The Effects of Macroeconomic Variables on US Bank Stock Returns

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Abstract:

Macroeconomic variables play an important role in an economy as they can help in determining the financial and economic situation within an economy. Since the financial crisis the financial strength of banks within the US have improved due to an increase in their balance sheets and more appropriate corporate governance. The objective of this paper is to investigate the effects of macroeconomic variables on the US bank stock returns by using monthly observations over a 11-year period ranging from January 1st 2009 to December 31st 2019. The financial variables used included Fed Fund Rate, consumer price index and money supply. The real economy variables used are personal consumption expenditure, unemployment and total nonfarm payroll. The KBW Index was used as the proxy for the US Bank stock returns.

Single and multiple regression were both carried out in order to determine the relationship between the financial variables and the KBW Index and the real economy variables and the KBW Index. A number of diagnostic tests were carried out on the data including multicollinearity to check for any potential linear relationship among the explanatory variables and heteroscedasticity to test the dispersion of variance. In relation to the single regression results the strongest model for the financial variables was the KBW Index vs money supply with the largest R square value of 87.82%. The b value for all three of the models were positive and significant. For the multiple regression models for the financial variable models all the models had similar strong R square values ranging between 86% and 88%. For the KBW Index vs Fed Fund rate and consumer price index model the f value was significant. In relation to the single regression results for the real economy variables the model with the largest R square value was the personal consumption expenditure model with a value of 88%. However, all three of the models had an R square value above 80% which represents a strong relationship. All the p values for the single regression models are significant. In regards to the multiple regression models all the models had a strong R square value ranging between 86% and 88%. However, many of the b values of the regression coefficients were not significant.

Keywords: Fed Fund Rate, consumer price index, money supply, personal consumption expenditure, unemployment, total nonfarm payroll, KBW Index, Multiple regression and correlation analysis

Submission of Thesis and Dissertation

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Table of Contents:

Chapter 1:

1.1) Introduction:

The rationale behind the research is to critically examine the effects of macroeconomic variables on the US bank stock returns. To understand the role of these macroeconomic variables the research provides an in-depth analysis of the effects these variables have on the US bank stock returns. Macroeconomic variables have a significant role in society along with the banking industry and to illustrate the effects these variables have on the US bank stock returns various models were built and tested. The contribution of the research is to try and evaluate whether certain macroeconomic variables have an impact on the US stock bank returns. Since the financial crisis the US banks are said to be more financially secure now than they were before the financial crisis. More measures have been put in place when it comes to regulations, applying for a mortgage or even taking out a loan. Banks have better equipped balance sheets now and are more financially secure today especially if any recession was to occur. However even though banks are more financially secure and have stronger balance sheets the significance of the study is to try and determine whether certain macroeconomic variables have impacted and benefited the stock returns on the US banks along with trying to determine any possible relationship which may exist between the variables and the US bank stock returns by focusing on the KBW Index. For the purpose of this research there will be three financial and three real economy variables used in this study. The three financial variables are consumer price index (CPI), interest rates (IR), and money supply (M2). The personal consumption expenditure, unemployment and total nonfarm payroll are the three real economy variables. In relation to all of the macroeconomic variables, all of the data for these macroeconomic variables are accessed through the Federal Reserve Bank of St. Louis website. The research critically examines the effects of these macroeconomic variables on the KBW Nasdaq Bank Index. The KBW index is a benchmark stock index of the banking sector which includes the 24 largest US banks by market capitalisation. The data is gathered and analysed from January 2009 – December 2019 using monthly figures for each period.

1.2) KBW Index:

The KBW Nasdaq Bank Index is widely known to be the benchmark stock index of the US banking sector. The index consists of the 24 largest banking stocks which are selected as indicators for the sector. These 24 bank stocks are known to be the largest US investment and commercial banks. The Index was first developed and brought to market by the investment bank Keefe, Bruyette and

Woods in 1991. The Index tracks the stock prices of these banks. Some of the banks which are within the index include J.P Morgan, Wells Fargo, Bank of America, Goldman Sachs and Bank of New York Mellon. The index is listed on the Nasdaq and the New York Stock Exchange. Smaller sized regional banks tend not to be in the index because they do not have the appropriate market capitalisation size. (Scott, 2019)

1.3) Financial Macroeconomic Variables:

Fed Fund Rate:

The federal funds rate is referred to as the interest rate at which institutions trade federal funds with one another overnight. A bank who may be in need of an injection of liquidity will be able to borrow liquidity of another bank who may have excess liquidity. The rate at which the banks then lend to each other is known as the effective federal funds rate. The Federal Open Market Committee determine the rate. The federal funds rate is an important component in relation to interest rates within the US as it tends to have an influence on other interest rates such as the prime rate, mortgages rates and savings rates. (Federal Reserve Bank of St Louis, 2020)

Consumer Price Index:

The consumer price index (CPI) is known to be the measure in which the average change over time in prices which are paid by consumers for a basket of consumer goods and services. Normally the consumer price index will include around 88% of the total production taking into account wages, clerical workers, the self-employed, unemployed, retirees and also people who are currently not actively working. In order to calculate the consumer price index, the changes in prices of food, clothing, fuel and transportation must be taken into account. Consumer price index can be used in order to measure both inflationary and deflationary periods. If there is a sharp increase in the consumer price index in a short period of time this tends to mean there is period of inflation present. However, if there is a sharp decrease in the consumer price index within the short time period then it will normally be referred to as a deflationary period. (Federal Reserve Bank of St Louis, 2020)

Money Supply:

Money supply is referred to as the total amount of money which is available in an economy at a point of time. Money supply also includes all the currency and liquid investments present within a country on the date measured. The total amount of money includes cash, balances in bank accounts, investments funds and deposit accounts. Banks tend to control the availability of supply to the public. (System, 2015)

1.4) Real Economy Macroeconomic Variables:

Personal Consumption Expenditure:

The personal consumption expenditure index is one of the methods of analysing US inflation whereby it tends to track the changes in prices of goods and services which are purchased by consumers within the Economy. The personal consumption expenditure tends to monitor the average percentage change in prices across all the necessary categories within personal consumption expenditure. The personal consumption expenditure data within the US is normally released which is part of the personal income and outlays release of the Bureau of Economic Analysis. (Diwan, 2020)

Unemployment:

Unemployment is commonly known as individuals who are employable who are actively seeking work but are unable to find a job. Unemployment within a country can be measured through dividing the number of people unemployed by the total amount of people in the workforce. Unemployment acts as a key macroeconomic variable. There are various types of unemployment which include demand deficient, frictional, structural and voluntary unemployment. In relation to demand deficient unemployment this type tends to happen when there is a recession causing large amounts of unemployment. Frictional unemployment is commonly known when workers are in between various jobs. Structural unemployment is commonly witnessed when a candidate for a role does not have the necessary skills in order to match the job specification. Finally, voluntary unemployment is when an employee decides to leave their job. (Corporate Finance, 2020)

Total Nonfarm Payroll:

Total nonfarm payroll measures the income of US workers in the economy which does not include private household employees, farm employees and unpaid volunteers. Total nonfarm payroll tends to account for 80% of the workers who tend to contribute to Gross Domestic Product. Total nonfarm payroll is a key macroeconomic variable as it helps in gaining more of an insight into the current economic situation within the US and the total amount of jobs which were added or lost in the economy. (Federal Reserve Bank of St Louis, 2020)

1.5) Structure of Dissertation:

The remaining chapters within this research will be the Literature review, Methodology, Results Presentation, Analysis and Discussion of results and a Conclusion. Chapter 2 is the literature review which reviews the relevant literature based on up to date and relevant academic journal papers. In relation to the academic journals they will be separated into different topics which will be journal papers based on the banking sector, journal papers based on different stock exchanges and journal papers based on the Hotel sector. Chapter 3 is methodology and focuses on the design of the research along with the rationale behind the chosen method of the research. While chapter 4 is the presentation of results from the various models which included the models from the financial and real economy variables. Chapter 5 will be an analysis and discussion of the results which will critically analyse the results which were obtained from the various models. Finally, chapter 6 will be the conclusion of the research carried out.

Chapter 2:

Literature Review:

2.1) Introduction:

There has not been any past research carried out on the effects of macroeconomic variables specifically on the US bank stocks in particular the KBW index. The majority of the journal papers are based on the effects of macroeconomic variables on the returns of certain stock exchanges in different countries or based on the effects of macroeconomic variables on the profitability of banks in different countries. The macroeconomic variables which are tested in this study will include financial and real economy variables. The financial variables are the Fed Fund Rate, consumer price index and money supply. The real economy variables are personal consumption expenditure, unemployment and total nonfarm payroll. The gap for this study is to look at the effects of macroeconomic variables on the US Bank stock returns by focusing on the KBW index which will be used as the proxy for the US Bank stock returns. In relation to the KBW index there has not been another piece of research carried out whereby it analyses the effects on the KBW index of macroeconomic variables hence the gap in this study being to focus on the KBW index. Various methodological approaches will be undertaken in this research by trying to get a better understanding of the effects of both the financial and real economy variables on the KBW index. By choosing both financial and real economy variables there will be more of an understanding achieved especially by looking at which variables are more correlated to the KBW index and which is least correlated.

The research approach carried out in this study involves a quantitative approach. The financial and real economy macroeconomic variables will all be accessed and gathered through the Federal Bank of St Louis website. The rest of the information provided within the study will be gathered from reputable financial sources and will be up to date. As there were not any past journals which only focused on the KBW index the literature reviewed journals will be broken down into various segments including articles/papers based on the banking sector, journals based on various stock exchanges and journals based on a specific sector. The rationale behind this approach of analysing the various journal types is that all the journals cover a similar methodological approach along with using similar macroeconomic variables. All of the journals carry out and test various macroeconomic variables with similar models thus by analysing these journals the appropriate models were tested in this research in order to test the hypothesis.

2.2) Research on the banking sector:

Many economists and practitioners have extensively researched how certain macroeconomic variables have affected the returns on the stock market in the short and long run (Issahaku, et al., 2013) (Laichena & Obwogi, 2015) (Rahman, et al., 2009). There seems to be a justification that macroeconomic variables such as interest rates, money supply, oil prices and inflation all have an effect on the stock market return however for the purpose of this research an examination will be carried out to test whether consumer price index, interest rates and money supply have an effect on the returns of the KBW index. According to (Castro, 2013) the approach undertaken in this study was to examine the macroeconomic determinants of the credit risk in the banking system during the period 1997 to 2011. The study focused in particular on Greece, Ireland, Portugal, Spain and Italy. Macroeconomic variables like unemployment and public deficit and debt were all analysed in the study. The study analysed these macroeconomic variables and the banking credit risk by employing a dynamic panel data approach to the five countries over the given time period. The author was able to conclude that the banking credit risk was significantly affected by the macroeconomic environment and variables. Credit risk increases when GDP growth and share prices decline while rises when the unemployment rate, interest rate and credit growth increase. It is also positively affected by an appreciation of the real exchange rate. The methodology approach carried out in this research is similar to that of the approach taken by the authors in the journals: (Rahman, et al., 2009) (Kuwornu & Owusu, 2011). The author (Castro, 2013) built a correlation matrix and a descriptive statistical analysis. These two methodologies will be carried out in this study however there will be more in-depth analysis undertaken through carrying out a regression analysis.

(Kanwal & Nadeem, 2013) analysed the impact of macroeconomic variables on the profitability of listed commercial banks in Pakistan from the period ranging from 2001 to 2011. The authors built a pooled ordinary least square method to examine the effects of three major external factors inflation, GDP and interest rates on the profitability measures which included return on assets, return on equity and equity multiplier by using three different models. An equity multiplier is a financial leverage ratio that measures the amount of a firm's assets which tend to be financed through its shareholders by analysing the total assets to shareholder equity. The methodologies used to carry out the study included a descriptive analysis, Pearson Correlation and Regression model. The empirical findings from the research carried out stated that there was a strong positive relationship between interest rates and return on equity, return on assets and the equity multiplier.

However, GDP on its own was said to have an insignificant positive effect on return on equity and equity multiplier. Inflation had a negative relationship with all three of the profitability measures overall concluding that all three of the variables together were said to have a significant impact on the profitability of the commercial banks in Pakistan.

(Badar & Javid, 2013) carried out a study on the impact of macroeconomic forces on nonperforming loans in Pakistan based on commercial banks covering the period of January 2002 to December 2011. The macroeconomic variables which were used in this study included inflation, exchange rates, interest rates, GDP and money supply. The authors were able to determine that a long run relationship existed among the variables by using the following methodology Johansen and Juselius multivariate cointegration. The pair wise bivariate cointegration methodology revealed that there was a long run relationship between nonperforming loans with money supply and interest rates. However, the Granger Causality test was carried out to determine the cause and effect of the relationship within the sample and it concluded that inflation and exchange rates have an effect on the performance of the nonperforming loans. In regards to the short run relationship this was carried out by using the vector error correction model which concluded that weak short run relationship exists between nonperforming loans with exchange rates and inflation.

(Alper & Anbar, 2011) focused on the macroeconomic determinants of commercial banks profitability by looking at Turkey over the time period from 2002 to 2010. The profitability on the banks was measured by return on assets and return on equity. There were 13 variables used all together and these ranged from bank specific independent variables, macroeconomic independent variables and dependent variables. The study sample was carried out by analysing 10 commercial banks over the period 2002 to 2010 which all together included 90 observations. In relation to the methodology which was used to carry out in the study a descriptive analysis and correlation analysis were carried out to test the hypothesis. The authors were able to conclude that asset size had a positive influence on banks profitability. Larger banks tend to have a greater profitability stream therefore resulting in a higher return on assets and return on equity. The study found that there was a negative relationship between loans and profitability. The contribution of this dissertation is to carry out an analysis through various correlation and regression models to get more of an indication on the relationship between the macroeconomic variables and the KBW index. The author in the study could potentially have analysed the hypothesis in more detail by adding in more methodological approaches to get more of an insight into the relationship.

In the case of (Bennaceur & Goaied, 2011) they analysed the determinants of commercial bank interest margin and profitability in Tunisia during the period of 1980 to 2000. The study was able to determine that individual bank characteristics tend to explain the rationale behind net interest margin leading to a higher profitability margin. However, in relation to macroeconomic variables the study was able to determine that these have no impact on the profitability of the Tunisian banks. Private banks tend to perform better than state owned banks. The paper did determine that bank loans tend to have a positive and significant impact on the capacity of Tunisian banks to generate interest margins. Finally, the outcome of the study was that stock market fluctuations and developments have an effect on the interest margins and profitability in the banks in Tunisia. Contrast this study to the approach taken by (Abreu & Mendes, 2011) whereby they looked at the commercial bank interest margins and profitability based on banks from the EU. The countries taken into account for the study where Portugal, Spain, France and Germany. The data provided was from a period from 1986 to 1999. The authors used variables which included inflation rates, exchange rates, economic growth, bank size, capitalisation and bank product mix to help in the methodology approach which was undertaken in the study. There were several methodologies which were used which included a descriptive analysis of some variables and a Covariance model. Well capitalised banks face lower expected bankruptcy costs therefore lower funding costs and higher interest margins on assets. Finally, the effective exchange rate doesn't have any impact on net interest margin or profitability and a higher inflation will being higher costs but also generate higher income for the banks.

2.3) Research based on various different stock exchanges:

(Hosseini, et al., 2011)) carried out a study to determine the role of macroeconomic variables on the stock market index in China and India. The research carried out investigates the relationship between the stock market indices in both countries while using four macroeconomic variables which were crude oil, money supply, industrial production and inflation rate. The data was computed from the period of January 1999 to January 2009. The authors carried out the research by using three different methodologies. The first methodology which was carried out was a Unit root rest model which involved the process of analysing the short and long run relationship between the four macroeconomic variables and the stock market indices within both countries. The second model used was a Multivariate cointegration test which examines the long-term relationship between the variables. The authors concluded that in both countries China and India both the maximum

eigenvalue test and trace test indicate that the stock exchange index has a long run relationship with the macroeconomic variables chosen in the research. The third and final model which was used was a Vector Error Correction Model which was carried out to find the short run correlation between the macroeconomic variables and the stock market indices in both countries. In the short run the impact of crude oil on the Chinese stock market is negative however money supply had a positive relationship. Industrial production had a negative effect and inflation had a positive effect. In regards to the Indian stock exchange the authors were able to determine that the oil and industrial production have a positive effect on the market however money supply and interest rates both have a negative impact on the market. The models in this research will be different as regression and correlation models will be carried out to test the hypothesis. By using the correlation model there will be more of a focus on the direction of the three variables used in this research. The correlation approach undertaken in this research will help determine the relationships between each variable and the KBW index. In this dissertation there will be more of a narrow focus on only one section of the market being the US banks rather than focusing on the broad index of two different regions which was carried out by the authors in this journal.

According to the research carried out by (Laichena & Obwogi, 2015) the authors analysed the effects of macroeconomic variables on stock returns in the East African community stock exchange market. The variables which were used to carry out the study were interest rates, inflation rate, currency exchange and GDP. The research relied on Fisher's Theory of interest rates, purchasing parity theory, classical growth theory and finally the arbitrage pricing theory. The study was broken down and conducted by focusing on three East African countries which included Kenya, Uganda and Tanzania over the time period of 2005 to 2014. The methodology undertaken involved a descriptive analysis, correlation analysis, chi square test and multiple regression model. The authors were able to conclude that there was an inverse significant relationship between stock return and interest rate. GDP also had a positive relationship whereas inflation and exchange rates had a negative impact. The chi test determined that there was no significant effect existed ruling out the need for such variables. Finally, the multiple regression model was able to determine the R squared was 51.1% meaning the four variables explained 51.1% of the variance and 48.9% of the variance was explained by other factors which were not used out in the model.

Similar to (Issahaku, et al., 2013) who analysed the effects of interest rates, inflation, crude oil and exchange rate on the Ghana stock market. Both studies used similar methodology models which

included a correlation analysis. Both studies concluded that from using the correlation model interest rates had a positive relationship between the return on the stock market. The chi test will help determine whether there is a relationship between the independent variables. The correlation coefficient matrix will assist in understanding the coefficients between the variables. The drawback of using the chi square is that it does not specify the type of relationship which exists. In relation to the research being carried out in this study a correlation coefficient matrix will be carried out to determine whether a correlation exists between the variables and the KBW index. By using a correlation coefficient matrix and a regression analysis a conclusion will be drawn up on the variations of the bank stock returns and whether a relationship exists between the variables and bank stocks.

2.4) Research based on a specific sector:

No previous studies have examined the relationship between macroeconomic variables and the KBW index. (Leong & Hui, 2009) were one of the few who conducted a study on the hotel industry in Singapore by analysing macroeconomic and non-macroeconomic factors and how they affect the hotel stock return over a 15-year period from January 1991 to December 2005. The author used the Singapore Hotel Index to measure the hotel stock returns. Consumer price index, money supply, the 3-month inter- bank rate was used used as the proxy for the short-term interest rates and the 5yr government bond was used as the proxy for the long-term interest rate. The study hypothesized the model between the hotel stock returns in Singapore between the six macroeconomic variables which were industrial production, money supply, inflation, short term and long-term interest rates and exchange rates. The methodology approach undertaken was to carry out a descriptive analysis, correlation coefficient and regression models. The correlation coefficient matrix determined that the monthly hotel stock returns appear to be strongly correlated with the short-term interest rates. Industrial production had a high correlation with inflation. Overall, the results showed that exchange rates had the most influence on hotel stock returns while money supply, industrial production, interest rates and inflation did not have a significant influence on the hotel stock returns.

(Assaf, et al., 2017) also used a similar approach by analysing the characteristics which drive hotel performance. Some of factors which were determined from the study which affected the hotel performance included GDP, tax, exchange rates and fuel prices. All of these factors have had a positive influence on the stock returns of the hotel globally according to the authors. The two

studies carried out a correlation and regression analysis. Correlation and regression analysis were the appropriate methodology approaches carried out in both studies. The variables included in this study will be varied and not all the same as in the studies above. The correlation coefficient methodology is the appropriate model to undertake as it tries to measure the strength of the relationship between two different variables. A single and multiple regression will also be carried out in this study however in the studies above, a multiple regression was only used. An alternative for the studies above could have been to use a single regression model as it would have compared one independent variable to the dependent variable and then after use a multiple regression model which would have given the authors a better indication and understanding of potential relationship between the variables and the R squared. The contribution of this dissertation will be to use the same models however by only focusing on the US bank stock returns.

Arising from the literature review the following formal research question established is “Do macroeconomic variables have an effect on US bank stock returns”.

Chapter 3

Methodology

3.1) Introduction

In this chapter the methodology approach undertaken is described and outlined. The models that were used along with the data used are all described. The three macro-economic variables which were chosen to test the hypothesis are described. However, in order to get more of an insight into the correlation between the macroeconomic variables and the KBW Index there were two sets of variables carried out in the testing. The first set of three variables were financial variables and the second set of three variables were real economy variables. Through using real economy variables and financial variables a greater understanding of correlations and relationships is obtained and which variables are more correlated with the KBW Index. The type of research along with how the data was collected along with how the data gathered is implemented and adopted in the various models is all discussed in the below sections.

3.2) Data collection and Analysis:

The main objective of this research is to determine the effects of macroeconomic variables on the US bank stock returns by using financial and real economy variables. Financial variables are commonly used is assisting to predict future macroeconomic conditions such as economic growth and inflation levels. However, real economy variables are non-financial element of an economy whereby the non-financial data is analysed. This study required the collection of secondary data for the analysis. The rationale behind choosing the three financial variables was as the economy rebounded from the financial crisis the market has said to have been in one of the longest cyclical bull markets mainly driven by the amount of money supply in the market, record low interest rates and the fluctuations of the consumer price index levels. All of these variables have said to have had an impact on the market to date and through the various models which will be carried out in this study a conclusion will be found as to if these variables have impacted the returns on the KBW Index or not. In relation to the real economy variables the variables chosen for this research will help in understanding the real value of goods and services within the US economy and analysing whether the real economy variables are more correlated with the KBW Index or whether the financial variables are more correlated. In relation to the KBW Index it was used as a proxy for the US bank stock returns. The relevant data was also gathered from the Federal Bank of St Louis.

There was a quantitative research approach undertaken in this study as there was a need to gather and collect numerical data in order to test the data with the relevant models. In relation to the time frame of the data collected for both the financial and real economy variables all of the data collected was a monthly data series over a 11-year period ranging from January 1st 2009 to December 31st 2019. All of the data for the macroeconomic variables were collected and gathered from the Federal Bank of St Louis website.

The three financial macroeconomic variables were consumer price index, money supply and the Fed Fund Rate. The consumer price index (CPI) was used in order to measure the aggregate price level, money supply (M1) was used as a broader measure for the money supply and the fed funds rate was used as a proxy to represent the interest rates. The consumer price index is a measure which examines the weighted average of prices of a basket of consumer goods and services. (Federal Reserve Bank of St Louis, 2020) Money supply is the total value of money available in an economy at one point in time. (Federal Reserve Bank of St Louis, 2020) The Fed Fund Rate is the interest rate whereby depositary institutions trade federal funds with one another overnight. (Federal Reserve Bank of St Louis, 2020).

The three real economy variables which were used in this study were the personal consumption expenditure, unemployment and total nonfarm payroll. The personal consumption expenditure is a measure of inflation and tracks the changes in prices of goods and services which are purchased by a consumer within the economy. (Diwan, 2020) Unemployment is referred to a situation whereby an individual who is capable of working can't find a job. (Corporate Finance, 2020) Total nonfarm payroll is commonly known as the measure of the amount of US workers present in the economy which doesn't include private household workers, farm employees or unpaid volunteers. (Federal Reserve Bank of St Louis, 2020) Real economy variables are commonly known referred to as non-financial elements of an economy hence giving and unlike the financial variables by choosing real economy variables there will be more of an understanding of the correlation between these variables the KBW Index and how the results compare with the financial variables.

3.3) Research Approach and Design

As all the data was gathered through the Federal Reserve Bank of St Louis the study was able to use this data to carry out the required tests in order the test the hypothesis. As there was a need to implement and carry out various tests through using different models the rationale was concluded

as to carry out a quantitative approach due to the fact numerical data was needed. All of the data which was gathered was up to date and gathered from a reputable financial source. The rationale behind the strategy of using monthly series data was that the total number of data periods gathered was 132 meaning there was enough periods of data in order to carry out the required tests and to be able to get more of an understanding of which variables are more correlated with each other and the KBW Index. The results obtained reflected the time period. The six macro-economic variables which were chosen reflect the current macro environment and each variable portrays and covers a different aspect of the macro economic environment so the results achieved will be diverse.

3.4) Models and Tests Carried Out

As there is a quantitative approach being undertaken in this study a number of approaches and tests were used to carry out the and test the hypothesis. A descriptive statistical analysis was carried out in order to understand and summarize the date in a more meaningful way which included patterns from the set of data. The descriptive statistical analysis will include the mean, standard deviation, median and variance. The mean is the average of the data set which is found by adding up all the data and dividing by the number of values in the set. Standard Deviation is the measure of dispersion within the set of values. Median is known to be the middle value in distribution. Variance measures how far spread apart the set of data are. The mean and median will both measure central tendency, standard deviation, variance, minimum and maximum will all measure variability.

Diagnostic Testing:

Prior to a regression model a multicollinearity test was necessary in order to try and detect the probability of the existence of any linear relationship among the explanatory variables. Multicollinearity refers to a situation whereby two or more variables within a multiple regression model tend to be highly linearly related. (Stephaine, 2015) In relation to the variables in the multicollinearity model it refers to the correlation of independent variables which in this study will be the consumer price index, money supply, the Fed Fund Rate, personal consumption expenditure, unemployment and total nonfarm payroll. Multicollinearity tends to not have an effect on the equation of the multiple regression in order to predict the dependent variable. A commonly used test for multicollinearity is to draw up a matrix of correlation coefficients between various independent variables and for the purpose of this study this will be carried out. The correlation

matrix consists of a table showing the correlation coefficients between the variables. Depending on the results if the coefficient achieved is greater than 0.7 or less than -0.7 then there will be a need to remove one of them in the study.

Heteroscedasticity refers to the variability of a variable whereby it tends to be unequal across a range of values of a second variable that predicts it. (Hayes & Westfall, 2020) The rationale for carrying out a test for Heteroscedasticity in the regression analysis within this study is to analysis the variance, as it helps to invalidate the tests of significance which assumes the modelling errors all have the same variance. Heteroscedasticity was tested only on the financial macro-economic variables. Residuals were needed in order to carry out Heteroscedasticity. For the purpose of this study all three of the financial variables were used in the analysis of Heteroscedasticity. The first step was to run the model and then derive the residuals and then looking at three ways in which Heteroscedasticity is present. The first is a graph, the second is the Breusch Pagan test and the third is the White test for Heteroscedasticity. The analysis begins with running a regression analysis whereby the dependent variable was the KBW Index and the independent variables were the Fed Fund Rate, money supply and consumer price index. The residuals box was ticked in order to make sure Excel generated the residuals in order to run the tests.

The first step in analysing Heteroscedasticity was to look at the residuals which were obtained from the regression analysis. As all the tests look at the square of the residuals a variable was created called residual squared. A scatter graph was computed showing the predicted y values and the residual squared values. In order to confirm that Heteroscedasticity is present a Breusch Pagan test was carried out by regressing the residual squared on all the independent variables. The Breusch Pagan test is used to assist in the testing of Heteroscedasticity in a linear regression model. The regression analysis was carried out whereby the residual squared was the dependent variables and the three macroeconomic variables were the independent variables. Once this was computed the White's test was then run to confirm the presence of Heteroscedasticity whereby it involved the squared residual values of the predicted y values and the predicted y values squared. A regression analysis was run again whereby this time whereby the independent variables were the residual squared and the dependent variables were the predicted y and predicted y squared values.

A regression analysis was appropriate in order to determine the relationship between the dependent and independent variables. A regression analysis was carried for both the financial and real economy macro-economic variables. There were two necessary forms of regression analysis which were necessary to be carried out with the first being a single regression analysis and the second being a multiple regression analysis. The rationale behind choosing a regression analysis was

to try and predict the value of an independent variable versus the value of a dependent variable**.** The null hypothesis is to try and determine whether a relationship exists between the independent and dependent variables.

There were seven tests carried out for the financial variables and seven tests also carried out for real economy variables with the first three being single regression tests and the remaining four been multiple regression tests. Once the single regression models were carried out then a multiple regression analysis was then carried out. In relation to all of the single regression model results a scatter graph is provided for only the single regression models which includes the R squared value, the regression equation and the relevant output from the data analysis facility.

The six single regression models carried out are the KBW Index vs the Fed Fund Rate, KBW Index vs the money supply, KBW Index vs the consumer price index, KBW Index vs Personal Consumption Expenditure, KBW Index vs Unemployment and KBW Index vs Total nonfarm payroll. The rationale for carrying out a single regression analysis first was to determine the relationship between the independent variable against the individual dependent variables. A single regression analysis involves quantifying the relationship between just one independent variable and one dependent variable. The main focus on the single regression models was to interpret and analysis the results of each test. Each test achieved different results with the main focus being on analysing the F value, R squared, P value of regression coefficient of each test respectively. The F statistic is a value which helps in determining whether the means between the populations are significantly different. The F value will help in determining whether the test is statistically significant. (Glen, 2020) The R squared is referred to as the coefficient of determination. It helps to determining how many points lie on the regression line. The R squared value will indicate the percentage of variance present in the dependent variable that the independent variables explain collectively. (CFI, 2020) The P value result will determine whether the relationship within the sample also exist in the larger population. The P value for all the independent variables individually tests the null hypothesis that the variable has no correlation with the dependent variable. The regression coefficients results will help in determining how much the dependent variable is expected to increase when the independent variable increases by one therefore holding all the other independent variables constant. A positive coefficient will mean that as the independent variable increases the dependent variable will also increase whereas a negative coefficient means when the independent variable increases the dependent variable will decrease.

In relation to the multiple regression it involved the diagnostics of tests which are the standard multiple regression diagnostics. There were eight models carried out in this part. The models carried

out for the financial variables included the KBW Index vs the Fed Fund Rate and money supply, KBW Index vs Fed Fund Rate and consumer price index, KBW Index vs money supply and consumer price index and KBW Index vs all three variables. In relation to the models carried out for the real economy variables they included KBW Index vs personal consumption expenditure and unemployment, KBW Index vs personal consumption expenditure and total nonfarm payroll and the KBW Index vs unemployment and total nonfarm payroll. The final step of the multiple regression was then to test the KBW Index vs consumer price index, Fed Fund Rate and money supply for the financial variables and KBW Index vs personal consumption expenditure, unemployment and total nonfarm payroll for the real economy variables. The multiple regression was an extension on from the single regression whereby the value of the KBW Index was compared too by more than one variable in each of the four multiple regression models for both the financial and real economy variables The rationale behind carrying out a multiple regression is to get more of an understanding of the difference between the dependent variable and multiple independent variables and then to compare the results to the single regression models to see whether there is much of a difference in the R squared, P value, coefficient, F value and adjusted R square.

Once the multiple regression was completed the final step was then to compute a correlation matrix. A correlation matrix consists of a table whereby it shows the correlation coefficients of the various variables. There was a correlation coefficient carried out for both the financial and real economy variables in order to achieve an R squared.

Chapter 4

Presentation of Results

This section focuses on presenting the results achieved through carrying out a regression analysis of all the various models. There were two sets of macro-economic variables which were used to carry out all the necessary regression analysis tests which were the financial variables and the real economy variables. The presentation of results is split into two sections with the first section being the results achieved from the financial variables and the second part being the results obtained from the real economy variables. Within each section there were seven regression models carried out. The first three models were single regression models, the next three models were multiple regression models with two independent variables and the last model in each section compared the relationship between the KBW Index and all three of the independent variables for both the financial and real economy variables. In relation to the three single regression models for both the financial and real economy variables there is a scatter graph provided. The scatter graph shows the dispersion between the variables, the linear trend line, the R^2 value and the regression equation. A data analysis output grid was is presented for all the seven models for both the financial variables and the real economy variables. Within the data analysis output grid there were some key metric results which included the R square, Adjusted R square, regression coefficients, P value of the coefficients and the significance of the F value. The final grid compares all the various results from the fourteen models by focusing on the R square, Adjusted R square, regression coefficients, p value of the coefficients and the significance of the F value.

Description of statistical analysis/tests undertaken

Section 1:

Financial Variables:

Model 1: KBW Index vs Fed Fund Rate

Model 2: KBW Index vs Money Supply

Model 3: KBW Index vs Consumer Price Index

Model 4: KBW Index vs Fed Fund Rate and Money Supply

Model 5: KBW Index vs Fed Fund Rate and Consumer Price Index

Model 6: KBW Index vs Money Supply and Consumer Price Index

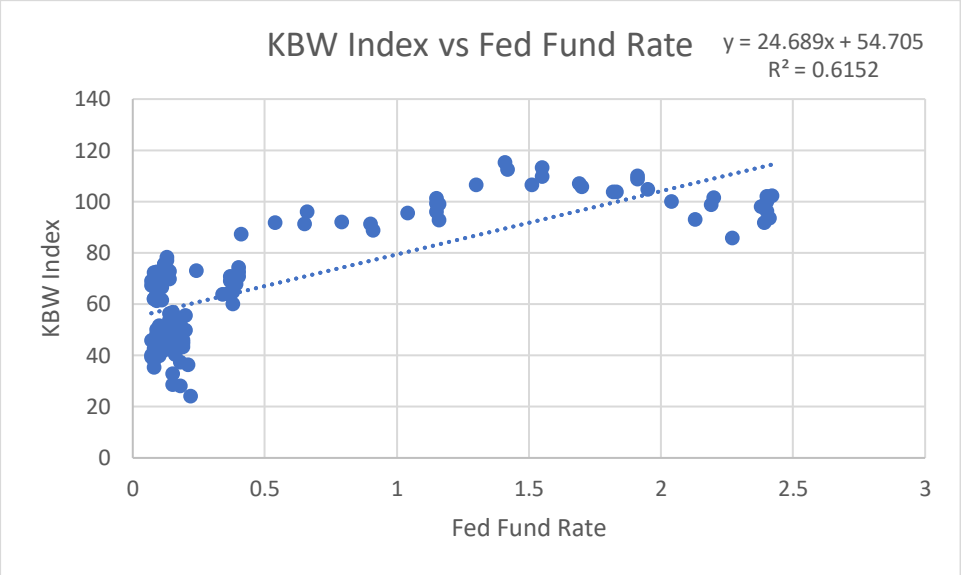
Model 7: KBW Index vs Fed Fund Rate, Money Supply and Consumer Price Index

Model 1:

KBW Index vs Fed Fund Rate.

This model shows the link between the KBW Index and the Federal Fund Rate. The scatter graph includes the linear trend line along with the equation. The data analysis output box includes some of the key results achieved through carrying out the single regression analysis for this model. The graph is sloping upwards meaning there is a positive relationship as the Fed Fund Rate goes up so does the KBW Index. As the slope is upward sloping the b value is a positive figure which is 24.689. The graph is showing the correct sign between the KBW Index and the Fed Fund Rate because as the Fed Fund Rate goes up the economy is said to be doing better and more financially secure. In relation to the R squared it is 61% which is said to be very high. This means that 61% of the variability of the KBW Index can be explained by the entire set of the independent variable which is the Fed fund Rate.

Chart 1A:



Data Analysis Output:

Table 1A:

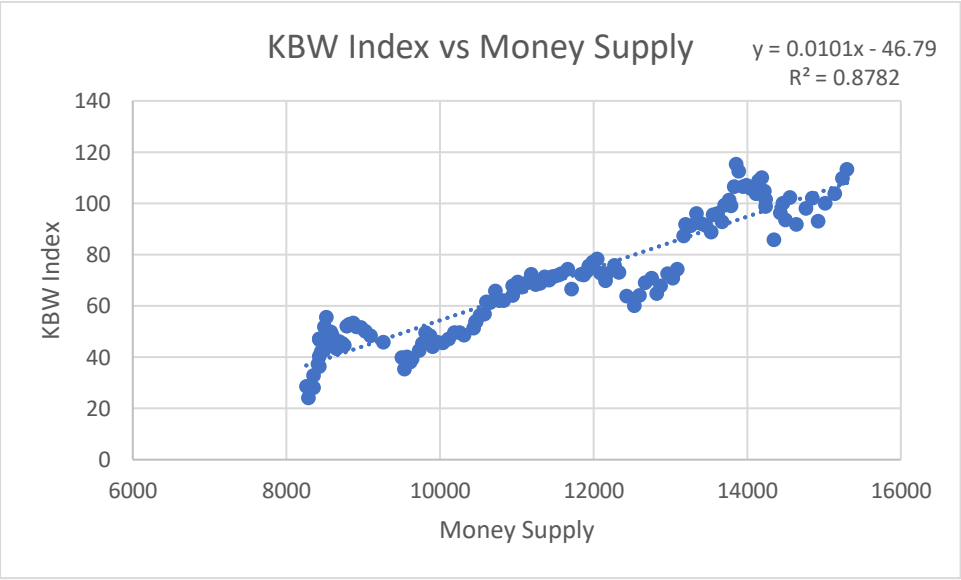
Metric	**Value**
R Square	0.615159881
Adjusted R Square	0.612199572
Coefficient of fed fund rate	24.68878126
P - value of fed fund rate coefficient	9.79099E-29
Significance of F value of model	9.79099E-29

Model 2:

KBW Index vs Money Supply

This model looks at the relationship between the KBW Index and Money Supply. The scatter graph shows the relationship between both the KBW Index and the Money Supply. Also, the data analysis output shows the necessary results achieved through carrying out a regression analysis.
The shape of the graph indicates that it is upward sloping meaning there is a positive relationship between the KBW Index and money supply. The relationship is showing the correct sign as if there is more money in the economy then investors will normally invest more instead of having money in depositary institutions due to lower interest rates. As there is more money in the economy the KBW Index should go up and investors are investing more money and this is shown on the graph as it sloping upwards showing a positive relationship exists. As the graph is upward sloping the b value should be positive which it is. Overall, when there is more money in the economy this tends to push down interest rates leading to low returns for investors therefore leading investors to invest in stocks in order to achieve a higher return greater than the interest rates value. The upward sloping graph has a b value of 0.0101 which demonstrates the relationship between the KBW Index and money supply is showing the correct sign. In relation to the R squared in this model it is 87% which is very high meaning there is a high level of variability between the KBW Index and Money Supply.

Chart 2A:



Data Analysis Output:

Table 2A:

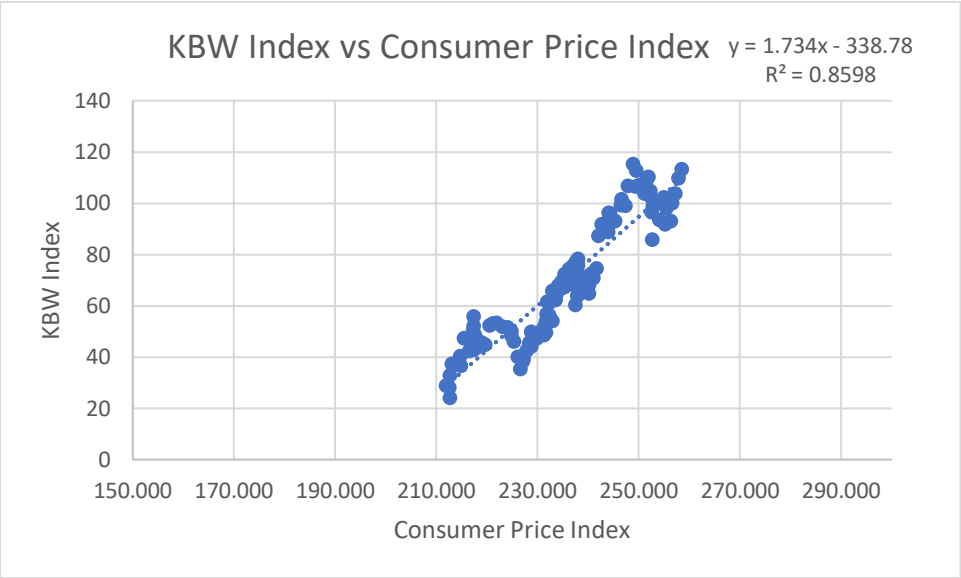
Metric	Value
R Square	0.878200727
Adjusted R Square	0.87726381
Coefficient of money supply	0.010115418
P - value of money supply coefficient	2.74654E-61
Significance of F value of model	2.74654E-61

Model 3:

KBW Index vs Consumer Price Index

This is a summary of the results achieved from carrying out the single regression analysis for the KBW Index versus the consumer price index. The scatter graph demonstrates the lack of dispersion or the points. The data analysis output grid shows the most important results achieved through carrying out the regression analysis. The graph below is sloping upwards as there is a positive relationship between the KBW Index and the consumer price index. The upward sloping graph is showing the correct relationship between the variables because if the consumer price index is increasing this means there is inflation and the prices of goods and services also start to increase. In relation to the KBW Index which represents the largest 24 banks in the US if CPI increases, this tends to lead to inflation. Banks will normally make more profits when there is inflation therefore leading to the stock prices of the banks increasing as they're making more money. This in turn will lead to the KBW Index increasing in value. This positive upward sloping graph leads to a positive b value which in this model is 1.734. The R squared in this model is 85% which is said to be very high therefore concluding that variability is present between the KBW Index and consumer price index.

Chart 3A:



Data Analysis Output:

Table 3A:

Metric	**Value**
R Square	0.859796098
Adjusted R Square	0.858717607
Coefficient of consumer price index	1.734029556
P - value of consumer price index coefficient	2.6E-57
Significance of f value of model	2.605E-57

Model 4:

KBW Index vs Fed Fund Rate and Money Supply

This model shows the multiple regression analysis of the KBW Index versus the Fed Fund Rate and the money supply. The data analysis output shows the relevant results of the Fed Fund Rate and the money supply when comparing them to the KBW Index through carrying out a regression analysis. In relation to the R square of this multiple regression model you can see it is 88% therefore meaning that the two independent variables which are the Fed Fund Rate and Money Supply explain more than 88% of the variation in the dependent variable which is the KBW Index. This is a very high R square figure. Adjusted R square tends to be slightly less than the R square and this is the case for this model. The high adjusted R square indicates this is a good model. The model is significant because the F statistic has a P value that is well below the 0.05 for the 95% significance level. In relation to the coefficient of the Fed Fund Rate which is 4.23 this means that if the Fed Fund Rate increases by 1% then the KBW Index should increase by 4.23. For an additional increase of 1 for the money supply this would lead to an additional 0.0089 increase in the KBW Index.

Data Analysis Output:

Table 4A:

Metric	**Value**
R Square	0.885274372
Adjusted R Square	0.88349568
Coefficient of fed fund rate	4.238092088
P-value of fed fund rate coefficient	0.005557
Coefficient of money supply	0.008980572
P-value of money supply coefficient	1.04E-35

Significance of F value of model	2.23E-61

Model 5:

KBW Index vs Fed Fund Rate and Consumer Price Index

This model is a multiple regression analysis and looks at the link between the KBW Index versus the Fed und Rate and the consumer price index. The data analysis output shows the results achieved through carrying out the necessary regression analysis. The R square for this model of 86% is very high. This means that 86% of the variability of the KBW Index can be explained by the entire set of the two independent variables which are the Fed Fund Rate and the consumer price index. Adjusted R square should always be a less than the R square and this is the case in this model. In relation to the coefficient of the Fed Fund Rate which is 4.08 this means that if the Fed Fund Rate increases by 1% then the KBW Index should increase by 4.08. For an additional increase of 1 for the consumer price index this would lead to an additional 1.51086749 increase in the KBW Index. The Fed Fund Rate is significant however the consumer price index is not significant. This means that the Fed Fund Rate is a significant predictor of the KBW Index.

Data Analysis Output:

Table 5A:

Metric	Value
R Square	0.86884938
Adjusted R Square	0.866816037
Coefficient of fed fund rate	4.084243758
P-value of fed fund rate coefficient	0.003403
Coefficient of consumer price index	1.51086749
P-value of consumer price index coefficient	6.03E-32
Significance of F value of model	1.25E-57

Model 6:

KBW Index vs Money Supply and Consumer Price Index

Within this multiple regression model, the data analysis output shows the results achieved by comparing the KBW Index versus money supply and the consumer price index. The R square of 87% represents a high level of variance is present between the KBW Index compared to the two independent variables which are money supply and the consumer price index. The adjusted R square could increase within this model but only if another variable is added to the model which would improve the model by more than expected. The coefficient of money supply figure of 0.008265007 which means it is significant. This means that money supply is a significant predictor of the KBW Index. In relation to the consumer price index it not significant.

Data Analysis Output:

Table 6A:

Metric	Value
R Square	0.879207006
Adjusted R Square	0.877334246
Coefficient of money supply	0.008265007
P-value of money supply coefficient	1.21E-05
Coefficient of consumer price index	0.326025216
P-value of consumer price index coefficient	0.301837
Significance of F value of model	6.19E-60

Model 7:

KBW Index vs Fed Fund Rate, Money Supply and Consumer Price Index

This model shows the link which exists between all of the variables which were the KBW Index, Fed Fund Rate, money supply and the consumer price index by carrying out a multiple regression model. The R square of this model 88% is very high which represents a high proportion of variance of the KBW Index compared to all three of the independent variables which are Fed Fund Rate, money supply and consumer price index. The adjusted R square should be slightly less than the R square and this is the case. The coefficient of the Fed Fund Rate is significant with the KBW Index. The money supply is significant meaning money supply is significant with the KBW Index. In relation to the consumer price index it is not significant.

Data Analysis Output:

Table 7A:

Metric	**Value**
R Square	0.885736596
Adjusted R Square	0.883058548
Coefficient of fed fund rate	4.103262722
P-value of fed fund rate coefficient	0.007771
Coefficient of money supply	0.00775289
P-value of money supply coefficient	2.76E-05
Coefficient of consumer price index	0.222667175
P-value of consumer price index coefficient	0.473097
Significance of F value of model	4.35E-60

Section 2:

<u>Real Economy Variables</u>:

Model 1: KBW Index vs Personal Consumption Expenditure

Model 2: KBW Index vs Unemployment

Model 3: KBW Index vs Total Nonfarm Payroll

Model 4: KBW Index vs Personal Consumption Expenditure and Unemployment

Model 5: KBW Index vs Personal Consumption Expenditure and Total Nonfarm Payroll

Model 6: KBW Index vs Unemployment and Total Nonfarm Payroll

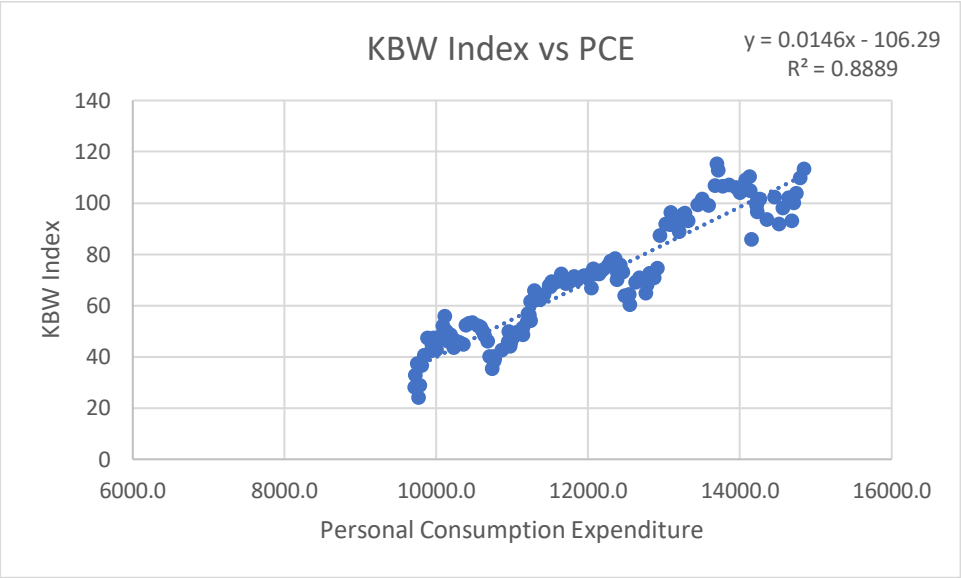
Model 7: KBW Index vs Personal Consumption Expenditure, Unemployment and Total Nonfarm Payroll

Model 1:

KBW Index vs Personal Consumption Expenditure

This single regression model looks the link between the KBW Index and the personal consumption expenditure. The scatter graph shows the dispersion of the variables along with the linear trend line and the equation. The data analysis output shows the results of some of the most important metrics from carrying out the regression analysis. The graph below of the KBW Index and the personal consumption expenditure shows the graph is upward sloping. This means that when the personal consumption expenditure goes up in value so does the KBW index. As personal consumption expenditure measures consumer spending if it increases this will lead to more money in the economy will in turn will lead to more money being invested in the stock market. Asset prices and index funds such as the KBW Index tend to go up in value when investors are increasing their positions in the index fund. The upward sloping graph is represented with a positive b value which in this model is 0.0146.

Chart 1B:



Data Analysis Output:

Table 1B:

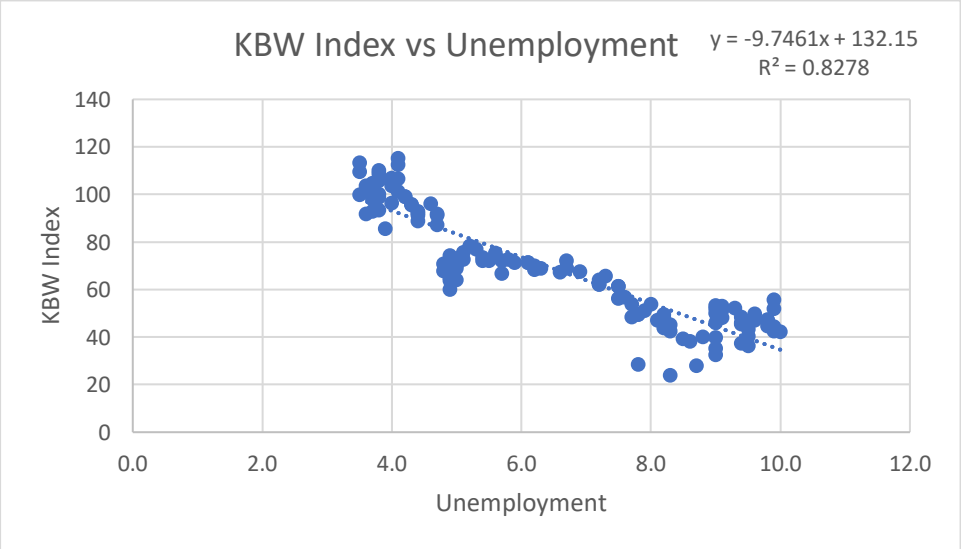
Metric	**Value**
R Square	0.888926108
Adjusted R Square	0.888071693
Coefficient of personal consumption expenditure	0.014624048
P - value of personal consumption expenditure coefficient	6.82E-64
Significance of F value of model	6.82448E-64

Model 2:

KBW Index vs Unemployment

The second model shows the relationship between the KBW Index and unemployment. As it is a single regression analysis the scatter graph shows the relationship between the KBW Index and unemployment. The graph is downward sloping meaning that when one variable goes up the other variable goes down. This is the case here in this model as when the value of unemployment goes up then the value of the KBW Index would fall in value. When unemployment increases then people have less income coming into their household along with consumers not spending as much. This in turn leads to less money being invested in the stock market which normally reduces the value of stocks and assets prices. This is seen in the graph as when unemployment increases in value the KBW Index falls in value. This downward sloping graph is represented by a negative b value because as the graph is downward sloping the b value must be negative which is the case in this model. The relationship on the graph between the KBW Index and unemployment is showing the correct sign meaning when unemployment increases the KBW Index goes down.

Chart 2B:



Data Analysis Output:

Table 2B:

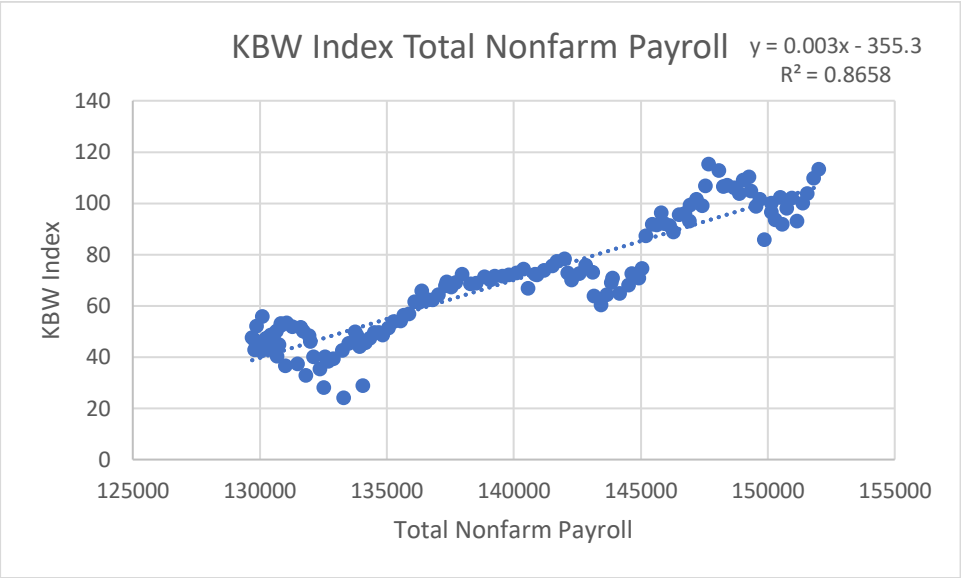
Metric	Value
R Square	0.827776
Adjusted R Square	0.826451
Coefficient of unemployment	-9.74608
P - value of unemployment coefficient	1.701E-51
Significance of F value of model	1.70064E-51

Model 3:

KBW Index vs Total Nonfarm Payroll

Within this model the single regression analysis focuses on the KBW Index versus the total nonfarm payroll through the results achieved from the scatter graph and the data analysis output. The graph provided is upward sloping which means as one variable goes up the other variable goes up too. In this case as total nonfarm payroll goes up the KBW Index will go up as well. As total nonfarm payroll is a measure of the total number of US workers working in the economy excluding private household employees and farm employees with there being more people working leading to an increase in total nonfarm payroll this means more people have more disposable income to be investing leading to higher asset prices and index funds. The upward sloping graph leads to a positive b value which in this model is 0.003 which means the relationship is showing the correct sign.

Chart 3B:



Data Analysis Output:

Table 3B:

Metric	Value
R Square	0.8658323
Adjusted R Square	0.8648002
Coefficient of total nonfarm payroll	0.0030383
P - value of total nonfarm payroll coefficient	1.486E-58
Significance of F value of model	1.48606E-58

Model 4:

KBW Index vs Personal consumption expenditure and Unemployment

This multiple regression model shows the link between the KBW Index, personal consumption expenditure and unemployment through the data analysis output grid. The R square of this model is 88% which represents a high level of variance therefore meaning that the two independent variables which are the personal consumption expenditure and unemployment explain more than 88% of the variation in the dependent variable which is the KBW Index. The adjusted R square should be below the R square figure and this is the case however if another variable is added then the value of the adjusted R square could change. The personal consumption expenditure is significant with the KBW Index. In regards to unemployment it is not significant with the KBW Index.

Data Analysis Output:

Table 4B:

Metric	**Value**
R Square	0.88893452
Adjusted R Square	0.887212574
Coefficient of personal consumption expenditure	0.014460531
P-value of personal consumption expenditure coefficient	5.98E-14
Coefficient of unemployment index	-0.117124219
P-value of unemployment coefficient	0.921414
Significance of F value of model	2.75329E-62

Model 5:

KBW Index vs Personal consumption expenditure and Total nonfarm payroll

Within this multiple regression model, it focuses on the relationship between the KBW Index, personal consumption expenditure and the total nonfarm payroll. The R square for this model is 88% which represents a high level of variance therefore meaning that the two independent variables which are the personal consumption expenditure and total nonfarm payroll explain more than 88% of the variation in the dependent variable which is the KBW Index. The adjusted R square is slightly below the R square which should be the case. Personal consumption expenditure is significant meaning that personal consumption expenditure is significant with the KBW Index. However total nonfarm payroll is not significant.

Data Analysis Output:

Table 5B:

Metric	**Value**
R Square	0.888983977
Adjusted R Square	0.887262798
Coefficient of personal consumption expenditure	0.015384079
P-value of personal consumption expenditure coefficient	8.07E-07
Coefficient of total nonfarm payroll index	-0.000161913
P-value of total nonfarm payroll coefficient	0.795807

Significance of F value of model	2.68E-62

Model 6:

KBW Index vs Unemployment and Total nonfarm payroll

This multiple regression model looks at the link between the KBW Index, unemployment and the total nonfarm payroll through the results in the data analysis output. The R square of this model is 86% which represents high level of variance therefore meaning that the two independent variables which are the unemployment and total nonfarm payroll explain more than 86% of the variation in the dependent variable which is the KBW Index. In relation to unemployment it is not significant. In relation to total nonfarm payroll however it is significant with the KBW Index.

Data Analysis Output:

Table 6B:

Metric	**Value**
R Square	0.867527973
Adjusted R Square	0.865474144
Coefficient of unemployment	2.584666492
P-value of unemployment coefficient	0.201088
Coefficient of total nonfarm payroll index	0.003814596

P-value of total nonfarm payroll coefficient	6.35E-09
Significance of F value of model	2.38E-57

Model 7:

KBW Index vs Personal Consumption Expenditure, Total Nonfarm Payroll and Unemployment

Within this model it compares the relationship between the KBW Index, personal consumption expenditure, total nonfarm payroll and unemployment. The R square for this model is 88% which represents a high proportion of variance is present within the KBW Index in relation to the three independent variables which are personal consumption expenditure, total nonfarm payroll and unemployment. Personal consumption expenditure is significant meaning the personal consumption expenditure is significant with the KBW Index. Total nonfarm payroll is also significant. However, in relation to unemployment it is not significant. The p value of unemployment is not significant with the KBW Index

Data Analysis Output:

Table 7B:

Metric	**Value**
R Square	0.889208665
Adjusted R Square	0.886611993
Coefficient of personal consumption expenditure	0.015973468
P-value of personal consumption expenditure coefficient	1.81E-06
Coefficient total nonfarm payroll	-0.000587714
P-value of total nonfarm payroll coefficient	0.574566

Coefficient of unemployment index	-1.009486571
P-value of unemployment coefficient	0.611281
Significance of F value of model	6.04E-61

Below is a table summarising all the results from the seven models from the financial variables and the seven models from the real economy variables. The first half of the table summarises the financial variable models and the second half of the table summarises the real economy variable results. There were four different sets of results provided for both the financial and real economy variables with there being the adjusted R^2 B co-efficient(s), p value of coefficients and the significance of F value of all the models. Models 1, 2 and 3 for both the financial and real economy variables are results from the single regression models, model 4, 5, 6 are the multiple regression model results with X1 representing the first independent variable and X2 representing the second independent variable and model 7 is the KBW Index vs all three of the independent variables.

Model - Financial Variables:

In relation to X1 in model 4 this represents the Fed Fund Rate and X2 is the money supply. In relation to model 5 X1 is the Fed Fund Rate and X2 is the consumer price index. For model 6 X1 is the money supply and X2 is the consumer price index. In relation to model 7 X1 is the Fed Fund Rate, X2 is money supply and X3 is the consumer price index.

Model – Real Economy Variables:

In relation to model 4 X1 represents the personal consumption expenditure with X2 being unemployment. For model 5 X1 is personal consumption expenditure with X2 being total nonfarm payroll. In relation to model 6 X1 represents unemployment and X2 is total nonfarm payroll. Finally, in relation to model 7 X1 is personal consumption expenditure, X2 is total nonfarm payroll and X3 is unemployment.

Model - Financial Variables	(Adjusted) R^2	B co-efficient(s)	P-value of coefficients	Significance of F-value of model
1	0.612199572	24.68878126	9.79099E-29	9.79099E-29
2	0.87726381	0.010115418	2.74654E-61	2.74654E-61
3	0.858717607	1.734029556	2.6E-57	2.605E-57
4 X1	0.88349568	4.238092088	0.005557	2.23E-61
X2		0.008980572	1.04E-35	
5 X1	0.866816037	4.084243758	0.003403	1.25E-57
X2		1.51086749	6.03E-32	
6 X1	0.877334246	0.008265007	1.21E-05	6.19E-60
X2		0.326025216	0.301837	
7 X1	0.883058548	4.103262722	0.007771	4.35E-60
X2		0.00775289	2.76E-05	
X3		0.222667175	0.473097	
Model – Real Economy Variables	(**Adjusted**) R^2	**B co-efficient(s)**	**P-value of coefficients**	**Significance of F-value of model**
1	0.888071693	0.014624048	6.82E-64	6.82448E-64
2	0.826451	-9.74608	1.701E-51	1.70064E-51
3	0.8648002	0.0030383	1.486E-58	1.48606E-58
4 X1	0.887212574	0.014460531	5.98E-14	2.75329E-62
X2		-0.117124219	0.921414	
5 X1		0.015384079	8.07E-07	2.68E-62
X2		-0.000161913	0.795807	
	0.887262798			

6	**X1**	2.584666492	0.201088	2.38E-57
	X2	0.003814596	6.35E-09	
		0.865474144		
7	**X1**	0.015973468	1.81E-06	6.04E-61
	X2	-0.000587714	0.574566	
	X3	-1.009486571	0.611281	
		0.886611993		

Section 4.3 Descriptive Analysis

The two grids below consist of the descriptive analysis for both the financial variables and the real economy variables. There were six key data points which were calculated for both sets of variables and they were the mean, median, standard deviation, minimum, maximum and range. These six key data points are the most important factors when it comes to understanding and getting a better understanding of the descriptive analysis of all variables. The first part consists of the descriptive analysis for the financial variables and the second part consists of the descriptive analysis of the real economy variables.

Mean:

The mean is normally referred to as been a statistical indicator which can be used in order to help get a better understanding of the performance of a stock price of a company over a certain period of

time. Overall a mean is the average of two or more numbers by counting up all the numbers within a set and then dividing by the total number. (Hayes, 2020)

Median:

The median is a commonly used statistical measure which tries and measures the middle value of a dataset which must be listed from smallest to largest. The median tries and divides the lower half from the higher half of a set of data. (Corporate Finance, 2020)

Standard Deviation:

Standard Deviation is a statistical approach which measures the dispersion of a given set of data relative to its mean and is usually calculated by square rooting the variance figure. If the given data points are further away from the mean then a larger standard deviation present within the set of data. (Hargrave & Westfall, 2020)

Minimum:

Minimum is commonly referred to as the smallest observation present within a set of data. Minimum is used in relation to calculating the sample size of a set of data. (Statistic Solutions, 2020)

Maximum:

Maximum is commonly referred to as the largest observation present within a set of data and is usually carried out when trying to get a better understanding of the sample size of a certain set of data. (Statistic Solutions, 2020)

Range:

The range of a given set of data is the difference between the largest and lowest values within the given set of data. The range can be calculated by subtracting the lowest figure from the largest figure. (Scott, 2020)

Descriptive Analysis for Financial Variables

	Fed Fund Rate	Money Supply	Consumer Price Index
Mean	0.57	11429.95	235.06
Median	0.16	11395.95	236.13
Standard Deviation	0.74	2150	12.41
Minimum	0.07	8258.20	211.93
Maximum	2.42	15299.00	258.44
Range	2.35	7040.80	46.51

In relation to the descriptive analysis for the financial variables the mean for all three variables differs due to the sample size of the data for all the individual independent variables. The Fed Fund Rate sample of data is far less in value compared to the money supply and consumer price index sets of data. The mean for the Fed Fund Rate is 0.57 meaning the average all of the set of data divided by the total number of data points is 0.57. The mean for money supply is 11429.95 which represents the largest mean value for all three variable and for the consumer price index the mean value is 253.06. In relation to the standard deviation of all variables it differs a lot. For the Fed Fund Rate, the standard deviation is 0.74 which is the smallest value for all three variables, for money supply the standard deviation is 2150 which is the largest value for all the variables and for the consumer price index the standard deviation is 12.41. This is a wide dispersion for all the standard deviation figures for all the variables however taking into account the sample size of all the given set of data for all variables you would expect this. In relation to the Fed Fund Fate it ranges from a minimum of 0.07 to a maximum of 2.42. This is a relatively wide range of 2.35. For money supply it ranges from a minimum of 8258 to a maximum of 15299 which a range of 7040. This also represents a relatively wide dispersion level. However, for the consumer price index there is a lower dispersion with the consumer price index ranging from a minimum of 211 to a maximum of 258 with a range of 46.51. The range for the Fed Fund Rate is the lowest compared to the other two variables. All of the data sets differ for all three variables due to the respective sample size. As the Fed Fund Fate figures are far less in value compared to the other two variables you would expect the answers for the Fed Fund Rate to be far less in value than the other two variables which is the case. In relation to money

supply as the set of data is in thousands the answers for the descriptive analysis are greater in value compared to the Fed Fund Rate and money supply.

Descriptive Analysis for Real Economy Variables

	Personal Consumption Expenditure	**Unemployment**	**Total Nonfarm Payroll**
Mean	11974.73	6.49	139593.70
Median	11835.4	6.15	138953
Standard Deviation	1496.20	2.16	7107.41
Minimum	9718.5	3.5	129698
Maximum	14847	10	151998
Range	5128.6	6.5	22300

In regards to the descriptive analysis for the real economy variables the mean for the personal consumption expenditure is 11974.73, 6.49 for unemployment and 139593.70 for total nonfarm payroll. There is a clear wide dispersion evident between the mean values of all the three variables. There is also a wide dispersion for the median of all the variables with the total nonfarm payroll having the greater value of 138953. The median for the personal consumption expenditure is 11835 and 6.15 for unemployment. In relation to the standard deviation for all three variables it is 1496.20 for personal consumption expenditure, 2.16 for unemployment and 7107.41 for total nonfarm payroll. In relation to the personal consumption level it ranges from a minimum of 9718 to a maximum of 14847 with a range of 5128 compared to unemployment which has a minimum of 3.5 with a maximum of 10 and a range level of 6.5. For total nonfarm payroll it has a minimum of 129698 with a maximum of 151998 and a range of 22300. The range of unemployment is the lowest compared to both personal consumption expenditure and total nonfarm payroll. Total nonfarm payroll has the largest range figure of 22300. There is a clear level of dispersion between all the three variables for all the given data points due to their sample size differing in size.

Correlation Coefficient Matrix:

Financial Variables:

A correlation matrix is a table which shows the correlation coefficients between all the variables. In the below table it shows the correlation of the KBW Index with the Fed Fund Rate, money supply and consumer price index. All the cells within the table shows the correlation between two variables. However, the line of 1.00s which is going from top left to bottom right is referred to as the main diagonal which shows that each variable is always perfectly correlated with itself. The below table is a correlation coefficient matrix of all the financial variables as seen in the table. Firstly, the KBW Index has a positive relationship with all three of the financial variables as they value for each of the three variables are all positive. Money supply correlation is 0.937123646 showing that money supply has a high positive correlation with the KBW Index. This represents the highest positive correlation in the table. This value would represent the correct sign as if there is an increase in money supply this leads to more capital available in the market which means more capital is been invested in the market leading to an increase in value of the KBW Index. Consumer price index had the second highest positive correlation with the KBW Index which was 0.927251907. The Fed Fund Rate has the lowest positive relation with the KBW Index. As all the variables have a positive correlation relationship with the KBW Index it therefore reiterates the relationship that when one variable goes up so does the other variable. There are no negative relationships between the independent and dependent variable within the table. In relation to the multicollinearity of the independent variables between each other the Fed Fund Rate and money supply are said to have a high multicollinearity of 0.78088168. The Fed Fund Rate and the consumer price index also have a strong multicollinearity of 0.781883824. Finally, Money Supply has a very high multicollinearity with the consumer price index of 0.983306652.

	KBW	**Fed Fund Rate**	**Money Supply**	**Consumer Price Index**
KBW Index	1			
Fed Fund Rate	0.784321287	1		
Money Supply	0.937123646	0.78088168	1	
Consumer Price Index	0.927251907	0.781883824	0.983306652	1

Real Economy Variables:

In the table below it shows the correlation of the KBW Index with the three real economy variables which are personal consumption expenditure, unemployment and total nonfarm payroll. The line of 1.00s which is going from top left to bottom right is referred to as the main diagonal which shows that each variable is always perfectly correlated with itself. Personal consumption expenditure is 0.94282878 showing that personal consumption expenditure has a high positive correlation with the KBW Index. As personal consumption expenditure increase so will the KBW Index hence reflecting the positive correlation. Unemployment is -0.90982187 showing that unemployment has a high negative correlation with the KBW Index. By unemployment having a negative correlation with the KBW Index this means that when unemployment goes up the KBW Index will go down because people will not have the disposable income to be investing if they are unemployed. However, in relation to total nonfarm payroll it has a high positive correlation with the KBW Index of 0.930501078 meaning that when total nonfarm payroll goes up so will the KBW Index. In relation to the multicollinearity of the independent variables between each other personal consumption expenditure and unemployment have a strong negative multicollinearity of -0.964175598. Personal consumption expenditure and total nonfarm payroll have a strong multicollinearity of 0.988162557. Finally, in relation to unemployment and total nonfarm payroll they have a strong negative multicollinearity of -0.985329021.

	KBW	**Personal Consumption Expenditure**	**Unemployment**	**Total Nonfarm Payroll**
KBW Index	1			
Personal Consumption Expenditure	0.94282878	1		
Unemployment	-0.90982187	-0.964175598	1	
Total Nonfarm Payroll	0.930501078	0.988162557	-0.985329021	1

Chapter 5:

Analysis and Discussion:

In this piece of research, the aim was to analyse the effects of macroeconomic variables on the US bank stock returns by focusing on the KBW Index. The macroeconomic variables were separated in to financial variables which were Fed Fund Rate, money supply and consumer price index. The second set of variables were real economy variables and they included personal consumption expenditure, unemployment and total nonfarm payroll. Various studies and pieces of research have not examined the effects of macroeconomic variables on the KBW Index however, there have been past studies looking at the effects of macroeconomic variables on the banking sector, effect of macroeconomic variables on various stock exchanges and various sectors such as the hotel sector. In regards to the empirical findings of the single regression results from the financial variables the model with the strongest R square was model 1 which was money supply with an R square of 87.82%. The model with the weakest R square was model which was the Fed Fund Rate. The largest P value was model 1 which was the Fed Fund Rate with a P value of 9.79099E-29. The model with the smallest P value was model 3 which was consumer price index with a P value of 2.6E-57.

In relation to the significance of F value model 1 which is Fed Fund Rate had the largest value of 9.79099E-29. Model 3 which is consumer price index had the smallest significance F value of 2.605E-57. In regards to the single regression results of the real economy variables the model with the largest R square value was model 1 which was personal consumption expenditure with a value of 88%. However, all three of the models had and R square value above 80% which represents a strong R square. Model 1 also had the highest P value which was 6.82E-64, followed by model 2 the model 3 which had the lowest P value of 1.486E-58. Finally, in relation to the significance F value model 1 had the largest value which was 6.82448E-64 then came model 2 and then model 3 which had the smallest F value. Comparing the largest R square value between the financial and real economy variables personal consumption expenditure which is a real economy variable had the largest R square value across all six of the single regression models carried out in the study.

There was also a multiple regression analysis carried out for the financial and real economy variables. There were four multiple regression tests carried out for each of the financial and real economy variables. In relation to the R square value of the four multiple regression results for the financial variables they all had similar R square values in the range between 86% and 88% which represents a very strong R square for each of the models. In comparing the R square values within this research paper to the R square values in the paper (Leong & Hui, 2009) we can conclude that the

three financial variables Fed Fund Rate, money supply and consumer price index had an R square value of 0.885736596 compared to 0.125 within the (Leong & Hui, 2009) research paper who used consumer price index, money supply and the 3-month inter- bank rate as their macroeconomic variables. Even though all over the models have similar R square values models 4 and 6 are the strongest models as they don't really improve so there the strongest financial multiple regression models. Model 4 is the KBW Index vs Fed Fund Rate and money supply and model 6 is the KBW Index vs money supply and consumer price index. The F value of model 4 is 2.23E-61 and model 6 is 6.19E-60. For model 6 consumer price index had the largest b coefficient value of 0.326025216. In regards to the research paper carried out by (Sharma & Mahendru, 2010) the authors carried out a multiple regression analysis by using two variables exchange rate and gold price and analysing their impact on the Indian stock exchange. In relation to model 4 it is significant. In regards to model 6 the coefficient of money supply is 0.008265007 meaning it is significant. This means that money supply is a significant predictor of the KBW Index however consume price Index is not significant. The value of the R square within the paper by the authors was 0.95 which is a greater value than the financial variables within this research paper. Model 7 which is the KBW Index vs all three of the variable had a high R square of 88% and an F value of 4.35E-60.

For the multiple regression results of the real economy variables models 4 and 5 are the strongest models due to strong R square values, significance F and b coefficients. Model 4 which was KBW Index vs personal consumption expenditure and unemployment had an R square of 88.89% while model 5 which was KBW Index vs personal consumption expenditure and total nonfarm payroll had an R square of 88.89% also. The significance F value of model 4 was 2.75329E-62 compared to 2.68E-62 of model 5. In regards to model 4 unemployment is not significant with the KBW Index. In relation to model 5 total nonfarm payroll is not significant with the KBW Index. All of the multiple regression models for both financial and real economy variables have similar R square values along with multicollinearity between them. There is no doubt that from the results the Fed Fund Rate has the most impact on the KBW Index. The insights provided through these results have a role to play when it comes to making investment decisions on the banking sector. The Fed Fund Rate and unemployment are the two variables which have more severe of an impact on the banking sector in general. An increase in unemployment means more people do not have the disposable income to take out mortgages and loans along with not having the disposable income to pay down loans and debts. In regards to the Fed Fund Rate lower rates lead to lower net interest margins for banks which effect their profitability margins.

Chapter 6: Conclusion:

The findings of this study were appropriate in regards to the objective of the research being the effects of macroeconomic variables on US bank stock returns. The findings from the tests carried out were able to conclude that the Fed Fund Rate and unemployment had the most impact on the KBW Index. Within the paper there were relevant and important insights provided throughout. With careful consideration investors and can use these results to determine when best in invest in bank stocks.

For future studies it would be interesting to see different macro-economic variables carried out for example choosing GDP, employment, total exports or even the purchasing managers index as the variables while choosing a different time frame such as weekly data rather than monthly data and compare the results. Various different sets of data may only be published weekly or monthly. However, if weekly data for the macroeconomic variables can be accessed then comparing the weekly data results to the monthly data results would be a topical area for future studies. The weekly data may be different to the monthly data depending on the volatility within a given week so it would be interesting to compare monthly data vs weekly data. In summary this research paper presented the results achieved of the effects of macroeconomic variables on the US bank stock returns focusing on the KBW Index.

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