though slight changes are visible. The whole ski industry is present certainly only in winter. However, ski resources adopt

in a way to offer also other services outside the winter seasons, which makes it possible to provide many employments the whole year.

The construction industry was always considered a seasonal industry, but new technologies and changing climate made it possible to operate the entire year. Nonetheless, the peak time is still during warmer periods.

2.1.1.5 Natural Unemployment

Natural unemployment explains why there will always be a certain level of unemployment. Frictional and structural unemployment together represent the natural rate. People, as well as the economy, are developing, so it is impossible to avoid changes. Workers will always change their job due to various reasons. Moreover, the ongoing development results in a situation where some jobs get redundant and therefore skills are no longer needed. (Amadeo, 2020)

2.1.2 Phillips Curve

The Phillips curve is a well-known economic model describing an inverse relationship between unemployment and inflation. The popularity and importance of this model can be illustrated by the amount of appearance in books as well as in empirical studies.

2.1.2.1 Theory

In 1958, A.W. Phillips made an extraordinary discovery. He plotted the rate of inflation against the rate of unemployment (as illustrated in figure 1) and found clear evidence of a negative relationship (Blanchard & Johnson, 2012). This means that when unemployment was low, inflation was high, and vice versa. In the next year, also other researchers tested this theory and came to the same conclusion. Thus, it reached rapid importance in the macroeconomic society.

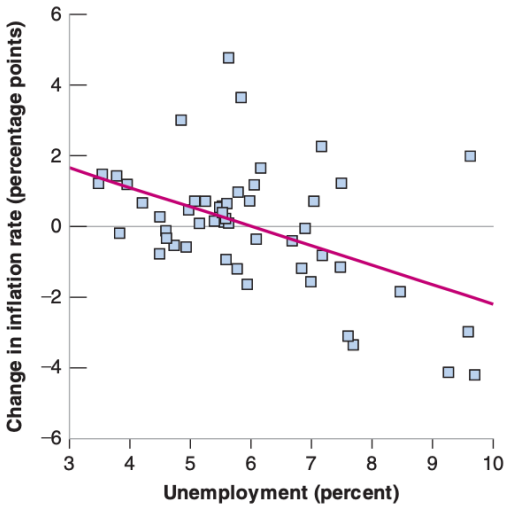


Figure 1 Changes in the inflation rate versus the unemployment rate

Source: Blanchard & Johnson, 2012

The Phillips Curve allows policymakers a new way to make decisions by just asking what is currently more important. For some countries, it could be an advantage to achieve low unemployment and thus they were willing to tolerate higher inflation – others favored stability on the price level and accepted higher unemployment. The Phillips Curve makes it possible to intervene and reach the desired outcome. (Blanchard & Johnson, 2012)

The relationship broke down in the 1970s. In the US and most OECD countries were both high inflation and high unemployment, which contract with the initial theory (Blanchard & Johnson, 2012). In retrospect, it shows that the Phillips Curve does not hold true in stagflation, which represented an economic situation that could not be explained at the time (Ferguson et al., 2010). Nowadays we know that the rapid inflation and high unemployment were a result of an oil shock caused by stagnating economic output (Ferguson et al., 2010).

The negative relationship between the two variables can be explained through supply and demand and the wage-price spiral. When the demand for workers is high and supply already low through a low unemployment rate wages will automatically increase. Further, the wage-price spiral suggests that rising wages will simultaneously result in higher prices (Blanchard & Johnson, 2012). This scenario appears due to the higher costs of production, which have to be paid by the customers. In response to higher prices, works will ask for a higher nominal wage in order to keep their level. Hence, it results in a steady wage and price inflation (Blanchard & Johnson, 2012).

The existents of high inflation and deflation result in a difficult situation as it results in a high uncertainty and therefore makes the whole situation more variable. High inflation results in wage increases at the somehow same rate but considering high inflation can be the difference higher than expected. For example, if the salaries increase 10% more than the inflation companies will struggle and some of them even go bankrupt. On the other hand, if wages increase 10% lower than the inflation the disposable income decline massively, and goods are too expensive for the people. Deflation combines many factors at once. Firstly, lowering wages is not really accepted and therefore would result in a massive dissatisfaction and thus productivity of the employees. Moreover, this uncertainty results in a situation where people reduce their spending as they expect that price decline even more. This circumstance is also called the deflation trap. (Blanchard & Johnson, 2012)

The Phillips Curve, however, is only in the short run inverse. Because employees and consumers can adapt their expectations about future inflation rate based on current unemployment and inflation values, so in other words during the adjustment phase. (Jossa & Musella, 2002)

Assuming that employees can adjust to the new environment the Phillips Curve resembles a vertical line (as illustrated in figure 2) at the natural rate of unemployment (Jossa & Musella,

2002). Natural unemployment is the minimum unemployment in an economy due to various reasons such as replacement by technology or lack of certain skills or knowledge (Nowotny & Zagler, 2009). This situation cannot be changed in our existing system as it results in flexibility of the labor markets as well as fosters a growing economy.

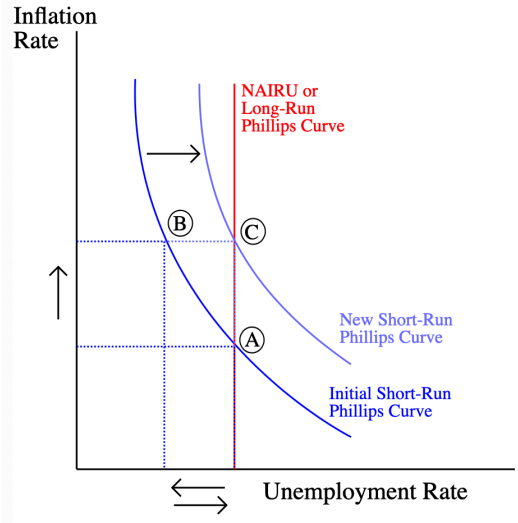


FIGURE 2 NAIRU AND PHILLIPS CURVE

Source: Boundless, n.d.

2.1.2.2 Empirical Study

The Phillips Curve is a controversial topic these days. Especially because the theory extended slightly over time as researchers include different factors in order to represent the current changes such as digitalization and globalization.

The United States for example has a low unemployment rate over the last decade. However, inflation remained at less than 2 percent. This could convince policymakers that the Phillips Curve might be a poor guideline for monetary policy. Instead, the nominal GDP could be considered as a base for a long-run strategy. (Dorn, 2020)

Many researchers investigate if the Phillips curve is still alive, especially because unemployment is below estimating of the natural rate and inflation remains below the target. It might be possible that the curve could be hibernating, and it will wake up with inflationary pressures rising in the face of an overheating labor market (Hooper et al., 2020). In the euro area, it can be seen that the Phillips curve is still alive. However, the model was slightly changed. They argue that the estimated trend of inflation could be a proxy for inflation expectation (Hindrayanto et al., 2020). Still, figures are not in every euro country significant, which also results from the general heterogeneity of several characteristics such as differences in the labor market (Hindrayanto et al., 2020). Still, most researchers agree that structural changes result in non-linearities and therefore the presence of the Phillips Curve is not visible at the first sight. Furthermore, many

other factors influence the labor market and inflation, which makes it even more difficult considering the increasing globalization.

The Phillips Curve model finds also importance in Austria and therefore is considered in the decisions of policymakers. A test of the Phillips Curve between 1964 and 1981 shows that the models hold in the long run. Especially the influence of social partners allows a stable relationship between inflation and unemployment due to the reduction of uncertainty (Wörgötterr, 1983). On the other hand, a study with data from 1949 to 2009 illustrates a positive relationship between inflation unemployment in the long run (Mulligan, 2011). Therefore, policymakers should embrace a goal of zero inflation in order to reach lower unemployment (Mulligan, 2011). However, data for all time frames were not fully available and therefore results might change.

2.1.3 Okun's Law

Okun's law describe the relationship between country's unemployment and economic growth. Therefore, it represents the main factors economists must consider.

2.1.3.1 Theory

Okun's law was first examined by Arthur Okun in the 1960s. He had the intuition that if output growth is high, unemployment will decrease. (Blanchard & Johnson, 2012)

Considering that this empirical regularity is based on a statistical relationship that relies on regression it can be best described in form of a scatterplot. Figure 3 plots both variables in the United States between 1960 and 2010. The downward slope visualizes the relationship between economic growth and unemployment. In this example, the slope of the line is -0.4. This implies that if the growth rate increases by 1% the unemployment rate decrease around -0.4% (Blanchard & Johnson, 2012). Based on this relationship it can be explained that unemployment will go down during an expansion phase and vice versa.

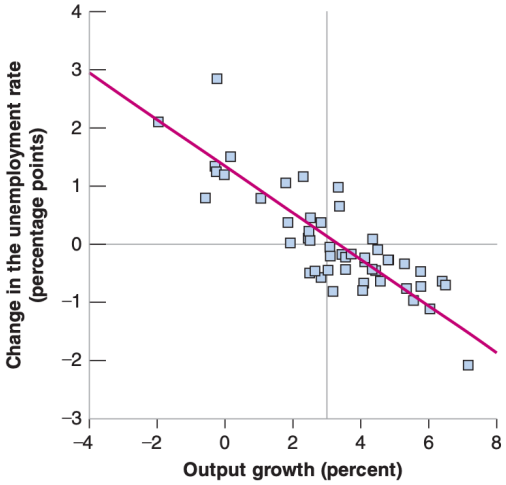


FIGURE 3 CHANGES IN THE UNEMPLOYMENT RATE VERSUS OUTPUT GROWTH

Source: Blanchard & Johnson, 2012

Additionally, in our example, unemployment keeps constant at a growth rate of 3%. Hence, the economy must grow at a pace above its potential in order the reduce unemployment. The reasons are rather simple. On the one hand, the population and therefore also the labor force increases, so the overall employment must grow just to keep the unemployment rate the same. On the other hand, the productivity of the workforce increases over time. Thus, it requires fewer employees to keep the same output. (Blanchard & Johnson, 2012)

2.1.3.2 Empirical Study

The relationship between output and unemployment is a widely discusses topic. Thus, many researchers tested the validity of Okun's law under several variables. Considering the wide range of variables many different results appear, which makes it impossible to simply accept or reject the empirical regularity.

Research shows that figures are not the same in the European Union, but that there is evidence in favor of Okun's law for the majority of countries in the European Union. Even more, it indicates that it is more persistent in less regulated labor markets (Economou & Psarianos, 2016).

Expanding the data to gender and age groups made it possible to understand that gender makes no difference. Nevertheless, significant differences in the age groups are visible, especially the older population tends to be less exposed to business cycles. (Blázquez-Fernández et al., 2018)

Economou & Psarianos shows already evidence that Okun's law is valid for Austria but did not go into detail. The economic growth that is needed for stable unemployment is not stable over time. Moreover, figures suggest that entering the European Union resulted in decreased employment threshold (Christl et al., 2017). Taking into account the restriction to early retirement

and increasing immigration it can be expected the unemployment will increase in Austria (Christl et al., 2017). Therefore, new challenges might arise over time, if no measures will be taken.

Self-employment is in most cases not part of the total employment. Including this factor indicate a negative relationship between the share of self-employment in total employment and Okun's coefficients (Porras-Arena & Martín-Román, 2019). Based on that it would be reasonable to consider the share of self-employment in the total employment in order to get a more accurate picture.

Many people conduct research in this field and therefore many opinions exist about, if the theory holds true or not. That the model does not always hold true in every time frame and country seems to be obvious, but it can be seen as a rule of thumb (Aguiar-Conraria et al.,2020). In contrast, a simple linear relationship cannot explain the complexity of fluctuations in the macroeconomy, so taking it as given might not be accurate (Meyer & Tasci, 2012).

2.1.4 General

There is enough evidence that there is a relationship between unemployment and stock return based on the theory above. That is why the general effect is also studied, without focusing on a single theory.

The UK shows a relationship in the direction of the stock market to the labor market. Still, some moments gain more interest, such as the 1950s boom-and-bust cycle did not explain the changes in unemployment. Economic conditions mainly responded to the significant volatility in output. (Sibande et al. 2019)

An evaluation of the S&P500 between 1950 and 2014 suggests that only the anticipated unemployment rate has a strong impact on stock prices. On the other hand, unanticipated unemployment is not significant. This US example shows that higher unemployment results in higher stock prices. The reason for it is that the FED decreases the interest rate when the unemployment rate is high. Subsequently, stock market prices increase. (Gonzalo & Taamouti, 2017)

Interestingly, even unemployment news affects the overall stock return in the US, but on an individual basis earning surprises have a stronger effect than unemployment surprises (Gupta et al., 2018). Thus, it can be inferred that importance varies based on the type of portfolio and no rule of thumb can be suggested.

The influence of unemployment insurance in the US, however, is somewhat surprising considering that the system is not comparable with the European standards. There is strong evidence that unemployment insurance positively influences the companies' future performance. Less volatility and lower compensation premiums demanded by the workforce dominate the costs of

unemployment insurance. As a result, it is advisable to provide sufficient insurance to their employees. (Wang & Zheng, 2018)

A general evaluation of the relationship between unemployment and the stock market in Austria does not exist. Nonetheless, based on the findings in other countries and research on particular theories a relationship is expected. Particularly, because of the lack of considerable crises in the time frame and existence of a stable and accepted social system.

A relationship for Austria seems to be possible but not guaranteed due to the following reasons. Firstly, even within the European Union differences are visible. Secondly, within a country, different results are shown based on the time frame. Thirdly, every market has its own dynamic and patterns, so even a lacking relationship might be possible as the individual market cannot be seen as entirely self-sufficient.

2.2 Inflation

Inflation is one of the macroeconomic variables, which receive attention in various fields. Furthermore, inflation is used as an indicator by most investors. On the one hand, it is used to calculate the real rate of return on their investments. On the other hand, it is an indicator, which influences many other factors and thus provides the possibility to model investment decisions.

Considering that this study focuses on the stock return of macroeconomic variables two theories are of particular importance in the context of inflation.

2.2.1 Fisher Effect

The Fisher Effect (also called the Fisher hypothesis) is an economic theory created by economist Irving Fisher. It describes the relationship between inflation and interest rate. In detail, it postulates that the nominal interest rate minus the expected inflation equals the real interest rate one-for-one (Blanchard & Johnson, 2012). It further implies that that the expected return on assets provides a complete hedge against inflation i.e. a positive relationship between stock return and inflation must be the case (Gavriilidis & Kgari, 2016).

The Fisher equitation is expressed through the following formula:

$$(1 + i) = (1 + r) \times (1 + \pi)$$

Where “i” stands for the nominal interest rate, “r” for the real interest rate and “π” the inflation rate. Nonetheless, often times just the approximate version of the formular is used.

$$i \approx r + \pi$$

Based on the theory it highlights the importance for central banks in particular the money supply and their effect on the nominal interest rate and inflation rate.

The International Fisher Effect (IFE) is somehow an extension of the basic theory. It suggests that appreciation or depreciation of currency prices is proportional to the difference in nominal interest rates of two countries. Thus, it implies that no arbitrage possibilities across countries exist if the concept is fully applicable. (Hatemi-J, 2009)

The International Fisher equitation is expressed through the following formula:

$$E = \frac{i_1 - i_2}{1 + i_2} \approx i_1 - i_2$$

Where "E" stands for the percent change in the exchange rate, "i_1" for country A's interest rate and "i2" for country B's interest rate.

2.2.2 Inflation Puzzle

Macroeconomic factors affect all companies, employees, investors, and many more. If something goes not in the preferred direction these stakeholders change their behavior to manage this uncertainty. In general, we can say the majority of stakeholders dislike when economic growth slows, or inflation is high (Ang, 2014). The reasons are quite obvious for consumers as they are afraid of losing their jobs or they are not able to afford the same basket of goods and services as before.

High inflation, as well as deflation, tend to result in less return for stocks. The reasons are that equities are not inflation-adjusted i.e. equities are bad in hedging inflation risk. There are indeed numerous reasons why stocks do badly in periods of high inflation, but for this thesis, we will focus on the two most rational ones. (Ang, 2014)

Firstly, high inflation reduces profit margins because companies can pass through cost increases only in small steps to their customers. Subsequently, it affects the cash flow of the company as well as reduces the future profitability of the firm. (Ang, 2014)

Secondly, the risk is increasing and thus must also be considered in the discount rate. History shows that expected returns on stock are increasing during high inflation, which cuts equity prices. As a result, there is a low correlation between realized inflation and realized stock return. Still, it should be noted that many factors influence stock prices. Thus, a perfect correlation with inflation is not possible. (Ang, 2015)

Eugen F. Fama researched the relationship between stock return, real activity, inflation, and money and was able to find many explanatory results. In case of inflation figures suggest that there is a clear negative relation between expected and unexpected inflation and stock returns.

However, the results for unexpected inflation are less consistent. Additionally, stock returns and inflation rates are most strongly related to measures of future real activity. (Fama, 1981)

2.2.3 Empirical Study

The Fisher effect and inflation puzzle are oftentimes studied at the same time. Hence, it is reasonable to summarize both theories in one. In regards that inflation is well researched, differences between regions are expected.

Research suggests that there exists a long-run relationship between nominal interest rates and expected inflation in France, the UK, and the US (Peng, 1995). However, even though the US suggests a positive relationship between interest rate and inflation a one-for-one relationship is not visible as postulated by Fisher (Corray, 2002). Several decades back the situation in the United States looked differently. A negative relationship was visible in the short-run, however, in a much longer period it moved to a positive relationship between the two variables (Miller et al., 1976)

Germany has a much weaker relationship than the US (Peng, 1995) and a series regression does not show a reliable relation between nominal stock return and inflation (Gultekin, 1983). In fact, the relationship between stock return and inflation is not stable over time and among countries (Gultekin, 1983).

A replication of Fama's concept in Germany with data from 1970 to 1999 shows similar results as the theory suggests. Figures confirm the proxy hypothesis and indicate the role of stock returns on the real activity reported by Fama. (Kim, 2002)

The behavior seems to be consistent in different markets. For example, the US and UK market shows just a low correlation, but the relation between inflation and nominal return is similar. Moreover, there are no differences in the results between ex-ante or ex-post inflation. However, figures suggest a positive relationship between nominal stock return and inflation in the long horizon and a negative relationship in the short horizon. (Boudoukh & Richardsons, 1993)

Focusing solely on inflation could still result in different results as expected. There is a clear correlation between inflation and stock return in the USA between 1791 and 2015. However, it is not always negative. In the 1840s, 1860s, 1930s, and 2011 correlation show a significant positive result. On the other hand, in all other periods, it shows a negative correlation. Hence, it can be said that there is a strong tendency to a negative correlation, and a positive relationship is not impossible. (Antonakakis et. al., 2017)

A study in Pakistan shows a different result in comparison to strong markets as the USA and UK. Figures suggest that inflation and stock return are independent at least in the long-run. Thus, in

the long-run, the stock market in Pakistan could provide a hedging possibility against inflation. (Tiwari et. al.,2015)

Since many different results were published it is difficult to predict the effect in the Austrian environment for the given time frame. Considering that the market is driven by many external factors such as the general trend on the major stock markets, it would be reasonable that macroeconomic variables and stock returns are independent of each other.

3 RESEARCH DATA

This thesis considers two macroeconomic indicators (unemployment and Inflation) as the explanatory variable and the ATX index and 10 individual stocks as the response variable.

Monthly time series data for the period January 2015 to December 2019 was collected. This data collection represents secondary data, which implies that none of the data was collected by the researcher but generated by a reliable data provider. The data sources used for each variable are highlighted in the individual explanation of the variable.

Additionally, this chapter will go through the descriptive statics as well as the individual charts of all the variables.

For each variable, an individual chart has to be prepared by plotting the data over time and visualize it through a graph. Analyzing a graph seems to be not necessary since the other models provide mathematical evidence to illustrate if there is an influence. However, it gives the possibility to see if there are any trends or patterns visible. Moreover, extreme effects are immediately visible and thus gives the possibility to analyze the potential reason.

The summary table contains several important information: Max, Min, Mean, Median, Std. Dev., Skewness and Kurtosis. Min and max illustrate the maximum and minimum values of the dataset. The mean represents the arithmetic average of the given dataset and the median is the exact midpoint between min and max. The standard deviation (Std. Dev.) measures the dispersion of the dataset relative to its mean. Skewness describes the type and strength of the asymmetry of a probability distribution (Shanmugam & Chattamvelli, 2015). In other words, a negative skewness indicates a distribution to the right and positive skewness a distribution to the left. Kurtosis indicates the relative concentration or accumulation of probability mass towards the center of distribution (Shanmugam & Chattamvelli, 2015). Excess kurtosis of 0 represents a normal distribution, below 0 a platykurtic distribution, and above 0 leptokurtic distribution. As a result, it can be highlighted that skewness and kurtosis are measures of shape departure from normality.

3.1 Unemployment Rate

The Public Employment Service Austria (hereinafter referred to as AMS) provides the data about the unemployment rate. For this thesis, the unemployment rate corresponds to unemployed people in percent of the labor force potential, whereby the labor force potential is the sum of registered unemployed and dependently employed people.

$$u = \frac{registered\ unemployment}{labor\ force\ potential}$$

This kind of unemployment calculation was chosen as it is based on real figures and not estimations based on micro census. Moreover, the criteria seem to be more accurate in comparison to the International Labour Office (ILO) as the reasons to exclude an unemployed person from the statistic are stricter.

To get a better understanding of the factor unemployment the total unemployment gets subdivided into women, total, and youth unemployment (unemployed aged 24 or less). Especially a difference between men and women is anticipated since the job as well as the industries vary significantly between these two groups.

A categorization by industry is not possible as the categories published by AMS do not correspond to the exact categories of the companies. Furthermore, taking a close industry as a proxy would result in wrong conclusions as the similarities are too week.

Appendix 1 illustrates the graphs of the four specified data sets of unemployment in a given period and the illustration below the corresponding descriptive statistics table.

	total	*women*	*men*	*youth unemployment*
Mean	0,0835	0,0779	0,0883	0,0778
Median	0,0824	0,0788	0,0841	0,0767
Minimum	0,0646	0,0661	0,0634	0,0518
Maximum	0,1086	0,0883	0,1282	0,1090
Std.Dev.	0,0116	0,0058	0,0181	0,0147
Skewness	0,4248	-0,1290	0,6850	0,3257
Kurtosis	-0,5156	-0,9990	-0,4211	-0,7029
Obvservations	60	60	60	60

TABLE 1 DESCRIPTIVE STATISTICS UNEMPLOYMENT

At the first sight, it is immediately visible that the unemployment curve from women is not as volatile as for total, men and youth unemployment. Additionally, the curve for total, men and youth unemployment pictures an equal shape. Still, the unemployment for men is over time higher than the total unemployment and youth unemployment.

The mean for men is at 8.83% and thus 0.48 percentage points higher than in total and more than 1 percentage point higher than for women and youth. The highest value is reached by men with 12.82%, which is significantly more than for women with 8.83%. Still, the lowest unemployment is visible for youth with just 5.18%.

All the different categories of unemployment have a negative linear trend, so unemployment is going down. Whereas this trend is strongest for youth unemployment. Data shows that total, men and youth unemployment have a positive Skewness and women unemployment negative. Therefore, it can be said just that unemployment for women peaks on the right side. However, the values are rather low. All categories show a negative Kurtosis, which indicates that the distribution has lighter tails than the normal distribution.

3.2 Inflation

The Consumer price index (hereinafter referred to as CPI) was used as a proxy for inflation. The data got extracted from STATISTICS AUSTRIA.

STATISTICS AUSTRIA contacts every 5 years randomly people from the residential register and asks them if they are willing to participate in a study for the upcoming CPI. Participants have to have at least two interviews and must fill out all their income and expenses in a table explaining the purpose of the expenses for a certain period.

The CPI for this thesis represents the basket of goods and services according to the consumer behavior of households in the year 2010. Potentially a combination of the CPI from 2010 and 2015 would have been possible. However, the difference between these two baskets is minor, so it would not affect our results. In order to better evaluate the effect on the equities, the CPI was transferred to annual inflation by using the provided data.

Lastly, the CPI is also the basis for the valorization of fixed amount money and the basis for remuneration (wages, salary, pension, etc.) negotiations. Therefore, it is a well-known factor and thus gets published on monthly basis.

Appendix 2 shows the corresponding graph for CPI and annual inflation and the table below correspondent descriptive table.

	CPI	*Annual Inflation*
Mean	114,1550	0,0149
Median	113,8500	0,0160
Minimum	109,1000	0,0063
Maximum	119,7000	0,0241
Std.Dev.	2,8940	0,0007
Skewness	0,1474	-0,2083
Kurtosis	-1,2831	-1,3476
Obvservations	60	60

TABLE 2 DESCRIPTIVE STATISTICS CPI

First of all, both graphs show that we did not have a deflation period in the sample. Moreover, the annual inflation graph shows a positive linear trend. Hence, it can be assumed that inflation was overall increasing in the given period. The minimum inflation was 0.63% and the maximum was 2.41%. The mean lied at 1.49% and is therefore slightly lower than the media with 1.60%. Furthermore, inflation shows a very low standard deviation and negative Kurtosis, which indicates that the distribution has lighter tails than the normal distribution.

3.3 Vienna Stock Exchange

The Vienna Stock Exchange was founded in 1771 by Maria Theresia. At this time only bonds, bills of exchange, and foreign currencies were traded. (WBAG, n.d.) These days the Vienna Stock

Exchange offers all kinds of financial instruments and provides a modern IT infrastructure to all participants. However, trading volumes are not comparable with stock exchanges in financial hubs such as New York. Moreover, trading and settlement costs are above average, which makes it for investors less attractive.

The stock prices for the index and equities comes from yahoo! finance, where the adjusted closing price will be taken. This price is already adjusted for both dividends and splits and therefore makes it easier possible to conduct an analysis.

3.3.1 ATX Index

The ATX index consists of the 20 most liquid stocks traded on Vienna Stock Exchange. It is structured as a free-float weighted price index, where the weights are capped quarterly to ensure compliance with UCITS standards for portfolio diversification. (WBAG, 2019)

The companies within the index changed over time, but the sector breakdown remained close to the same. Therefore, it can be seen that the banking sector was always represented by more than 25% within this period.

The ATX index can be seen as a diversified portfolio of all stocks within the ATX index and thus gives a good overview of the overall market situation. Appendix 3 pictures the graph and the table below highlights the descriptive tables of the ATX.

	ATX
Mean	2842,4595
Median	2944,4149
Minimum	2095,9600
Maximum	3594,2700
Std.Dev.	434,5672
Skewness	-0,1044
Kurtosis	-1,3643
Obvservations	60

TABLE 3 DESCRIPTIVE STATISTICS ATX

The financial crises had also an effect on the Austrian market. Even though the crises were outside the investigated period effects are still visible. Moreover, the interest rate reached a new low in 2015, which resulted in a situation that companies preferred taking debt in form of bonds instead of equity increases.

The ATX shows a mean of 2,842.46 and a rather high standard deviation of 434.57. It peaked at the beginning of 2018 at 3,594.27.

3.3.2 Stocks

The Vienna Stock Exchange has in general low liquidity in comparison to major markets. This applies also to the stocks within the ATX. Considering these factors, the thesis focuses on 10 stocks within the ATX index. Moreover, these companies represent also well know companies with a strong reputation within Austria.

The table below illustrated all the stocks including corresponding descriptive data.

	ANDR	*CAI*	*EBS*	*OMV*	*POST*	*RBI*	*TKA*	*VIG*	*VOE*	*WIE*
Mean	40,3332	20,5953	30,6585	30,7388	27,7027	15,1093	5,8532	19,8629	31,0244	16,9169
Median	40,9055	19,0198	30,4625	35,4514	28,8325	15,7040	6,0626	20,0667	28,7773	17,5532
Minimum	30,7379	12,8342	19,2250	15,8821	21,6594	7,6961	4,4079	13,4121	20,7369	11,0076
Maximum	47,5473	34,8804	41,9100	45,1443	33,6509	25,6265	7,3521	30,1824	47,8135	24,8229
Std.Dev.	4,1035	6,7842	5,3265	10,0307	3,2037	4,8517	0,9585	3,5305	6,9683	3,2242
Skewness	-0,5132	0,4358	0,0789	-0,1968	-0,2463	0,1291	-0,1050	0,4950	0,5892	0,1131
Kurtosis	0,0792	-1,2251	-0,6839	-1,7218	-1,1567	-1,1287	-1,3961	0,9341	-0,5867	-0,6677
Obvservations	60	60	60	60	60	60	60	60	60	60

TABLE 4 DESCRIPTIVE STATISTICS STOCKS

3.3.2.1 Andritz AG

Andritz AG (hereinafter referred to as ANDR) is an international technology group, who provides plants, systems, equipment, and services for various industries. Moreover, it is leading in the pulp and paper, metals, hydro, and separation industrial segments. However, also other fields are gaining significant importance. (Andritz, 2020)

The company is listed since 2001 and shows a free float of more than 65%. The major shareholders are Customs Vermögensverwaltungs GmbH (25% + 1 share) and Certrus Beteiligungs-GmbH (5.7%). (Andritz 2, 2020)

Appendix 4 pictures the graph including the historic prices from ANDR. The graphs show the highest volatility within the overall stock sample. Moreover, it shows a negative linear trend within the given period. The Skewness value is the lowest of all the stocks, which indicates that the data are negative moderately skewed.

3.3.2.2 CA Immobilien Anlage AG

CA Immobilien Anlagen AG (hereinafter referred to as CAI) is a real estate company specializing in office properties in the Central European capital. The company covers the entire value chain in the field of commercial real estate due to its in-house expertise in all fields. Moreover, CAI follows current trends such as sustainability to stay competitive and expand its business. (CA IMMO, 2020)

More than 70% of the share are in free float. The largest shareholder is SOF-11 Klimt CAI S.à r.l. (a company of Starwood Capital) with a shareholding of 27.7% and therefore has a major influence on the company. (CA IMMO 2, 2020)

CAI has a rather different graph (appendix 5) in comparison to the other stocks. From 01/2015 to 12/2016 the stock price remains on average somehow the same but starting in 2017 it shows a clear stable upwards trend.

In the course of time, the standard deviation would show completely different values considering the distribution of data but considering that descriptive statistics focuses on the whole period it has an overall standard deviation of 6.78. The skewness is slightly positive (<0.5) and the kurtosis value is -1.23.

3.3.2.3 Erste Group Bank AG

Erste Group Bank AG (hereinafter referred to as EBS) is one of the biggest universal banks in Austria. The company was founded in 1819 as the first Austrian savings bank and went public in 1997. The aim of going public followed the strategy to expand its retail business into Central and Eastern Europe. (Erste Bank, 2020)

The majority of shares are held by institutional investors with more than 40%. Moreover, the company had a free float of around 65% within the evaluated period. The major shareholder is the ERSTE Foundation followed by CaixaBank and BlackRock Inc.. (Erste Bank 2, 2020)

The graph from EBS (appendix 6) shows a similar picture as the ATX. The starting point was at the same time as the minimum with 19.22 and the maximum was reached equally to the ATX at the beginning of 2018. The average stock price was at 30.66 and the standard deviation reached 5.33.

3.3.2.4 OMV AG

OMV AG (hereinafter referred to as OMV) is one of the largest listed industrial companies. They are specialized in producing and marketing oil and gas, innovative energy, and high-end petrochemical solutions. OMV is present in many countries around the world in Up- and Downstream. The daily average production was 487,000 boe/d in 2019. Moreover, OMV holds shares in many other companies within the industry and invest in future-orientated ideas to remain in business. (OMV, 2020)

OMV has a free float of around 43% and two major shareholders. 31.5% are held by an Austrian state holding company (Österreichische Beteiligungs AG – till Feburary 20, 2019 Österreichische Bundes- und Industriebeteiligungen GmbH), and 24.9% are held by MPPH (Mubadala Petroleum and Petrochemicals Holding Company L.L.C). Additionally, more than one-fourth of the shares are held by institutional investors, which are distributed around the world, with a majority in the US and UK. (OMV 2, 2020)

The graph (appendix 7) shows a linear trend over time with a low (15.88) at the starting point of the sample and a peak (45.14) during the end, which represents more than 280% increase in

value in approximatly 5 years. The descriptive statistic table shows a mean of 30.74 and a standard deviation of 10.03.

3.3.2.5 Österreichische Post AG

The Österreichische Post AG (hereinafter referred to as POST) is Austria's leading logistics and postal service provider. Apart from the common service they also act as an intermediary for telecommunication providers as well as have their own bank.

More than 50% of the shares are held by the Österreichische Beteiligungs AG (ÖBAG), which is a state holding company that administers investments of the Republic of Austria in partially or entirely nationalized companies (Post, 2020). Apart from that the there is a large number of Austrian retail investors, which probably results from a big advertisement campaign before the public offering.

POST had a turbulent time in this period as illustrated in appendix 8. The price dropped massively in the first year and recovered in full after around 3 years time where the next drop arised. The descriptive statistic table shows a mean of 27.70 with represents roughly the middle between min and max value. Moreover, the sample shows a negative Kurtosis and Skewness close to zero.

3.3.2.6 Raiffeisen Bank International AG

Raiffeisen Bank International AG (hereinafter referred to as RBI) is one of the leading corporate and investment banks in Austria and CEE. RBI has been listed on the Vienna Stock Exchange since 2005, with the aim the expand even further. (RBI, 2020)

The majority of shares are held by regional Raiffeisen banks by approximately 58.8%. That is why the free float reaches just around 40%. The rest of the shareholder base is well diversified, with investors around the world. (RBI 2, 2020)

Appendix 9 shows the corresponding graph, which shows similarities with a normal distribution with lighter tails, which get confirmed by the negative Kurtosis. RBI had their low at the beginning at 4.85 and peaked at 25.63 at the end of 2017.

3.3.2.7 Telekom Austria AG

Telekom Austria AG (hereinafter referred to as TKA) provides digital services and communication solutions in Central and Eastern Europe. TKA expanded their business in the last years not only geographically it also did in terms of services such as payment solutions. (A1, 2020)

The shareholder structure changed massively during the given period. Especially the main shareholder América Móvil increased his holdings to 51%. The second major shareholder is the ÖBAG (Österreische Beteiligungs AG) with 28.42%. That is why the free float of TKA is just around 20%, however, this already included employee stocks and treasury shares. (A1 2, 2020)

The chart from TKA illustrated in appendix 10 is similar to the ATX chart. However, it started proportionally on a higher level, which results in a short upwards trend in slight drop to the low within the period. The data shows a minimum at 4.41 and a maximum at 7.35 with a mean at 5.85. Both Skewness and Kurtosis show negative values, whereby skewness is just slightly below zero.

3.3.2.8 Vienna Insurance Group AG

The Vienna Insurance Group AG (hereinafter referred to as VIG) consist of around 50 companies in 30 countries with a strong focus on insurance solutions. The core market is Austria and Central and Eastern Europe, where they managed to be one of the market leaders. (VIG, 2020)

VIG is publicly listed in Vienna and Prague, however, less than 30% of the shares are free float. The majority of the share is held by Wiener Städtischen Verischerungsverein – they own 72% of VIG's shares. (VIG, 2020)

The graph in appendix 11 shows a negative linear trend of the stock. It started high and peaked within the first months at 30.18. Subsequently, the stock moved in a declining phase, which reached the minimum in mid-2016 at 13.41. Afterward, it shows a somehow moderate increase until the end of the period. Skewness, as well as Kurtosis, have a positive value.

3.3.2.9 Voestalpine AG

Voestalpin AG (hereinafter referred to as VOE) is one of the leading steel and technology companies in the world. The company group consists of more than 500 companies and is located in more than 50 countries on 5 continents. The group contains 4 divisions: steel, high-performance metals, metal engineering, and metal forming. (Voestalpine, 2020)

The company is publicly listed since 1995. The company has three main shareholders, which are: Raiffeisenlandesbank Oberösterreich Invest GmbH & Co OG (~15%), voestalpine employee shareholding scheme (~15%) and Oberbank AG (~8%). As a result, the free float rate is slightly above 60%. Furthermore, more than 50% of the shares are held by Austrian investors excluding the employee shareholder scheme. (Voestalpine 2 2020)

The corresponding chart illustrated in appendix 12 shows on the first sight a normal distribution apart of the first year. This gets confirmed by the negative Kurtosis assuming lighter tails than the normal distribution. The standard deviation of 6.97 is rather high in the respect that data shows a mean of 31.02.

3.3.2.10 WIENERBERGER AG

Wienerberger (hereinafter referred to as WIE) is a well-known supplier of building material and infrastructure solutions. The key products are bricks, pipe systems, and pavements. They are

especially popular for the bricks as they are the largest global producer. To follow the sustainable trend, WIE invests heavily in smart solutions for the infrastructure of tomorrow. (Wienerberger, 2020)

In comparison to all other companies in this study, Wienerberger shares are all free-floating. However, the majority of shares are held by institutional investors. Privat investors held less than 15% offer time. (Wienerberger 2, 2020)

Appendix 13 shows the graph from WIE, which suggests a positive linear trend over time. Apart from slight up and downward movements, it can be seen that the stock increases constantly value over time with a sharp increase during the end of the period. The minimum of 11.00 was reached at the beginning but repeated one and a half years later after a short drop. The max of 24.82 was reached at the very end. Skewness is slightly positive and Kurtosis negative.

4 METHODOLOGY

This chapter will provide a detailed overview of how the research was conducted. First, it provides a brief overview of the research question and objectives. Secondly, it highlights in detail, which methods are used and why.

4.1 Research Question And Objectives

The purpose of this thesis is to find if there is a relationship between the selected macroeconomic variables and the Austrian stock market. The literature review already showed that researchers received different findings and a focus on the Austrian market is missing.

Research question:

Do inflation and unemployment influence stock prices in the Austrian stock market?

Considering that data about inflation and unemployment is publicly available and offered on a monthly time frame it would provide massive insights to investors. However, the difference between stocks is most likely visible due to the different industries. The ATX index, however, can be seen as a well-diversified portfolio that allows providing even more insights on the results.

Based on the research question three main objectives can be pointed out. First, the correlation between inflation, unemployment, and the Austrian stock market. Second, the causal relationship between the variables. Third, the difference in the short and long run.

4.2 Selection Of Methodology

Choosing the right method was among the most difficult part. Especially because there are numerous possibilities and all of them might be applicable and reasonable. Still, it makes no sense to make all of them because some would just provide additional information, which does not provide any value for the thesis. It could even result in a situation where a side information drives the overall results in the wrong direction.

The literature review reviews the individual theory as well as the direct impact on stock prices. Thus, many different types of methods are used. However, regression analysis, and granger causality are tests, which are mostly performed in our context.

Based on the methods used from other research as well as the purpose of the thesis the following tests has been performed:

- Correlation Analysis
- Time-series Analysis

- Granger Causality

These three categories provide enough information to answer the research question. Following more detail about the take methods.

4.2.1 Correlation Analysis

A correlation analysis will be conducted to determine both, the intensity and the direction of the relationship. However, it does not necessarily explain the causal effect between variables.

The results will be illustrated in form of a correlation matrix by using Spearman's correlation. It shows the correlation coefficients between all the variables. Thus, it provides a first good overview of the relationship between the variables. A positive coefficient means that there is a positive relationship between the variable and vice versa. A zero coefficient means that there is no association between the variables.

Considering that we have several variables it is highly likely that we have outliners. Therefore, a Person correlation analysis should be avoided to reduce the influence on the overall result. The Spearman correlation evaluates the monotonic relationship. As a result, the coefficient is based on the ranked values for each variable instead of the pure raw data. The corresponding formula reads a follow:

$$\rho = 1 - \frac{6 \sum d_i^2}{n(n^2 - 1)}$$

Where "ρ" stands for the Spearman rank correlation, "d_i" for the difference between the ranks of corresponding variables and "n" for the number of observations.

4.2.2 Time-series Analysis - Vector Autoregressive & Vector Error Correction Model

A time-series analysis will be conducted to get a better understanding of whether variables have a relationship in the long and short run with other variables over periods. The use of multiple time series analyses will therefore provide useful information about potential forecasts. To receive the results, one must follow a couple of steps to select the correct model.

First, a unit root test needs to be conducted to find out if the data is stationary after the first differences. If not, it would be recommended to perform an Autoregressive Distribution Lag Model. Since this does not apply to this dataset the model will be not further explained.

After facilitation that data is stationary after the first difference, a cointegration test must be performed. In case that the cointegration test shows that there is no cointegration between the variables, a Vector Autoregression Model (VAR) should be performed. Otherwise, a Vector Error Correction Model (VECM) is advisable.

Lastly, a Heteroskedasticity test will be conducted to confirm the reliability of the VAR and VECM outcomes.

4.2.2.1 Unit Root Test

The first step is to determine whether the levels of the data are stationary by using the Augmented Dickey-Fuller approach. Stationary series can be defined as one with a constant mean, constant variance, and constant autocovariance for each given lag (Brooks, 2008). Non-stationary data should be avoided because they can lead to spurious regressions (Brooks, 2008). In case that the first test shows that the series is non-stationary, it is possible to repeat the test by using the first differences of the data series.

4.2.2.2 Lag Length Selection

The next step is to determine the optimal lag length i.e. the number of lagged residuals used to evaluate the autocorrelation. If the taken lag length is too small the remaining serial correlation in the errors might bias the tests. However, if it is too large the power of the tests might suffer. (Brooks, 2008)

The optimal lag length will be determined by using the lag selection test in EViews with a maximum of 12 lags. The maximum of 12 lags has been specified due to the rather small sample size and to meet monthly data.

In case that the test suggests different lags for different types of criteria the lag which will suggest most often will be taken.

4.2.2.3 Cointegration Test

Next, a cointegration test will be used to find out if there is a correlation between several time series in the long run. Cointegration can be used to determine the extent to which two variables respond to the same mean over time. Hence, cointegration does not reflect whether the pairs would move in the same or opposite direction but can tell you whether the distance between them remains the same over the given period. This thesis will use the Johansen test, which is used to test cointegrating relationships between several non-stationary time series data (Brooks, 2008). One advantage in comparison to the Engle-Granger test is that it allows testing for more than one cointegration relationship. Nonetheless, it is important to note that it is recommended to have a large sample size to avoid unreliable results. Considering that the thesis sample has 60 observations it can be suggested that it is at the lower end of the necessary sample size, but still acceptable.

4.2.2.4 Vector Autoregression Model (VAR)

The VAR model is applicable in predicting multiple time series variables using a single model, which is recommended to use if data is stationary at I(1) and variables are not cointegrated. (Brooks, 2008)

In this study, the simplest case of a bivariate VAR applies, where there are only two variables y_{1t} and y_{2t}, each of whose values depend on different combinations of the previous k values of both variables, and error terms

$$y_{1t} = \beta_{10} + \beta_{11}y_{1t-1} + \cdots + \beta_{1k}y_{1t-k} + \alpha_{11}y_{2t-1} + \cdots + \alpha_{1k}y_{2t-k} + u_{1t}$$

$$y_{2t} = \beta_{20} + \beta_{21}y_{2t-1} + \cdots + \beta_{2k}y_{2t-k} + \alpha_{21}y_{1t-1} + \cdots + \alpha_{2k}y_{1t-k} + u_{2t}$$

Where uit is a whit noise disturbance term with $E(u_{1t})=0$, (i=1,2), $E(u_{1t}u_{2t})=0$. (Brooks, 2008)

Furthermore, the VAR model shows high flexibility and offers the possibility of generalization. This gets proven even more by the possibility to extend the model by for example adding the moving average error or including the first difference terms and cointegration relationship as mentioned in the next step the VECM model. (Brooks, 2008)

There are extensive advantages of VAR modeling in comparison with univariate time series models or simultaneous equations structural models. Firstly, it is not necessary to specify, which variables are endogenous or exogenous, which reduces the probability of misleading results. Secondly, the VAR model provides more flexibility than univariate AR models by allowing the value of a variable to depend on more than just its lags. Lastly, the VAR-generated outcomes often provide a better forecasts power, which had been mentioned in many articles. (Brooks, 2008)

However, the VAR models have also some disadvantages. Firstly, it is difficult to determine the most appropriate lag length since many different approaches are available. Secondly, the model occasionally consists out of many parameters. This can result even from relatively small sample size to a significantly high degree of freedom, which implies large standard errors and thus wide confidence intervals for model coefficients. Lastly, it is essential to have stationary data to proceed. Nonetheless, this applies mostly after the first differences, which purely examine the relationship between the variable by excluding information on any long-run relationship between the series away. (Brooks, 2008)

4.2.2.5 Vector Error Correction Model (VECM)

The VECM model is an extension of the VAR model, which should be used if variables are cointegrated. The model is important in time series analysis as it provides a better understanding of the long-run dynamics. (Brooks, 2008)

The equation can be defined as follows:

$$\Delta y_t = \beta_1 \Delta x_t + \beta_2 (y_{t-1} - \gamma x_{t-1}) + u_t$$

This model includes the error correction term y_{t-1} - γx_{t-1}. Furthermore, γ defines the long run relationship between x and y, and β_1 describes the short run relationship. The speed of adjustment is described in β_2.

4.2.2.6 Heteroskedasticity

A Heteroskedasticity test will be conducted to examine the efficiency of the VAR and VECM model. It refers to a situation where the variance of the residuals is unequal over a range of values (Brooks, 2008). Heteroskedasticity is a violation of the assumptions for linear regression modeling, so it can impact the validity of the analysis (Hayes, 2020).

As a result, the presence of Homoscedasticity is decisive for our model. Otherwise, the residuals may increase with fitted values of the response variable.

Heteroskedasticity can be visualized in a scatter plot. Nonetheless, the standard tests on EViews will be used to get concrete results.

4.2.3 Granger Causality

The granger causality test is the final test in this study. It examines whether a time series variable can predict another. Oftentimes a change in one variable affects another variable, but not simultaneously. As result, a particular variable might be a good indication to predict what happens with the other variable at a certain time. To illustrate this a Granger causality test will be used.

Even though the word causality is used it is important to note that this might be misleading. This test focuses on a Granger causality, which means a correlation between the current value of one variable and the past value of the other (Brooks, 2008). This does not necessarily mean that the movement of one variable is the cause of the movement of another variable.

5 EMPIRICAL RESULTS

The empirical examination follows the stated method mentioned in the methodology section. However, the focus will be on the actual results of the tests.

5.1 Correlation Analysis

In the first step, a correlation analysis was performed. As mentioned in the methodology chapter, this thesis focuses on Spearman's rank correlation coefficient as it best fits the purpose of this study.

To show the results best visualization in form of a matrix has been taken. However, the correlation between stocks was excluded as it provides no direct value to answer the research question.

	total unemployment	women unemployment	men unemployment	youth unemployment	CPI
total unemployment	1,00				
women unemployment	0,79	1,00			
men unemployment	0,98	0,69	1,00		
youth unemployment	0,95	0,89	0,90	1,00	
CPI	-0,33	-0,44	-0,30	-0,48	1,00
ATX	-0,47	-0,64	-0,42	-0,64	0,79
ANDR	0,16	0,18	0,12	0,14	0,37
CAI	-0,65	-0,83	-0,58	-0,80	0,56
EBS	-0,48	-0,61	-0,43	-0,65	0,81
OMV	-0,57	-0,69	-0,52	-0,72	0,66
POST	-0,36	-0,54	-0,29	-0,45	0,55
RBI	-0,43	-0,60	-0,38	-0,61	0,81
TKA	-0,51	-0,70	-0,44	-0,66	0,69
VIG	-0,10	-0,25	-0,06	-0,09	0,06
VOE	0,02	0,01	0,01	-0,04	0,57
WIE	-0,57	-0,71	-0,52	-0,72	0,62

TABLE 5 SPEARMAN CORRELATION OUTCOMES

Considering that unemployment is divided into four categories, the correlation between them provides valuable information. Total, men and youth unemployment are very strong positive correlated to each other, which is also clearly visible in the graph in appendix 1. However, women's unemployment shows a different pattern. It shows a rather strong positive correlation to total and youth unemployment, but just a moderate positive correlation for men. As a result, it can be concluded, when unemployment goes up it will apply to all unemployment variables. Still, women's unemployment seems to be slightly dispatched from the other three types of unemployment.

Since there is a strong positive correlation between the unemployment variables it is likely to see equal results between any kind of unemployment and the stock variables. Overall unemployment suggests a negative correlation towards the stock variables, but differences between the variables are present. CAI shows the strongest negative correlation, which can be interpreted as strong for women and youth unemployment. In contrast, VIG and VOE suggest that

they are not correlated, but it is important to note that it does not necessarily apply independence as other kinds of association might exist. ANDR shows a weak positive correlation.

The outcomes for inflation show a different picture as for unemployment. In general, a positive correlation is visible. However, VIG shows as already for unemployment a zero correlation. The strongest positive correlation shows the banking sector in this sample including EBS and RBI with 0.81.

ATX represents the Austrian market. Therefore, a closer look is of particular importance. At the first sight, it is visible that unemployment and CPI picture have contradicting results. Unemployment suggests a negative correlation, whereby women and youth unemployment is stronger negative correlated than men and total. On the other hand, CPI shows a strong positive correlation i.e. strong inflation results in higher stock prices.

To sum up, unemployment generally correlates negatively and CPIT correlates positively with stock prices. Within unemployment a similar picture is visible, just women's unemployment shows minor independence towards the other types of unemployment. The ATX shows a negative correlation for unemployment and a positive correlation for inflation. VIG in contrast shows no correlation with unemployment and inflation.

5.2 Time-series Analysis

The time-series analysis will be divided into five sub-sections. First, the results from the unit root tests will be presented. Subsequently, the most appropriate lags for each test will be selected. Based on these results it is possible to proceed with the cointegration test. Lastly, the VAR or VECM model results will be highlighted to illustrate the long and short-run relationship of the variables.

5.2.1 Unit Root Test

Before running the time-series analysis it is curial to perform a stationarity test. Much economic time series exhibit trending behavior or non-stationary in the mean, which often leads to spurious regressions, which results in misleading results. In order to reject the null hypothesis, the test statistic of the unit root test must be more negative than the critical value of 0.05 (5%).

The following illustration contains the outcome from the Augmented Dickey-Fuller test with all the variables at level.

Augmented Dickey-Fuller test outcomes			
Variable	P-value	Null hypothesis	Outcome
total unemployment	0,9939	Do not reject	is non-stationary
women unemployment	0,3345	Do not reject	is non-stationary
men unemployment	0,9886	Do not reject	is non-stationary
youth unemployment	0,8805	Do not reject	is non-stationary
CPI	0,3651	Do not reject	is non-stationary
ATX	0,5260	Do not reject	is non-stationary
ANDR	0,0356	Reject	is stationary
CAI	0,9960	Do not reject	is non-stationary
EBS	0,1748	Do not reject	is non-stationary
OMV	0,7478	Do not reject	is non-stationary
POST	0,3668	Do not reject	is non-stationary
RBI	0,4866	Do not reject	is non-stationary
TKA	0,7169	Do not reject	is non-stationary
VIG	0,1910	Do not reject	is non-stationary
VOE	0,6230	Do not reject	is non-stationary
WIE	0,6943	Do not reject	is non-stationary

TABLE 6 AUGMENTED DICKEY-FULLER TEST OUTCOMES

We can see that most of the variables in the study have a root. In detail, all variables apart of ANDR have a p-value greater than 0.05 and thus suggest that they are non-stationary. Only ANDR can reject the null hypothesis that the time series has a unit root and is therefore stationary at level.

Since almost every selected variable has a unit root it is necessary to take the first differences of the variables and perform the test again. The following tables demonstrates the results of the test with all variables after the first differences.

Augmented Dickey-Fuller test outcomes ADF test result after first differences			
Variable	P-value	Null hypothesis	Outcome
total unemployment	0,0000	Reject	is stationary
women unemployment	0,0000	Reject	is stationary
men unemployment	0,0000	Reject	is stationary
youth unemployment	0,0265	Reject	is stationary
CPI	0,0000	Reject	is stationary
ATX	0,0000	Reject	is stationary
ANDR	0,0000	Reject	is stationary
CAI	0,0000	Reject	is stationary
EBS	0,0000	Reject	is stationary
OMV	0,0000	Reject	is stationary
POST	0,0000	Reject	is stationary
RBI	0,0000	Reject	is stationary
TKA	0,0000	Reject	is stationary
VIG	0,0000	Reject	is stationary
VOE	0,0000	Reject	is stationary
WIE	0,0000	Reject	is stationary

TABLE 7 AUGMENTED DICKEY-FULLER TEST OUTCOMES AFTER 1ST DIFFERENCES

As we see from the outcomes the null hypothesis can be rejected for all variables. As a result, all variables are stationary after the first differences. Based on these results, it is not necessary to repeat the test with the second difference.

To conclude, just ANDR was stationary at level, which resulted in a second unit root test after the first differences. The second test showed that none of the time series have a unit root and therefore are stationary.

5.2.2 Lag Length Selection

The next step is to determine the optimal number of lagged residuals used for the upcoming tests. The lag selection test from EViews provides five different results based on the criterion (LR: sequentially modified LR test statistic, FPE: Final prediction error, AIC: Akaike information criterion, SC: Schwarz information criterion, HQ: Hannan-Quinn information criterion). The table below mentions the results, which were suggested by most criteria.

Lag Length Selection - Matrix					
Variables	**Total unemployment**	**Women unemployment**	**Men unemployment**	**Youth unemployment**	**CPI**
ATX	11	1	12	12	3
ANDR	11	1	12	12	1
CAI	11	1	12	11	1
EBS	11	1	12	12	1
OMV	12	1	12	11	1
POST	12	1	12	10	2
RBI	12	1	12	12	1
TKA	12	1	12	9	1
VIG	11	1	12	11	1
VOE	12	1	12	12	1
WIE	12	1	11	11	1
*Bases on the LR, FPE, AIC, SC & HQ criterions					

TABLE 8 LAG LENGTH SELECTION

At the first sight, it is visible that the results vary a lot. For total, men and youth unemployment mostly 11 lags or more were suggested. The lag selection test for women's unemployment suggests 1 lag, which is again different from the other types of unemployment. For CPI mostly on lag should be taken.

To sum up, the variable "women unemployment" shows the second time different results than the other three categories of unemployment. The lag selection test for women's unemployment and CPI suggests mostly on lag and for total, men and youth unemployment mostly 12 lags.

5.2.3 Johansen Cointegration Tests

In the next step it necessary to find out if the macroeconomic variables are cointegrated with the selected dependent variables. In order to, determine if they are cointegrated and how many cointegrating relationships in the system exists the Johansen cointegration tests have been performed. The tests has been done at level and after the first differences by showing the results based on the Trace-Test and Maximum Egentvalue test. However, just the results at level and

from the Trace-Test are highlighted below noting that contradicting results occoured. These tests were conducted because the results decide, which tests will be taken in the next step.

The following table pictures the results of the Johansen cointegration test for total unemployment.

Johansen Cointegration Trace-Test outcomes total unemployment			
Variables	**P-value**	**Null hypothesis**	**Outcome**
ATX	0,0050	Reject	indicates 1 cointegrating eqn(s) at the 0.05 level
ANDR	0,0000	Reject	indicates 1 cointegrating eqn(s) at the 0.05 level
CAI	0,0197	Reject	indicates 1 cointegrating eqn(s) at the 0.05 level
EBS	0,0000	Reject	indicates 1 cointegrating eqn(s) at the 0.05 level
OMV	0,0080	Reject	indicates 1 cointegrating eqn(s) at the 0.05 level
POST	0,0359	Reject	indicates 1 cointegrating eqn(s) at the 0.05 level
RBI	0,0000	Reject	indicates 1 cointegrating eqn(s) at the 0.05 level
TKA	0,0087	Reject	indicates 1 cointegrating eqn(s) at the 0.05 level
VIG	0,0177	Reject	indicates 1 cointegrating eqn(s) at the 0.05 level
VOE	0,0000	Reject	indicates 1 cointegrating eqn(s) at the 0.05 level
WIE	0,0224	Reject	indicates 1 cointegrating eqn(s) at the 0.05 level
*The Maximum Eigenvalue test do not provide contradicting results			

TABLE 9 JOHANSEN COINTEGRATION TEST OUTCOMES TOTAL UNEMPLOYMENT

Results suggest that the null hypothesis for all variables is rejected at a 5% significance level. Moreover, they indicate 1 cointegrating equation. Based on these results we proceed with the VECM model for the explanatory variable total unemployment.

The next table includes the cointegration test results for women's unemployment.

Johansen Cointegration Trace-Test outcomes women unemployment			
Variables	**P-value**	**Null hypothesis**	**Outcome**
ATX	0,1609	Do not reject	there is no cointegration
ANDR	0,2743	Do not reject	there is no cointegration
CAI	0,1750	Do not reject	there is no cointegration
EBS	0,1864	Do not reject	there is no cointegration
OMV	0,0808	Do not reject	there is no cointegration
POST	0,1545	Do not reject	there is no cointegration
RBI	0,1208	Do not reject	there is no cointegration
TKA	0,1704	Do not reject	there is no cointegration
VIG	0,1269	Do not reject	there is no cointegration
VOE	0,6504	Do not reject	there is no cointegration
WIE	0,2132	Do not reject	there is no cointegration
*The Maximum Eigenvalue test do not provide contradicting results			

TABLE 10 JOHANSEN COINTEGRATION TEST OUTCOMES WOMEN UNEMPLOYMENT

The test suggests that the null hypothesis cannot be rejected at a 5% significance level. Hence, there is no cointegration detectable. These results suggest continuing the time series analysis with the VAR model.

The following table highlights the results between men's unemployment and all response variables individually.

Johansen Cointegration Trace-Test outcomes men unemployment			
Variables	**P-value**	**Null hypothesis**	**Outcome**
ATX	0,0018	Reject	indicates 1 cointegrating eqn(s) at the 0.05 level
ANDR	0,0013	Reject	indicates 1 cointegrating eqn(s) at the 0.05 level
CAI	0,0000	Reject	indicates 1 cointegrating eqn(s) at the 0.05 level
EBS	0,0000	Reject	indicates 1 cointegrating eqn(s) at the 0.05 level
OMV	0,0207	Reject	indicates 1 cointegrating eqn(s) at the 0.05 level
POST	0,0181	Reject	indicates 1 cointegrating eqn(s) at the 0.05 level
RBI	0,0000	Reject	indicates 1 cointegrating eqn(s) at the 0.05 level
TKA	0,0104	Reject	indicates 1 cointegrating eqn(s) at the 0.05 level
VIG	0,0038	Reject	indicates 1 cointegrating eqn(s) at the 0.05 level
VOE	0,0000	Reject	indicates 1 cointegrating eqn(s) at the 0.05 level
WIE	0,0000	Reject	indicates 1 cointegrating eqn(s) at the 0.05 level
*The Maximum Eigenvalue test do not provide contradicting results			

TABLE 11 JOHANSEN COINTEGRATION TEST OUTCOMES MEN UNEMPLOYMENT

Figures suggest that all variables indicate one cointegrating equation at the 0.05 level. Thus, the VECM model will be used in the next step of this analysis.

The results of the cointegration for youth unemployment and all stocks individually are highlighted below.

Johansen Cointegration Trace-Test outcomes youth unemployment			
Variables	**P-value**	**Null hypothesis**	**Outcome**
ATX	0,0024	Reject	indicates 1 cointegrating eqn(s) at the 0.05 level
ANDR	0,0102	Reject	indicates 1 cointegrating eqn(s) at the 0.05 level
CAI	0,0000	Reject	indicates 1 cointegrating eqn(s) at the 0.05 level
EBS	0,0001	Reject	indicates 1 cointegrating eqn(s) at the 0.05 level
OMV	0,0057	Reject	indicates 1 cointegrating eqn(s) at the 0.05 level
POST	0,0450	Reject	indicates 1 cointegrating eqn(s) at the 0.05 level
RBI	0,0015	Reject	indicates 1 cointegrating eqn(s) at the 0.05 level
TKA	0,0458	Reject	indicates 1 cointegrating eqn(s) at the 0.05 level
VIG	0,0001	Reject	indicates 1 cointegrating eqn(s) at the 0.05 level
VOE	0,0020	Reject	indicates 1 cointegrating eqn(s) at the 0.05 level
WIE	0,0136	Reject	indicates 1 cointegrating eqn(s) at the 0.05 level
*The Maximum Eigenvalue test do not provide contradicting results			

TABLE 12 JOHANSEN COINTEGRATION TEST OUTCOMES YOUTH UNEMPLOYMENT

The p-value for all options is below 0.05, so the null hypothesis can be rejected, which means that there is one co-integration equation. Subsequently, the VECM model will be conducted.

The last table below pictures the results between CPI and all response variables individually.

Johansen Cointegration Trace-Test outcomes CPI			
Variables	**P-value**	**Null hypothesis**	**Outcome**
ATX	0,0798	Do not reject	there is no cointegration
ANDR	0,0614	Do not reject	there is no cointegration
CAI	0,7257	Do not reject	there is no cointegration
EBS	0,0689	Do not reject	there is no cointegration
OMV	0,3562	Do not reject	there is no cointegration
POST	0,0527	Do not reject	there is no cointegration
RBI	0,1182	Do not reject	there is no cointegration
TKA	0,4161	Do not reject	there is no cointegration
VIG	0,0544	Do not reject	there is no cointegration
VOE	0,5373	Do not reject	there is no cointegration
WIE	0,5351	Do not reject	there is no cointegration
*The Maximum Eigenvalue test do not provide contradicting results			

TABLE 13 JOHANSEN COINTEGRATION TEST OUTCOMES CPI

For CPI and all stocks, the test suggests that the null hypothesis will not be rejected. Hence, there is no cointegration between the variables. Based on these results the VAR model will be used in the next step.

To conclude, for all categories of unemployment apart of women's unemployment, there is one cointegration between the variables suggested. This shows again that women's unemployment has different movements in comparison to the other types of unemployment over time. Moreover, there is no cointegration between inflation and the response variables. These results suggest that the macroeconomic variables women unemployment and CPI will proceed with the VAR model and total, men and youth unemployment with the VECM model.

5.2.4 Vector Autoregression Model

For all variables where data is stationary at I(1) and variables are not cointegrated a VAR model has been conducted by using the first differneces to receive information about the long and short-run relationship between variables. This sample applies to two macroeconomic variables: women's unemployment and CPI.

The following tables include the VAR outcomes for the long and short run for women's unemployment.

Vector Autoregression Model long-run outcomes women unemployment			
Variable	**P-value**	**Null hypothesis**	**Outcome**
ATX	0,0000	Reject	There is a long-run association
ANDR	0,0000	Reject	There is a long-run association
CAI	0,0000	Reject	There is a long-run association
EBS	0,0000	Reject	There is a long-run association
OMV	0,0000	Reject	There is a long-run association
POST	0,0000	Reject	There is a long-run association
RBI	0,0000	Reject	There is a long-run association
TKA	0,0000	Reject	There is a long-run association
VIG	0,0000	Reject	There is a long-run association
VOE	0,0000	Reject	There is a long-run association
WIE	0,0000	Reject	There is a long-run association

TABLE 14 VAR MODEL LONG-RUN OUTCOMES WOMEN UNEMPLOYMENT

Vector Autoregression Model short-run outcomes women unemployment			
Variable	**P-value**	**Null hypothesis**	**Outcome**
ATX	0,3083	Do not reject	There is no short-run association
ANDR	0,3360	Do not reject	There is no short-run association
CAI	0,1382	Do not reject	There is no short-run association
EBS	0,1569	Do not reject	There is no short-run association
OMV	0,1433	Do not reject	There is no short-run association
POST	0,3245	Do not reject	There is no short-run association
RBI	0,6670	Do not reject	There is no short-run association
TKA	0,1540	Do not reject	There is no short-run association
VIG	0,0838	Do not reject	There is no short-run association
VOE	0,2139	Do not reject	There is no short-run association
WIE	0,1195	Do not reject	There is no short-run association

TABLE 15 VAR MODEL SHORT-RUN OUTCOMES WOMEN UNEMPLOYMENT

At the first sight, the results are unequivocal. Figures suggest that there is a long-run association between women's unemployment and all stock market variables. On contrary there is no short-run relationship as the p-value for all variables is above the 5% significands.

The next two tables illustrate the vector autoregression model outcomes for CPI in the long and short run.

Vector Autoregression Model long-run outcomes CPI			
Variable	**P-value**	**Null hypothesis**	**Outcome**
ATX	0,0000	Reject	There is a long-run association
ANDR	0,0000	Reject	There is a long-run association
CAI	0,0000	Reject	There is a long-run association
EBS	0,0000	Reject	There is a long-run association
OMV	0,0000	Reject	There is a long-run association
POST	0,0000	Reject	There is a long-run association
RBI	0,0000	Reject	There is a long-run association
TKA	0,0000	Reject	There is a long-run association
VIG	0,0000	Reject	There is a long-run association
VOE	0,0000	Reject	There is a long-run association
WIE	0,0000	Reject	There is a long-run association

TABLE 16 VAR MODEL LONG-RUN OUTCOMES CPI

Vector Autoregression Model short-run outcomes CPI			
Variable	**P-value**	**Null hypothesis**	**Outcome**
ATX	0,1376	Do not reject	There is no short-run association
ANDR	0,8152	Do not reject	There is no short-run association
CAI	0,6697	Do not reject	There is no short-run association
EBS	0,0976	Do not reject	There is no short-run association
OMV	0,3235	Do not reject	There is no short-run association
POST	0,0039	Reject	There is a short-run association
RBI	0,0162	Reject	There is a short-run association
TKA	0,0798	Do not reject	There is no short-run association
VIG	0,2551	Do not reject	There is no short-run association
VOE	0,8196	Do not reject	There is no short-run association
WIE	0,3131	Do not reject	There is no short-run association

TABLE 17 VAR MODEL SHORT-RUN OUTCOMES CPI

Figures show a similar situation as for women's unemployment. The hypothesis test for the long-run association shows for all variables a statistically significant result. Therefore, the null hypothesis can be rejected, so a long-run relationship is given. In the short run, just POST and RBI have a p-value below the 5% significance level. Hence, there is not a short-run association between the variables apart of POST and RBI.

In summary, the VAR model suggests that both women and CPI have a long-run association with all the response variables. On the other hand, a short-run association is in general not applicable.

5.2.5 Vector Error Correction Model

For all cointegrated varaibles a VECM model with data at level has been conducted to receive information about the long and short-run relationship between variables. This sample applies to all categories of unemployment except for women.

The following two tables include the VECM outcomes for the long and short run for total unemployment.

Vector Error Correction Model long-run outcomes total unemployment			
Variable	**P-value**	**Null hypothesis**	**Outcome**
ATX	0,0243	Reject	There is a long-run association
ANDR	0,0243	Reject	There is a long-run association
CAI	0,0000	Reject	There is a long-run association
EBS	0,0073	Reject	There is a long-run association
OMV	0,2687	Do not reject	There is no long-run association
POST	0,0489	Reject	There is a long-run association
RBI	0,8237	Do not reject	There is no long-run association
TKA	0,0346	Reject	There is a long-run association
VIG	0,0031	Reject	There is a long-run association
VOE	0,1937	Do not reject	There is no long-run association
WIE	0,3939	Do not reject	There is no long-run association

TABLE 18 VECM LONG-RUN OUTCOMES TOTAL UNEMPLOYMENT

Vector Error Correction Model short-run outcomes total unemployment			
Variable	**P-value**	**Null hypothesis**	**Outcome**
ATX	0,1465	Do not reject	There is no short-run association
ANDR	0,0190	Reject	There is a short-run association
CAI	0,5232	Do not reject	There is no short-run association
EBS	0,0199	Reject	There is a short-run association
OMV	0,7616	Do not reject	There is no short-run association
POST	0,0264	Reject	There is a short-run association
RBI	0,0384	Reject	There is a short-run association
TKA	0,0046	Reject	There is a short-run association
VIG	0,0025	Reject	There is a short-run association
VOE	0,4796	Do not reject	There is no short-run association
WIE	0,8129	Do not reject	There is no short-run association

TABLE 19 VECM SHORT-RUN OUTCOMES TOTAL UNEMPLOYMENT

The p-value for most variables does not exceed the 5% significance level. Hence, figures suggest that total unemployment has a long and short-run relationship. Still, this outcome cannot be confirmed for all combinations. The response variable ATX for instance shows suggests a long-run relationship, but no short-run association. This is of particular interest as the ATX represents the market as a whole and just the total unemployment finds a real presence in the media. Furthermore, the variables EBS and RBI represent the banking sector in this study, but the results are not equal. A short-run relationship is given but in the long run, is no clear picture visible.

The next two tables contain the result for men's unemployment.

Vector Error Correction Model long-run outcomes men unemployment			
Variable	**P-value**	**Null hypothesis**	**Outcome**
ATX	0,0390	Reject	There is a long-run association
ANDR	0,4151	Do not reject	There is no long-run association
CAI	0,0053	Reject	There is a long-run association
EBS	0,0019	Reject	There is a long-run association
OMV	0,4718	Do not reject	There is no long-run association
POST	0,0997	Do not reject	There is no long-run association
RBI	0,1762	Do not reject	There is no long-run association
TKA	0,1064	Do not reject	There is no long-run association
VIG	0,0106	Reject	There is a long-run association
VOE	0,0366	Reject	There is a long-run association
WIE	0,2805	Do not reject	There is no long-run association

TABLE 20 VECM LONG-RUN OUTCOMES MEN UNEMPLOYMENT

Vector Error Correction Model short-run outcomes men unemployment			
Variable	**P-value**	**Null hypothesis**	**Outcome**
ATX	0,0949	Do not reject	There is no short-run association
ANDR	0,2785	Do not reject	There is no short-run association
CAI	0,0001	Reject	There is a short-run association
EBS	0,0054	Reject	There is a short-run association
OMV	0,8654	Do not reject	There is no short-run association
POST	0,0594	Do not reject	There is no short-run association
RBI	0,0967	Do not reject	There is no short-run association
TKA	0,0124	Reject	There is a short-run association
VIG	0,0026	Reject	There is a short-run association
VOE	0,6220	Do not reject	There is no short-run association
WIE	0,9595	Do not reject	There is no short-run association

TABLE 21 VECM SHORT-RUN OUTCOMES MEN UNEMPLOYMENT

Even though there is a strong correlation between total and men unemployment results are different in the VECM model. Most stock market variables do show any long and short-run association. In detail, it is visible that there is a long-run association with ATX, but this does not apply in the short run. ANDR, OMV, POST, RBI, and WIE do not suggest any association with men's unemployment as an explanatory variable.

The last two tables in this section include the VECM outcomes for youth unemployment.

Vector Error Correction Model long-run outcomes youth unemployment			
Variable	**P-value**	**Null hypothesis**	**Outcome**
ATX	0,0295	Reject	There is a long-run association
ANDR	0,0263	Reject	There is a long-run association
CAI	0,4301	Do not reject	There is no long-run association
EBS	0,0012	Reject	There is a long-run association
OMV	0,0408	Reject	There is a long-run association
POST	0,0126	Reject	There is a long-run association
RBI	0,0492	Reject	There is a long-run association
TKA	0,0218	Reject	There is a long-run association
VIG	0,0023	Reject	There is a long-run association
VOE	0,0348	Reject	There is a long-run association
WIE	0,0667	Do not reject	There is no long-run association

TABLE 22 VECM LONG-RUN OUTCOMES YOUTH UNEMPLOYMENT

Vector Error Correction Model short-run outcomes youth unemployment			
Variable	**P-value**	**Null hypothesis**	**Outcome**
ATX	0,0670	Do not reject	There is no short-run association
ANDR	0,3563	Do not reject	There is no short-run association
CAI	0,5619	Do not reject	There is no short-run association
EBS	0,0007	Reject	There is a short-run association
OMV	0,3152	Do not reject	There is no short-run association
POST	0,0059	Reject	There is a short-run association
RBI	0,0045	Reject	There is a short-run association
TKA	0,0262	Reject	There is a short-run association
VIG	0,2089	Do not reject	There is no short-run association
VOE	0,6497	Do not reject	There is no short-run association
WIE	0,7827	Do not reject	There is no short-run association

TABLE 23 VECM SHORT-RUN OUTCOMES YOUTH UNEMPLOYMENT

Once again, the results do not correspond with the other categories of unemployment. Results suggest that the null hypothesis for the long-run association for all variables except CAI and WIE is rejected at a 5% significance level. Therefore, a long-run relationship is evident. On the other hand, the results in the short run are striking differences. For four response variables, there is a short-run association visible, which represents less than half of the variables. The ATX index shows equally to men unemployment just a long-run relationship. However, the two stocks in the banking sectors are long and short-run associations suggest.

To conclude, even though total, men and youth unemployment is strongly correlated results in the VECM model are different. In general, a long-run association can be assumed as it applies to most of the stock market variables. Nonetheless, this does not apply in the short run since the p-value for most variables exceeds the 5% significands level. In detail, the relationship between these macro variables and the ATX index is just in the long run suggested. In general, it seems that youth unemployment has the highest predicting power in the short run and total unemployment in the long run.

5.2.6 Heteroskedasticity

The section illustrates the results from the heteroskedasticity test, which provide information about the efficiency of the VAR and VECM outcomes. Heteroskedasticity should be avoided because otherwise the variance of the residuals increases with the fitted values of the repones variables.

Heteroskedasticity Test outcomes total unemployment			
Variable	**P-value**	**Null hypothesis**	**Outcome**
ATX	0,0645	Do not reject	Data is homoscedastic
ANDR	0,3236	Do not reject	Data is homoscedastic
CAI	0,2424	Do not reject	Data is homoscedastic
EBS	0,2078	Do not reject	Data is homoscedastic
OMV	0,0771	Do not reject	Data is homoscedastic
POST	0,3562	Do not reject	Data is homoscedastic
RBI	0,3297	Do not reject	Data is homoscedastic
TKA	0,1687	Do not reject	Data is homoscedastic
VIG	0,4424	Do not reject	Data is homoscedastic
VOE	0,0545	Do not reject	Data is homoscedastic
WIE	0,2457	Do not reject	Data is homoscedastic

TABLE 24 HETEROSKEDASTICITY TEST OUTCOMES TOTAL UNEMPLOYMENT

The table above provides the results for the explanatory variable total unemployment. The p-value is above 0.05, which means that the null hypothesis cannot be rejected. Hence, there is homoscedasticity, and the time-series results can be trusted.

Heteroskedasticity Test outcomes women unemployment			
Variable	**P-value**	**Null hypothesis**	**Outcome**
ATX	0,9954	Do not reject	Data is homoscedastic
ANDR	0,6098	Do not reject	Data is homoscedastic
CAI	0,0113	Reject	Data is heteroscedastic
EBS	0,5333	Do not reject	Data is homoscedastic
OMV	0,3131	Do not reject	Data is homoscedastic
POST	0,6427	Do not reject	Data is homoscedastic
RBI	0,0570	Do not reject	Data is homoscedastic
TKA	0,6218	Do not reject	Data is homoscedastic
VIG	0,3873	Do not reject	Data is homoscedastic
VOE	0,0215	Reject	Data is heteroscedastic
WIE	0,1962	Do not reject	Data is homoscedastic

TABLE 25 HETEROSKEDASTICITY TEST OUTCOMES WOMEN UNEMPLOYMENT

The results for women's unemployment are mostly not statistically significant and therefore provided the desired results. Just in the combination with CAI and VOE can the null hypothesis be rejected, which indicates there is heteroscedasticity in the model.

Heteroskedasticity Test outcomes men unemployment			
Variable	**P-value**	**Null hypothesis**	**Outcome**
ATX	0,2002	Do not reject	Data is homoscedastic
ANDR	0,1896	Do not reject	Data is homoscedastic
CAI	0,2999	Do not reject	Data is homoscedastic
EBS	0,1159	Do not reject	Data is homoscedastic
OMV	0,0669	Do not reject	Data is homoscedastic
POST	0,4598	Do not reject	Data is homoscedastic
RBI	0,4879	Do not reject	Data is homoscedastic
TKA	0,1252	Do not reject	Data is homoscedastic
VIG	0,6965	Do not reject	Data is homoscedastic
VOE	0,0445	Reject	Data is heteroscedastic
WIE	0,4861	Do not reject	Data is homoscedastic

TABLE 26 HETEROSKEDASTICITY TEST OUTCOMES MEN UNEMPLOYMENT

The table above shows that the hypothesis tests are not statistically significant apart of the combination with VOE. Therefore, the time-series results can be in general trusted since the data sets are mostly homoscedastic.

Heteroskedasticity Test outcomes youth unemployment			
Variable	**P-value**	**Null hypothesis**	**Outcome**
ATX	0,5200	Do not reject	Data is homoscedastic
ANDR	0,2335	Do not reject	Data is homoscedastic
CAI	0,1475	Do not reject	Data is homoscedastic
EBS	0,3560	Do not reject	Data is homoscedastic
OMV	0,3849	Do not reject	Data is homoscedastic
POST	0,6711	Do not reject	Data is homoscedastic
RBI	0,8844	Do not reject	Data is homoscedastic
TKA	0,0520	Do not reject	Data is homoscedastic
VIG	0,6097	Do not reject	Data is homoscedastic
VOE	0,1400	Do not reject	Data is homoscedastic
WIE	0,4893	Do not reject	Data is homoscedastic

TABLE 27 HETEROSKEDASTICITY TEST OUTCOMES YOUTH UNEMPLOYMENT

According to the test results above the p-values do exceed 0.05, which means that the null hypothesis cannot be rejected for any combination for youth unemployment. Hence, the desired results of showing a trustworthy model can be fulfilled.

Heteroskedasticity Test outcomes CPI			
Variable	**P-value**	**Null hypothesis**	**Outcome**
ATX	0,3918	Do not reject	Data is homoscedastic
ANDR	0,9938	Do not reject	Data is homoscedastic
CAI	0,0167	Reject	Data is heteroscedastic
EBS	0,6116	Do not reject	Data is homoscedastic
OMV	0,1536	Do not reject	Data is homoscedastic
POST	0,0164	Do not reject	Data is homoscedastic
RBI	0,0964	Do not reject	Data is homoscedastic
TKA	0,3311	Do not reject	Data is homoscedastic
VIG	0,0001	Reject	Data is heteroscedastic
VOE	0,5710	Do not reject	Data is homoscedastic
WIE	0,0940	Do not reject	Data is homoscedastic

TABLE 28 HETEROSKEDASTICITY TEST OUTCOMES CPI

The heteroskedasticity tests for the explanatory variable CPI suggest no statistical significands for the majority of combinations. As a result, the null hypothesis can be rejected only for the combination of CAI and VIG.

To sum up, heteroskedasticity is just in some exceptions detectable, so in general, we can trust the outcomes from the time-series model. Between all macroeconomic variables and ATX, the null hypothesis could not be rejected. This provides already trustworthy results for the Austrian market as a general. For a combination with the macro variables and CAI, VIG and VOE results suggest sometimes heteroskedasticity, which reduces the trustworthiness of these combinations.

5.2.7 Granger Causality

The final analysis - granger causality tests - examines whether a timer series variable can predict another or not. Since it is a commonly used tool for economic variables it will help to forecast the effects for this study.

The table below answers the question if the total unemployment Granger causes one of the stock market variables.

Granger Causality test outcomes total unemployment			
Variable	**P-value**	**Null hypothesis**	**Outcome**
ATX	0,0872	Do not reject	total unemployment does not Granger Cause ATX
ANDR	0,0949	Do not reject	total unemployment does not Granger Cause ANDR
CAI	0,5402	Do not reject	total unemployment does not Granger Cause CAI
EBS	0,2116	Do not reject	total unemployment does not Granger Cause EBS
OMV	0,1146	Do not reject	total unemployment does not Granger Cause OMV
POST	0,0808	Do not reject	total unemployment does not Granger Cause POST
RBI	0,1937	Do not reject	total unemployment does not Granger Cause RBI
TKA	0,0398	Reject	total unemployment Granger Cause TKA
VIG	0,0497	Reject	total unemployment Granger Cause VIG
VOE	0,8945	Do not reject	total unemployment does not Granger Cause VOE
WIE	0,9426	Do not reject	total unemployment does not Granger Cause WIE

TABLE 29 GRANGER CAUSALITY TEST OUTCOMES TOTAL UNEMPLOYMENT

Figures suggest that the total unemployment Granger causes the stock market variables TKA and VIG. On contrary, it means that total unemployment does not Granger cause the other variables. As a result, generally, there is not Granger causality suggest and thus total unemployment has no forecasting power based on the Granger causality test.

The next table illustrates the same for the explanatory variable of women's unemployment.

Granger Causality test outcomes women unemployment			
Variable	**P-value**	**Null hypothesis**	**Outcome**
ATX	0,3126	Do not reject	women unemployment does not Granger Cause ATX
ANDR	0,3401	Do not reject	women unemployment does not Granger Cause ANDR
CAI	0,1382	Do not reject	women unemployment does not Granger Cause CAI
EBS	0,1569	Do not reject	women unemployment does not Granger Cause EBS
OMV	0,1433	Do not reject	women unemployment does not Granger Cause OMV
POST	0,3245	Do not reject	women unemployment does not Granger Cause POST
RBI	0,6670	Do not reject	women unemployment does not Granger Cause RBI
TKA	0,1540	Do not reject	women unemployment does not Granger Cause TKA
VIG	0,0838	Do not reject	women unemployment does not Granger Cause VIG
VOE	0,2139	Do not reject	women unemployment does not Granger Cause VOE
WIE	0,1195	Do not reject	women unemployment does not Granger Cause WIE

TABLE 30 GRANGER CAUSALITY TEST OUTCOMES WOMEN UNEMPLOYMENT

The p-values for all options are above 0.05, which means that the null hypothesis cannot be rejected. This concludes that women's unemployment does not Granger cause the stock market variables in Austria.

The outcomes for the Granger causality test for the macroeconomic variable "men unemployment" are highlighted in the table below.

Granger Causality test outcomes men unemployment			
Variable	**P-value**	**Null hypothesis**	**Outcome**
ATX	0,5805	Do not reject	men unemployment does not Granger Cause ATX
ANDR	0,2442	Do not reject	men unemployment does not Granger Cause ANDR
CAI	0,0145	Reject	men unemployment Granger Cause CAI
EBS	0,5438	Do not reject	men unemployment does not Granger Cause EBS
OMV	0,8572	Do not reject	men unemployment does not Granger Cause OMV
POST	0,1035	Do not reject	men unemployment does not Granger Cause POST
RBI	0,4680	Do not reject	men unemployment does not Granger Cause RBI
TKA	0,0527	Do not reject	men unemployment does not Granger Cause TKA
VIG	0,0526	Do not reject	men unemployment does not Granger Cause VIG
VOE	0,9503	Do not reject	men unemployment does not Granger Cause VOE
WIE	0,8597	Do not reject	men unemployment does not Granger Cause WIE

TABLE 31 GRANGER CAUSALITY TEST OUTCOMES MEN UNEMPLOYMENT

The p-value for CAI does not exceed the 5% significance level. Hence, figures suggest that men's unemployment granger causes CAI. This outcome cannot be repeated for other combinations as the results are not statistically significant. In other words, men's unemployment does not Granger cause any other stock market variable apart of CAI.

The results below contain the results for the remaining unemployment category – youth unemployment.

Granger Causality test outcomes youth unemployment			
Variable	**P-value**	**Null hypothesis**	**Outcome**
ATX	0,5047	Do not reject	youth unemployment does not Granger Cause ATX
ANDR	0,4025	Do not reject	youth unemployment does not Granger Cause ANDR
CAI	0,5114	Do not reject	youth unemployment does not Granger Cause CAI
EBS	0,1443	Do not reject	youth unemployment does not Granger Cause EBS
OMV	0,2843	Do not reject	youth unemployment does not Granger Cause OMV
POST	0,1156	Do not reject	youth unemployment does not Granger Cause POST
RBI	0,0518	Do not reject	youth unemployment does not Granger Cause RBI
TKA	0,1773	Do not reject	youth unemployment does not Granger Cause TKA
VIG	0,2087	Do not reject	youth unemployment does not Granger Cause VIG
VOE	0,8922	Do not reject	youth unemployment does not Granger Cause VOE
WIE	0,7724	Do not reject	youth unemployment does not Granger Cause WIE

TABLE 32 GRANGER CAUSALITY TEST OUTCOMES YOUTH UNEMPLOYMENT

The p-value for all the related tests is greater than 0.05, so it is not possible to reject the null hypothesis that youth unemployment does not Granger cause the stock market variables.

The last table includes the outcome for CPI.

Granger Causality test outcomes CPI			
Variable	**P-value**	**Null hypothesis**	**Outcome**
ATX	0,1521	Do not reject	CPI unemployment does not Granger Cause ATX
ANDR	0,8152	Do not reject	CPI unemployment does not Granger Cause ANDR
CAI	0,6697	Do not reject	CPI unemployment does not Granger Cause CAI
EBS	0,0976	Do not reject	CPI unemployment does not Granger Cause EBS
OMV	0,3235	Do not reject	CPI unemployment does not Granger Cause OMV
POST	0,0065	Reject	CPI unemployment Granger Cause POST
RBI	0,0162	Reject	CPI unemployment Granger Cause RBI
TKA	0,0798	Do not reject	CPI unemployment does not Granger Cause TKA
VIG	0,2551	Do not reject	CPI unemployment does not Granger Cause VIG
VOE	0,8196	Do not reject	CPI unemployment does not Granger Cause VOE
WIE	0,3131	Do not reject	CPI unemployment does not Granger Cause WIE

TABLE 33 GRANGER CAUSALITY TEST OUTCOMES CPI

The p-value for POST and RBI does not exceed the 5% significance level. Hence, figures suggest that CPI Granger causes POST and RBI. This outcome cannot be repeated for other combinations as the results are not statistically significant. In other words, CPI does not granger cause any other stock market variable apart from POST and RBI.

In conclusion, just in a minority of cases, a Granger causality between the selected macro variables and stock market variables can be found. For women and youth unemployment is not even a single Granger causality visible. This applies also to the response variable ATX as the p-value always exceeds the 5% significance level.

5.3 Implications For Relevant Stakeholder

This study cannot be taken as a guide on investment decisions. The reasons follow the results mentioned above. There is evidence that macroeconomic variables influence the performance of stock prices, but a missing Granger causality makes it difficult to relay on it. What is more, the given period lies between two major crises (financial crises and COVID-19 pandemic). Therefore, the impact resulting from the COVID-19 pandemic cannot be estimated. Furthermore, the labor market in Austria in a direction where the younger generation tries to keep a work-life balance and women increase their participation. As a result, changes in the unemployment structure will impact unemployment in general as well as the purchasing power relating to it.

To conclude, corporations, investors, and policy marker should pay attention to macroeconomic indicators frequently in order to make profound decisions. A relationship between the variables is visible, but changing conditions have not only an effect on the macro variables they also affect the market in general.

5.4 Limitations And Recommendations For Further Research

The thesis focuses solely on the Austrian environment although internationalization is omnipresent. Considering the importance of international factors, it can be seen as a limitation to exclude them. Furthermore, the time frame relies on data between major crises. This provides valuable information in a constant environment but limits the results at the same time to this condition.

Additionally, to this study, international variables such as average unemployment in the European Union can be added to understand if it is reasonable to extend the overall scope. Furthermore, the COVID-19 pandemic provides several interesting changes. As an example, the categories of unemployment can be extended by short-time work as individuals in this scheme get a substantial part of the salary from the government by being officially not unemployed even when the working time gets reduced by 100%.

6 CONCLUSION

The contribution to the research contains the following answer to the research questions of this thesis.

Inflation and unemployment influence stock return in the Austria stock market. However, a closer look is crucial to get a better understanding of the results. Unemployment in this study was divided into four categories, whereas especially total, men and youth unemployment showed very similar movements. This intention was also confirmed during the correlation analysis, which suggests a very strong positive correlation. The correlation to women's unemployment was strong, but not as strong as between the other unemployment variables. Between unemployment and inflation, there is a week negative correlation visible. This does not confirm that the Phillips Curve holds in Austria, but it provides a first indication of the inverse relationship. Between all types of unemployment and stock market variables, a weak negative correlation can be suggested. Moreover, a weak positive relation is visible between inflation the stock market variables.

The time-series analysis needed to be separated in VAR and VECM due to the lacking cointegration for the explanatory variables' women unemployment and CPI. However, the results were similar. In general, the figures suggest a long-run relationship between the macro variables and the stock market variables. This however in most cases does not apply in the short run. Still, total unemployment seems to have the highest predicting power. The validity of the model gets confirmed by the R^2 of the VAR and VECM model as well as by the heteroskedasticity test. The related R^2 was in every case above 0.5 and most of the data homoscedastic.

Additionally, the Granger causality test that was carried out for this model showed that share price movement cannot be predicted by unemployment and inflation. Despite some exceptions no patterns are visible that suggest any predive information.

Considering that the results do not show a direct trend in one direction it fits studies conducted in other countries. The results vary between countries, period, and time frame and therefore show that many other factors have an impact, and not always macroeconomic indicators influence the individual situation on the stock market.

To sum up, macroeconomic variables are weakly correlated with the stock market variables. Furthermore, the hypotheses test suggests a long-run association, but a short-run association applies just in selected stocks. Lastly, macroeconomic variables do not Granger cause stock market variables.

7 BIBLIOGRAPHY

Antonakakis, N., Gupta, R., & Tiwari, A. K. (2017). Has the correlation of inflation and stock prices changed in the United States over the last two centuries? Research in International Business and Finance, 42, 1-8. doi:10.1016/j.ribaf.2017.04.005

Ang, A. (2014). Asset management: A systematic approach to factor investing. Oxford University Press.

Aguiar-Conraria, L., Martins, M. M., & Soares, M. J. (2020). Okun's law across time and frequencies. Journal of Economic Dynamics and Control, 116, 103897. doi:10.1016/j.jedc.2020.103897

Brooks, C. (2008). Introductory econometrics for finance: Chris Brooks (2nd ed.). Cambridge: Cambridge University Press.

Blanchard, O., & Johnson, D. R. (2012). Macroeconomics. Boston: Pearson.

Blázquez-Fernández, C., Cantarero-Prieto, D., & Pascual-Sáez, M. (2018). Okun's law in Selected European Countries (2005-2017): An age and gender analysis. Economics & Sociology, 11(2), 263-274. doi:10.14254/2071-789x.2018/11-2/18

Boudoukh, J., & Richardson, M. (1993). Stock Returns and Inflation: A Long-Horizon Perspective. He American Economic Review, 83(5), 1346-1355.

Boundless. (n.d.). The Relationship Between Inflation and Unemployment. https://courses.lumenlearning.com/boundless-economics/chapter/the-relationship-between-inflation-and-unemployment/.

CA IMMO 2. (2020). Capital stock and shareholder structure. Retrieved December 08, 2020, from https://www.caimmo.com/en/investor-relations/share/capital-stock-and-shareholder-structure/

Cooray, A. (2002). The Fisher Effect: A Review of the Literature. Retrieved March 14, 2021, from https://www.researchgate.net/publication/5165768_The_Fisher_Effect_A_Review_of_the_Literature

Christl, M., Köppl-Turyna, M., & Kucsera, D. (2017). Okun's law in Austria. DANUBE: Law and Economics Review,8(2), 97-110. doi:10.1515/danb-2017-0007

Dorn, J. A. (2020). The Phillips Curve: A Poor Guide for Monetary Policy. The Cato Journal, 40(1).

Economou, A., & Psarianos, I. N. (2016). Revisiting OKUN'S law in European Union countries. Journal of Economic Studies, 43(2), 275-287. doi:10.1108/jes-05-2013-0063

Fama, E. F. (1981). Stock Returns, Real Activity, Inflation, and Money. The American Economic Review, 71(4), 545-565.

Ferguson, N., Maier, C. S., Manela, E., & Sargent, D. J. (2010). The shock of the global: The 1970s in perspective. Cambridge, MA: Belknap Press of Harvard University Press.

Gavriilidis, K., & Kgari, L. (2016). Stock returns and inflation: The case of Botswana. Handbook of Frontier Markets, 27-38. doi:10.1016/b978-0-12-803776-8.00002-1

Gonzalo, J., & Taamouti, A. (2017). The reaction of stock market returns to unemployment. Studies in Nonlinear Dynamics & Econometrics, 21(4). doi:10.1515/snde-2015-0078

Gultekin, N. B. (1983). Stock market returns and inflation: Evidence from other countries. The Journal of Finance, 38(1), 49-65. doi:10.1111/j.1540-6261.1983.tb03625.x

Gupta, N. J., Strohush, V., & White, R. (2018). Investor reaction to simultaneous news releases: Unemployment vs. earnings. Journal of Economics and Finance, 43(4), 735-749. doi:10.1007/s12197-018-9460-z

Hatemi-J, A. (2009). The International Fisher Effect: Theory and application. Investment Management and Financial Innovations, 6(1).

Hindrayanto, I., Samarina, A., & Stanga, I. M. (2019). Is the Phillips curve still alive? Evidence from the euro area. Economics Letters, 174, 149-152. doi:10.1016/j.econlet.2018.11.021

Hooper, P., Mishkin, F. S., & Sufi, A. (2020). Prospects for inflation in a high pressure economy: Is the Phillips curve dead or is it just hibernating? Research in Economics, 74, 26-62. doi:https://doi.org/10.1016/j.rie.2019.11.004

Peng, W. (1995). The Fisher hypothesis and Inflation Persistence: Evidence from five major industrial countries. IMF Working Papers, 95(118), 1. doi:10.5089/9781451940824.001

Porras-Arena, M. S., & Martín-Román, Á L. (2019). Self-employment and THE Okun's law. Economic Modelling, 77, 253-265. doi:10.1016/j.econmod.2018.09.006

Sibande, X., Gupta, R., & Wohar, M. E. (2019). Time-varying causal relationship between stock market and unemployment in the United kingdom: Historical evidence from 1855 to 2017. Journal of Multinational Financial Management, 49, 81-88. doi:10.1016/j.mulfin.2019.02.003

Shanmugam, R., & Chattamvelli, R. (2015). Statistics for Scientists and Engineers (1st ed.). John Wiley & Sons.

Jossa, B., & Musella, M. (2002). Inflation, unemployment, and money: Interpretations of the Phillips curve. Cheltenham, UK: E. Elgar.

Kim, J. (2002). The stock return-inflation puzzle and the asymmetric causality in stock returns, inflation and real activity. Economics Letters, 80(2), 155-160. doi:10.1016/s0165-1765(03)00059-4

Miller, K. D., Jeffrey, F. J., & Mandelker, G. (1976). The “fisher effect” for risky assets: An empirical investigation. The Journal of Finance, 31(2), 447-458. doi:10.1111/j.1540-6261.1976.tb01898.x

Mulligan, R. F. (2011). An Austrian Rehabilitation of the Phillips Curve. Cato Journal, 31(1).

Nowotny, E., & Zagler, M. (2009). Der öffentliche Sektor: Einführung in die Finanzwissenschaft. Berlin: Springer.

Tiwari, A. K., Dar, A. B., Bhanja, N., Arouri, M., & Teulon, F. (2015). Stock returns and inflation in Pakistan. Economic Modelling, 47, 23-31. doi:10.1016/j.econmod.2014.12.043

McGee, R. T. (2015). Applied financial macroeconomics and investment strategy: A practitioner's guide to tactical asset allocation. Palgrave Macmillan.

Meyer, B., & Tasci, M. (2012). An unstable okun’s law, not the best rule of thumb. Economic Commentary (Federal Reserve Bank of Cleveland), 1-6. doi:10.26509/frbc-ec-201208

Wang, W., & Zheng, K. (2018). Labor unemployment insurance and firms’ future performance. International Journal of Managerial Finance, 14(3), 282-300. doi:10.1108/ijmf-08-2017-0178

WBAG. (n.d.). The History of the Vienna Stock Exchange. Retrieved November 24, 2020, from https://www.wienerborse.at/uploads/u/cms/files/press/media-fact-sheet-the-history-of-the-vienna-stock-exchange.pdf

Wörgötterr, A. (1983). A note on the stable Phillips curve in Austria. Empirica, 10(1), 29-40. doi:10.1007/bf00928919

Wharton. (2004, March 25). Value stocks vs. growth stocks: Timing counts. Retrieved April 26, 2021, from https://knowledge.wharton.upenn.edu/article/value-stocks-vs-growth-stocks-timing-counts/

WBAG. (2019, May). The Rules for the Austrian Indices of the Vienna Stock Exchange. Retrieved November 24, 2020, from https://www.wienerborse.at/en/indices/index-values/overview/?ISIN=AT0000999982

Voestalpine 2. (2020, April). Shareholder structure. Retrieved December 07, 2020, from https://www.voestalpine.com/group/en/investors/share/shareholder-structure/

Amadeo, K. (2020, May 28). Types of Unemployment. Retrieved March 13, 2021, from https://www.thebalance.com/types-of-unemployment-3305522

Hayes, A. (2020, October 24). Heteroskedasticity. https://www.investopedia.com/terms/h/heteroskedasticity.asp.

Erste Bank 2. (2020, October 31). Shareholder Structure. Retrieved November 25, 2020, from https://www.erstegroup.com/en/investors/share/shareholder-structure

Erste Bank. (2020). About us. Retrieved November 24, 2020, from https://www.erstegroup.com/en/about-us

RBI 2. (2020). SHAREHOLDER STRUCTURE. Retrieved November 24, 2020, from https://www.rbinternational.com/en/investors/rbi-share/shareholder-structure.html

RBI. (2020). FACTS & FIGURES. Retrieved November 24, 2020, from https://www.rbinternational.com/en/who-we-are/facts-figures.html

OMV 2. (2020). Shareholder Structure. Retrieved December 04, 2020, from https://www.omv.com/en/investor-relations/omv-share/shareholder-structure

Andritz 2. (2020). The ANDRITZ share. Retrieved December 7, 2020, from https://www.andritz.com/group-en/investors/share

Andritz. (2020). About us. Retrieved December 07, 2020, from https://www.andritz.com/group-en/about-us

Voestalpine. (2020). Overview. Retrieved December 07, 2020, from https://www.voestalpine.com/group/en/group/overview/

A1 2. (2020). Shareholder Structure. Retrieved December 08, 2020, from https://www.a1.group/en/ir/shareholder-structure

A1. (2020). About us. Retrieved December 08, 2020, from https://www.a1.group/en/group/about-us

CA IMMO. (2020). About CA Immo. Retrieved December 08, 2020, from https://www.caimmo.com/en/company/overview/

Post. (2020). Shareholder structure. Retrieved December 08, 2020, from https://www.post.at/en/ir/c/shareholder-structure

VIG. (2020). Profile. Retrieved December 08, 2020, from https://www.vig.com/en/vig/group/profile.html

Wienerberger 2. (2020). Share. Retrieved December 08, 2020, from https://www.wienerberger.com/en/investors/share.html

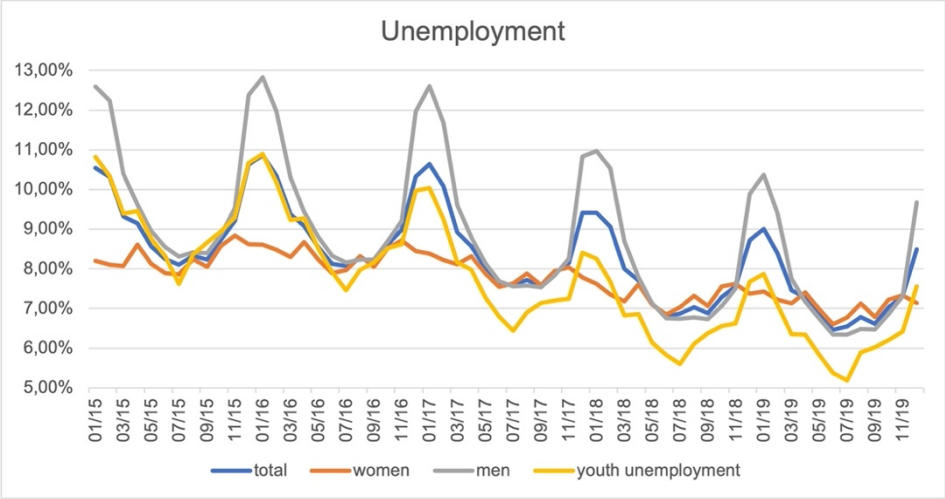
Wienerberger. (2020). About. Retrieved December 08, 2020, from https://www.wienerberger.com/en/about.html

STATISTICS AUSTRIA. (2020, December 18). Annual personal income. Retrieved December 20, 2020, from http://www.statistik.at/web_en/statistics/PeopleSociety/social_statistics/personal_income/annual_personal_income/index.html

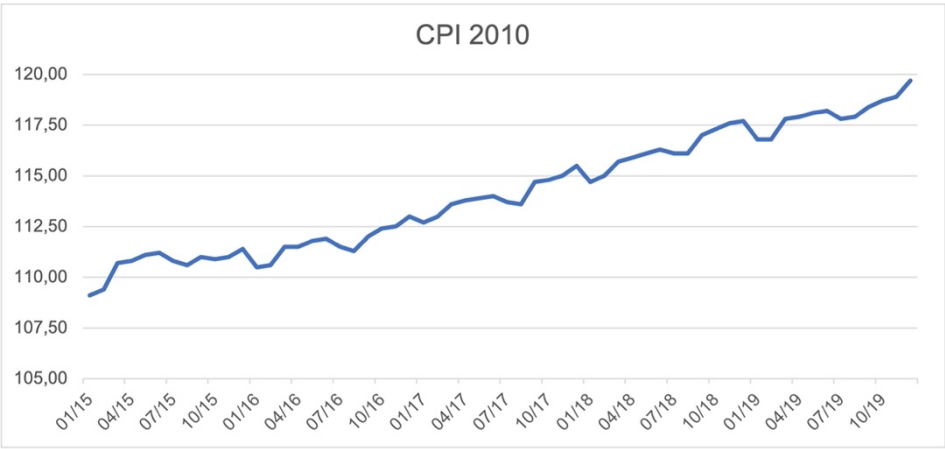
OMV. (2020, November). Factsheet OMV Group. Retrieved December 04, 2020, from https://www.omv.com/services/downloads/00/omv.com/1522162269657/dload_OMV%20Group%20Factsheet_EN

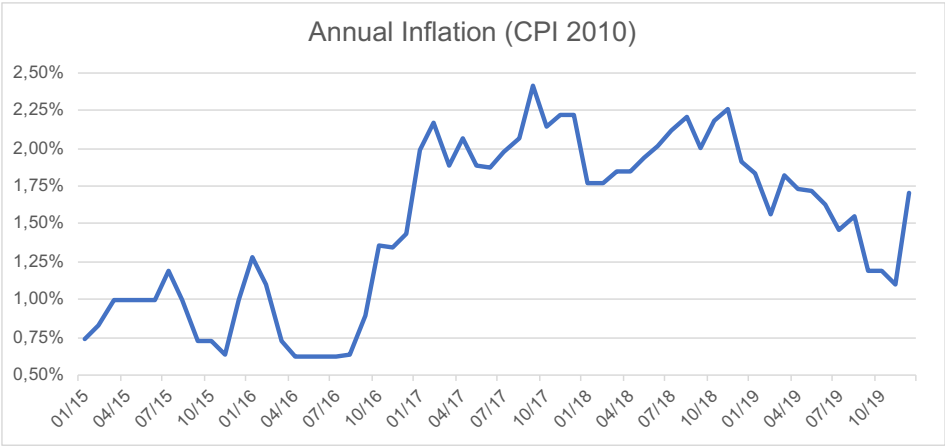
APPENDICES

Appendix 1: Chart Unemployment

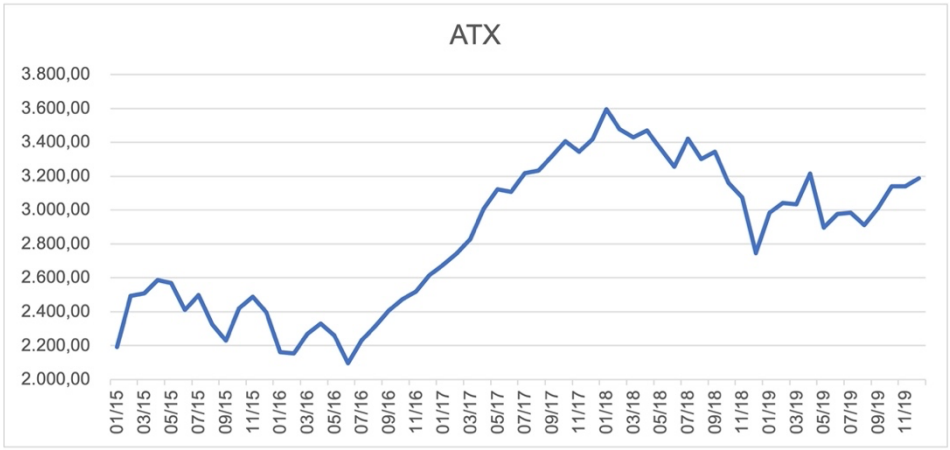


Appendix 2: Chart CPI

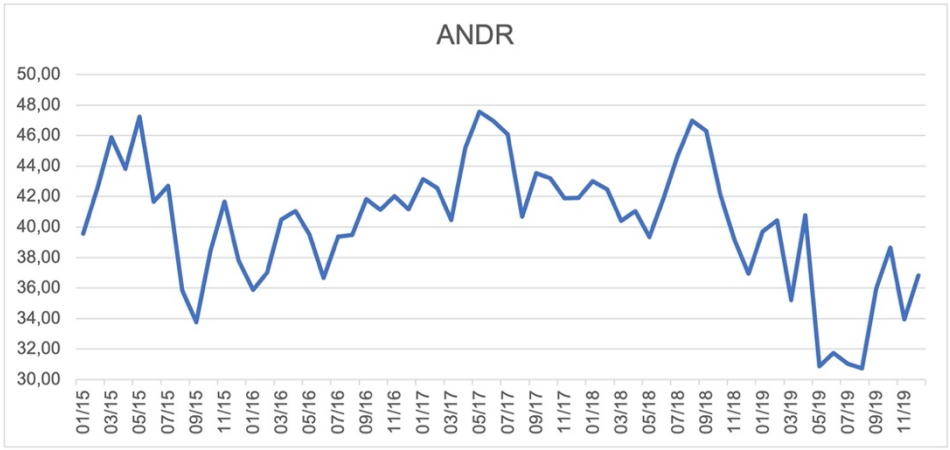




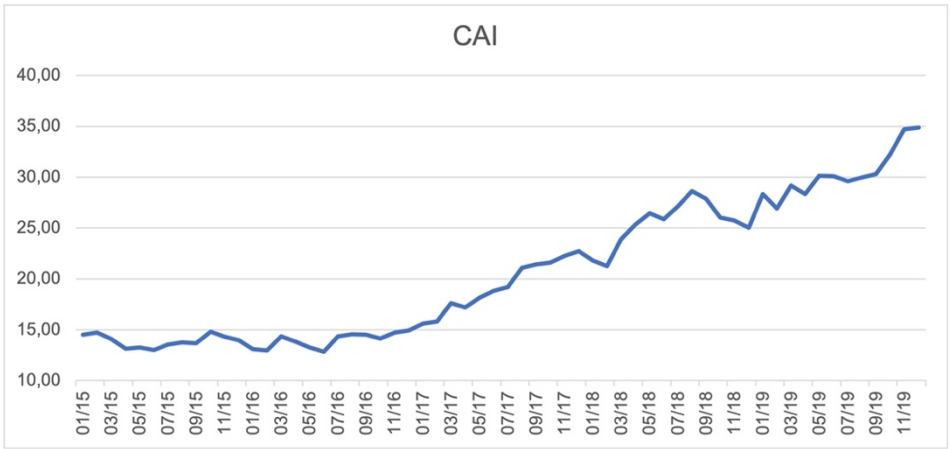
Appendix 3: Chart ATX



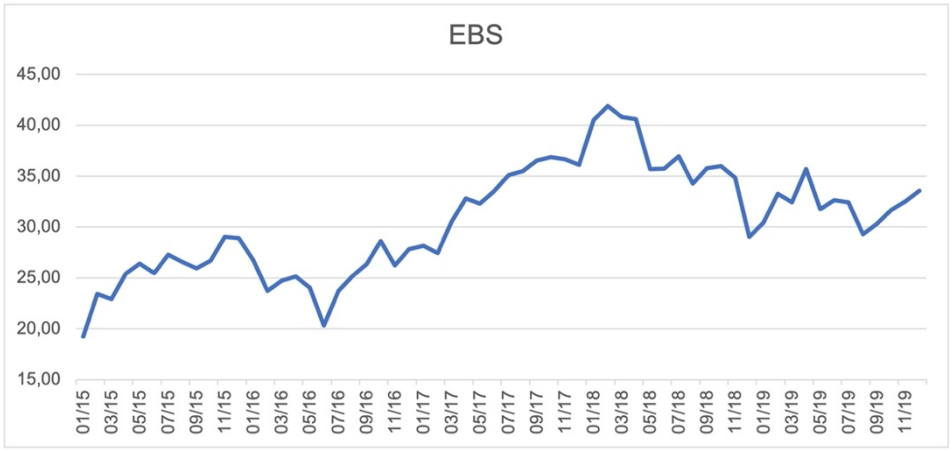
Appendix 4: Chart ANDR



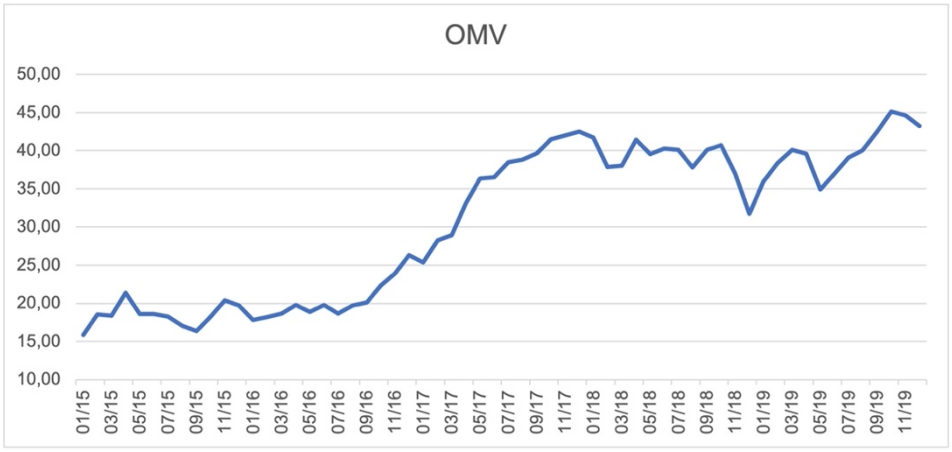
Appendix 5: Chart CAI



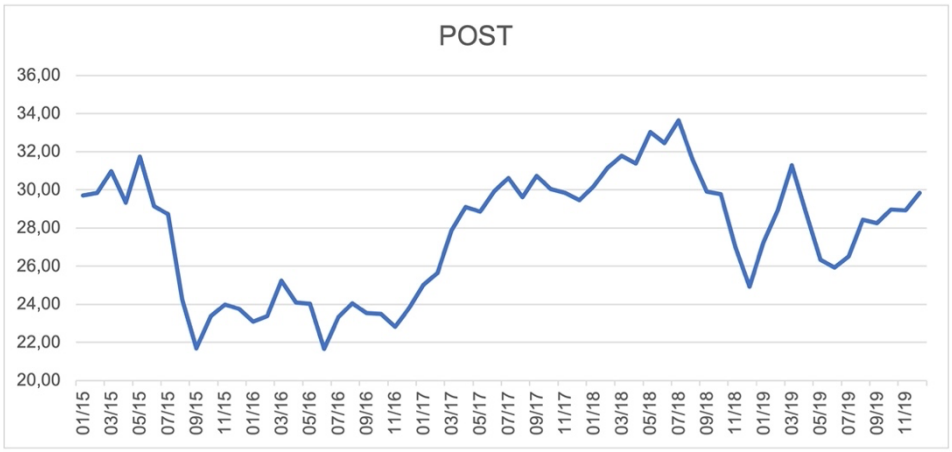
Appendix 6: Chart EBS



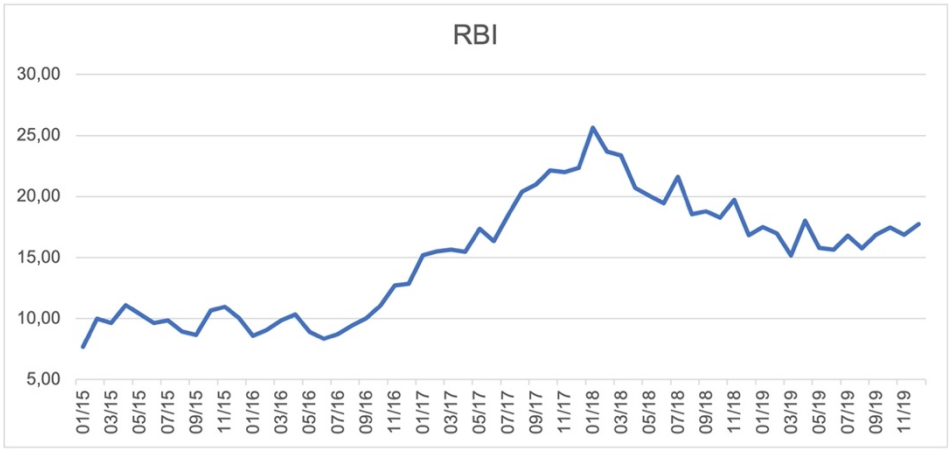
Appendix 7: Chart OMV



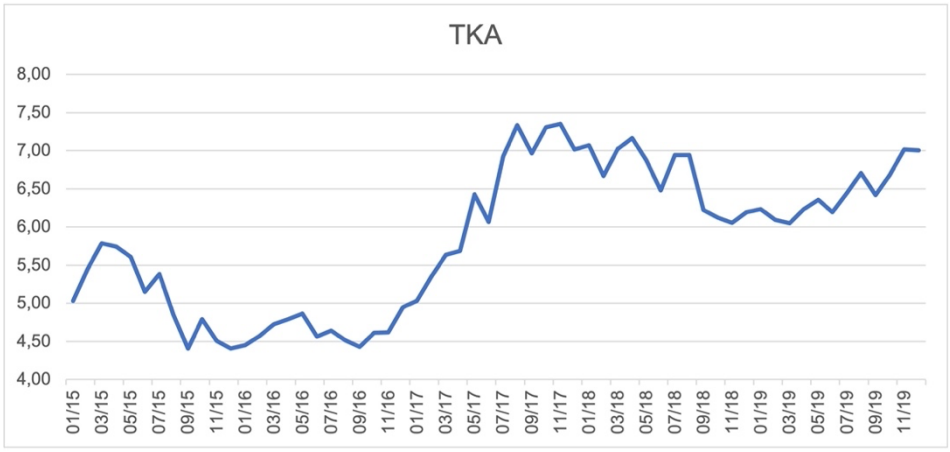
Appendix 8: Chart POST



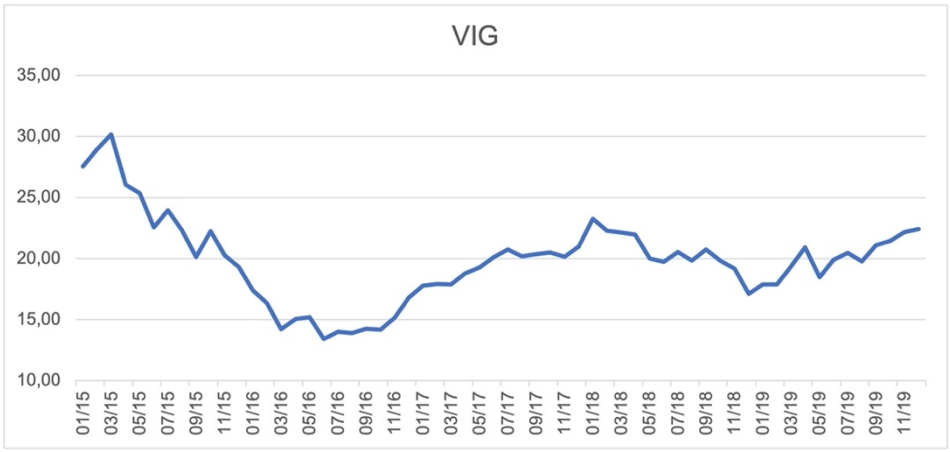
Appendix 9: Chart RBI



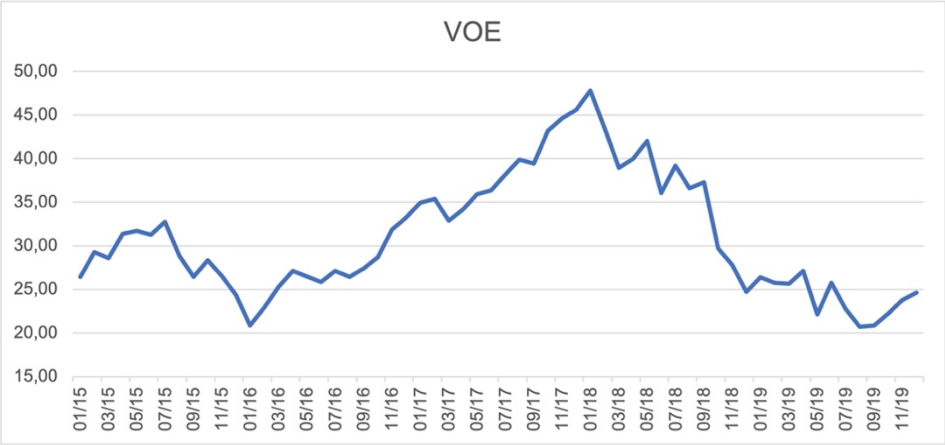
Appendix 10: Chart TKA



Appendix 11: Chart VIG



Appendix 12: Chart VOE



Appendix 13: Chart WIE