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Macroeconomic Factors and Stock Market Indices

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Abstract

This paper explores macroeconomic factors and their effect on the stock market. Our analysis covers the stock market indices, the Dow Jones, the S&P 500, and the NASDAQ, over the period of 10 years starting in 2011 and ending in 2021, compared against macroeconomic factors, such as gross domestic product, effective funds rate, oil prices, money supply, consumer price index, unemployment rate, and producer price index. In our analysis, NASDAQ is the best indicator to predict macroeconomic factors.

Keywords: Macroeconomic factors, Stock market Indexes, SP 500
JEL classification: G19; G10; G12

1. Introduction

This paper explores macroeconomic factors and their effect on the stock market in the United States. It is a long-accepted fact that macroeconomic factors affect movement in the economy, and the other way around, while also considering the stock market, which is the best indicator of the economy.

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The stock market is usually thought of as a perception of the future real economy. This paper hypothesizes that Dow Jones and S&P 500 are more affected by macroeconomic factors than the NASDAQ. These macroeconomic factors will correlate more than the NASDAQ. This is because macroeconomic factors represent a more industrial economy than a more tech-centered one. We will also explore which macroeconomic factors affect the Dow Jones and S&P indices the most.

The variables we use here to represent the New York Stock Exchange are the Dow Jones Industrial Average, the Standard & Poor's Composite Index, and the National Association of Securities Dealers Automated Quotations Systems. The Dow Jones Industrial Average is used due to its applicability to being price-weighted to the more prominent companies and only takes the 30 large-cap companies, which makes it applicable to how the New York Stock Exchange is performing. Jareño uses the Dow Jones because it considers the most affluent companies making it a simple index that reflects the evolution of the US markets Jareño (2016). The S&P 500 has more set requirements for a company to be included, such as a market cap above 5 billion, and public investors must hold at least 50% of shares. The S&P also tries to reflect the diversity of the larger markets through its representation of different companies in the 500 stocks. The Dow Jones can easily track movements of higher value stocks, while the S&P has a more average tendency. The NASDAQ is included to represent the largest tech-based companies relevant to the market, including the 4000 stocks being traded. Economists use these indices to evaluate the shape of the economy and do analysis to find expected returns.

The macroeconomic variables included are gross domestic product (GDP), consumer price index (CPI), industrial production index (IPI), unemployment rate, oil prices, the sufficient fund's rate(EFFR), and money supply. GDP represents the value of goods and services being sold during a given period, making it an indicator of the stock market to look at the economy's health in the sheer numbers the total market produces. The CPI is included to represent inflation through its basket of goods approach. Because the CPI generally indicates the cost of living at a point in time, which makes it a good indicator of how well the government is handling economic policy. While CPI focuses on the consumer, PPI looks at the seller.

Also, looking at inflation, PPI is used to predict CPI by looking at how the cost of production has changed over time. Lastly, the unemployment rate is included to represent what condition hiring is in and the prospects of getting a job or losing a job. The unemployment rate also looks at the economy's overall health, similar to GDP. Oil prices are included because they play a unique role in the economy. It is thought that when oil prices go down, people start spending more on other things leading to more growth in the economy. It is also believed to be tied to inflation. The adequate fund rate is one of the most significant indicators of the economy. It represents the interest rate banks charge each other on overnight loans. If banks have more money in their supply that goes over the requirements, banks will loan this money out to banks that need it

with a sufficient fund rate on top. This happens constantly and is an excellent indicator of the stock markets. Along with other measures kept in control by the central bank, the money supply is used to keep the economy in check. Playing with the money supply can cause substantial inflation, which many suggest after the many stimulus checks adding to the money supply and no change in interest rates.

2. Background on the stock market and macroeconomic factors

The stock market is attracting funding for companies or governments directly from investors to support investment projects or increase the size of institutions. It gives access to cheaper funding, which creates more jobs and sources, which drives down prices. Stock markets help improve economic conditions (Jareño and Negrut, 2016). Investors constantly look at macroeconomic factors to see where the stock market could be.

Prior research shows that many macro factors can influence asset prices (e.g., Dhaka et al. 1993; Fama 1981; Geske and Roll 1983; Khil and Lee 2000; Mukherjee and Naka 1995). As shown in Rashid (2014), the stock price index is strongly connected to macroeconomic variables even in the presence of investor sentiment. If macroeconomics factors correlate more with the Dow Jones or S&P 500 rather than the NASDAQ, it will help to give more accurate estimations and more weight to certain aspects.

We are comparing the macroeconomic factors to each different indices indicated above. This is done through a regression analysis of 3 other indices against the macroeconomic factors. In our findings, the NASDAQ was a better indicator of macroeconomic factors than both the S&P and the Dow Jones.

3. Literature Review

Previous literature shows that the stock market affects the primary macroeconomic factors and vice versa. Past research on factors affecting the stock market, macroeconomic, microeconomic, psychological, and subjective factors have been present. Psychological (e.g., investor sentiment) and subjective factors have gained some traction in analysis but have gravitated towards the short term. Microeconomics factors and analysis are good to look at. Still, they look at the bottom of the economic pyramid, while macroeconomic factors have a more top-down view of the economy. It is also said that macroeconomic factors account for 50% of what is going on in the stock market (Sirucek, 2012). The effect of macroeconomic factors has been disputed for a long time, with research coming to a different conclusion on if and how macroeconomic factors affect the stock market. In previous literature, Jareño and Negrut (2016) try to explain the relationship between economic cycles and the relationship between the financial and real economy.

They are focusing more on the business cycle. They use the gross domestic product, the consumer price index, the industrial production index, the unemployment rate, and long-term interest rates (Jareño and Negrut, 2016). They find all these factors correlate well with the stock market through their analysis, except for the consumer price index. When looking at the GDP and the Dow Jones, Jareño and Negrut (2016) see that the stock market is ahead of the US economy by six months, showing that the Dow Jones is a lead indicator of economic growth. The results are a 0.95 correlation coefficient, suggesting that when the price increases, GDP will increase. Again, when looking at the IPI, Jareño and Negrut (2016) believe that if seasonality is removed from the equation, IPI and the Dow Jones may share a very high correlation. When it comes to CPI and Dow Jones, we find another positive relationship. Jareño and Negrut (2016) find a statistically significant relationship; it is not as strong as GDP. The same goes along with CPI. As for the unemployment rate, the Dow Jones has a negative relationship, but a statistically significant one, which would indicate that an increase in unemployment would mean a decrease in Dow Jones. Jareño and Negrut (2016) prove their hypothesis that the market can be conceived as a leading economic indicator by analyzing Dow Jones closing prices and macroeconomic indicators.

4. Theory and Hypotheses

The stock market indices will be our dependent variable and macroeconomic variables as the independent variables for this study. *: S&P and DJIA R-Square NASDAQ R-Square: S&P and DJIA R-Square NASDAQ R-Square* Equations for standard regression analysis between stock market indices and macroeconomic indicators have established a straightforward framework.

Following Kandir (2008), we run the following regression model:

$$R_{it} = \beta_0 + \beta_{1t} IP_{it} + \beta_{2t} INF_{it} + \beta_{3t} EFFR_{it} + \beta_{4t} IR_{it} + \beta_{5t} M1_{it} + \beta_{6t} WMR_{it} + \beta_{7t} OIL_{it} + \varepsilon_{it} \quad (1)$$

where R_{it} is the return on the stock portfolio i, IP is the growth rate of industrial production index, INF is the change in the consumer price index, EFFR is the change in the exchange rate, IR is the 1-month time deposit rate, M1 is the growth rate of narrowly defined money supply, WMR is the return on the MSCI World Equity Index, OIL is the growth rate of international crude oil price, ε_{it} is the residual error of the regression

This model and data focus more on the change rates, while our data show pure data. Following Sirucek (2012), we also run another model of

$$I = \beta_0 + \beta_1 IPI + \beta_2 IR + \beta_3 IN + \beta_4 OP + \beta_5 PPI + \beta_6 UNRATE + \beta_7 MS + \varepsilon \quad (2)$$

where I is the change in stock index (S&P 500. DJIA), IPI is the change in industrial production index, IR is the change in the interest rate (1-month time deposit rate), IN is the change in inflation, OP is the change in the oil price (barrel west texas

intermediate), PPI is the change in production price index, UNRATE is the change in unemployment, MS is the change in money supply (monetary base M2 and MZM), $\varepsilon$is the residual error.

The theory underlying in our model is that macroeconomic factors have more validity and accuracy for the S&P 500 and the Dow Jones, rather than the NASDAQ. I will be performing three separate regressions, comparing each index and the macroeconomic factors. I hypothesize that S&P and Dow Jones will correlate more than the NASDAQ in macroeconomic factors.

H_0: *S&P and DJIA R-Square > NASDAQ R-Square*

H_1: *S&P and DJIA R-Square < NASDAQ R-Square*

5. Data

The data collected for this research includes quarterly averages of stock market prices and the macroeconomic factors identified. All of the data sets were collected from the Federal Reserve Bank of St. Louis from 2011 to 2020. The transformation of the stock market prices was changed from daily closes to monthly averages of daily close. The macroeconomic data sets were changed from monthly to quarterly standards as well. This was done to give the data a common benchmark to compare. The quarterly aspect of the data smooths the data more to exemplify the bigger economic picture. The next transformation was performed after the realization of not passing some assumptions. The data was then manipulated to represent a change from each period to the next. This was done to find more accurate results and give assumptions.

5.1 Descriptive Statistics

Table 1 Summary statistics of the variables

	Minimum	1st Quantile	Median	Mean	3rd Quantile	Maximum
SP500	1225	1785	2088	2215	2717	3555
DJIA	11648	15846	17906	19594	24854	29092
NASDAQ	2601	4017	5014	5672	7321	11954
UNRATE	3.600	4.175	5.267	5.914	7.458	13.067
PPI	182.0	193.1	199.6	197.6	202.5	208.2
CPI	226.0	234.5	238.7	242.1	251.5	261.0
GDP	15592	17088	18563	18723	20475	21747
EFFR	0.0700	0.0925	0.1600	0.6566	1.1225	2.4100
OIL	27.96	48.12	58.87	66.86	93.01	105.83
MS	2058	2666	3180	4094	3680	17633

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Table 2: Summary statistics on the change from the previous quarter

	Minimum	1st Quantile	Median	Mean	3rd Quantile	Maximum
SP500	150.68	22.08	66.20	62.95	123.13	388.15
DJIA	1983.7	196.0	450.0	471.5	948.1	2728.2
NASDAQ	659.5	102.1	231.5	252.6	326.0	1835.8
UNRATE	-4.2667	-0.26667	-0.16667	-0.06036	-0.06667	9.26667
PPI	-8.9000	-1.9333	0.3667	-0.1450	1.7000	5.8333
CPI	-2.0280	0.6060	1.0170	0.9446	1.5583	2.9
GDP	-2041.0	128.3	204.9	159.5	223.3	1650.1
EFFR	0.9000000	-0.0100000	0.0200000	0.0002703	0.1200000	0.3200000
OIL	-24.72600	-5.47714	0.07797	-1.26941	5.05704	12.93124
MS	-18.7	38.8	59.8	420.9	90.2	8724.6

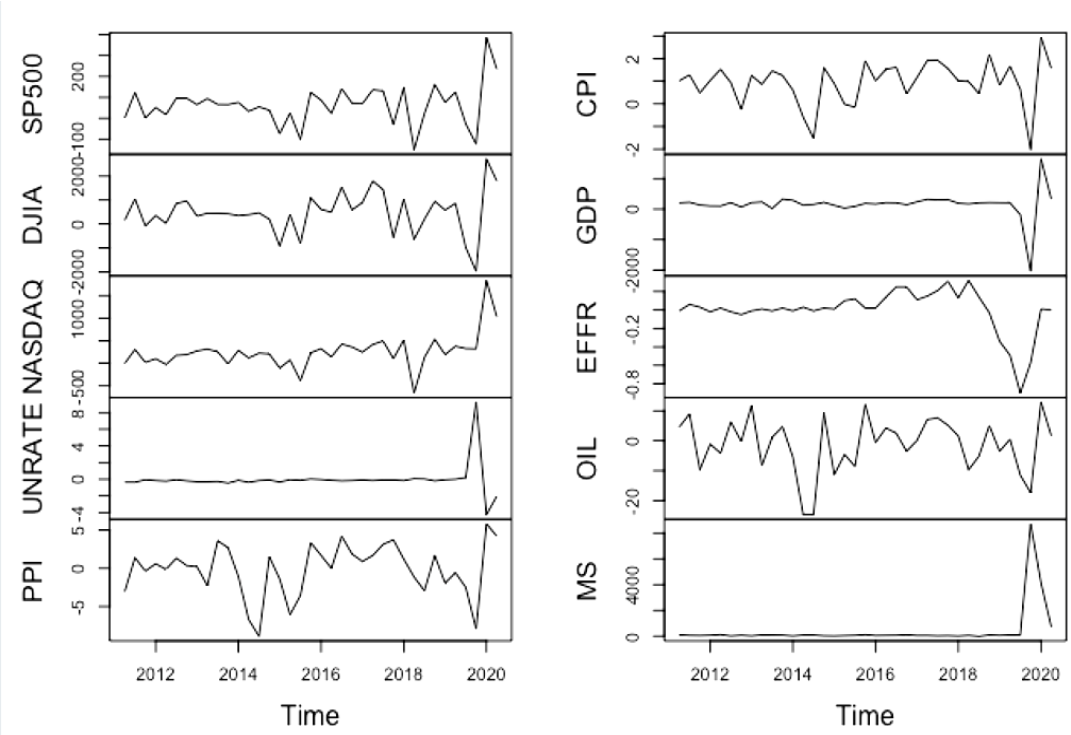

Figure 1. Plot on the Change from the previous quarter (Variable in Quarter T+1−Quarter T)

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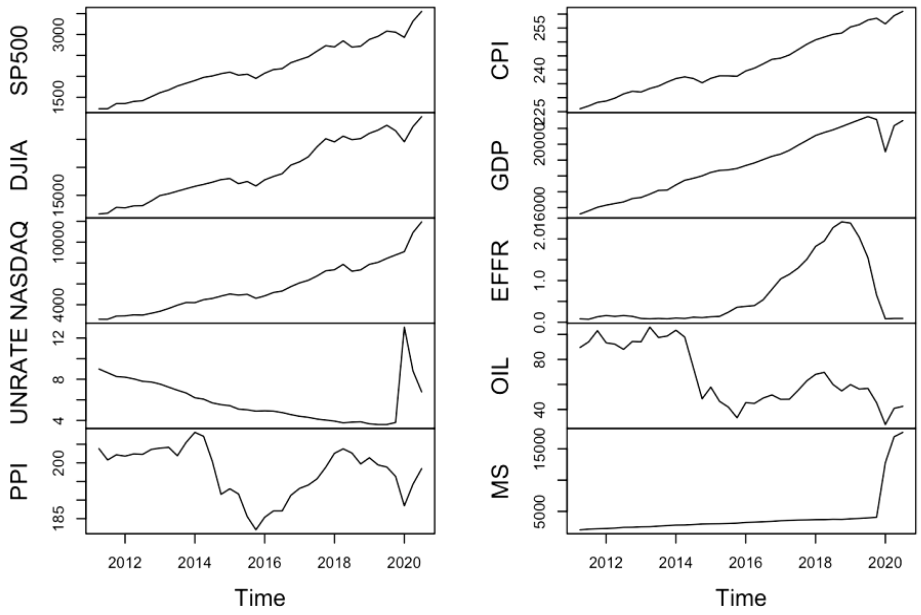

Figure 2. Time series of all the variables

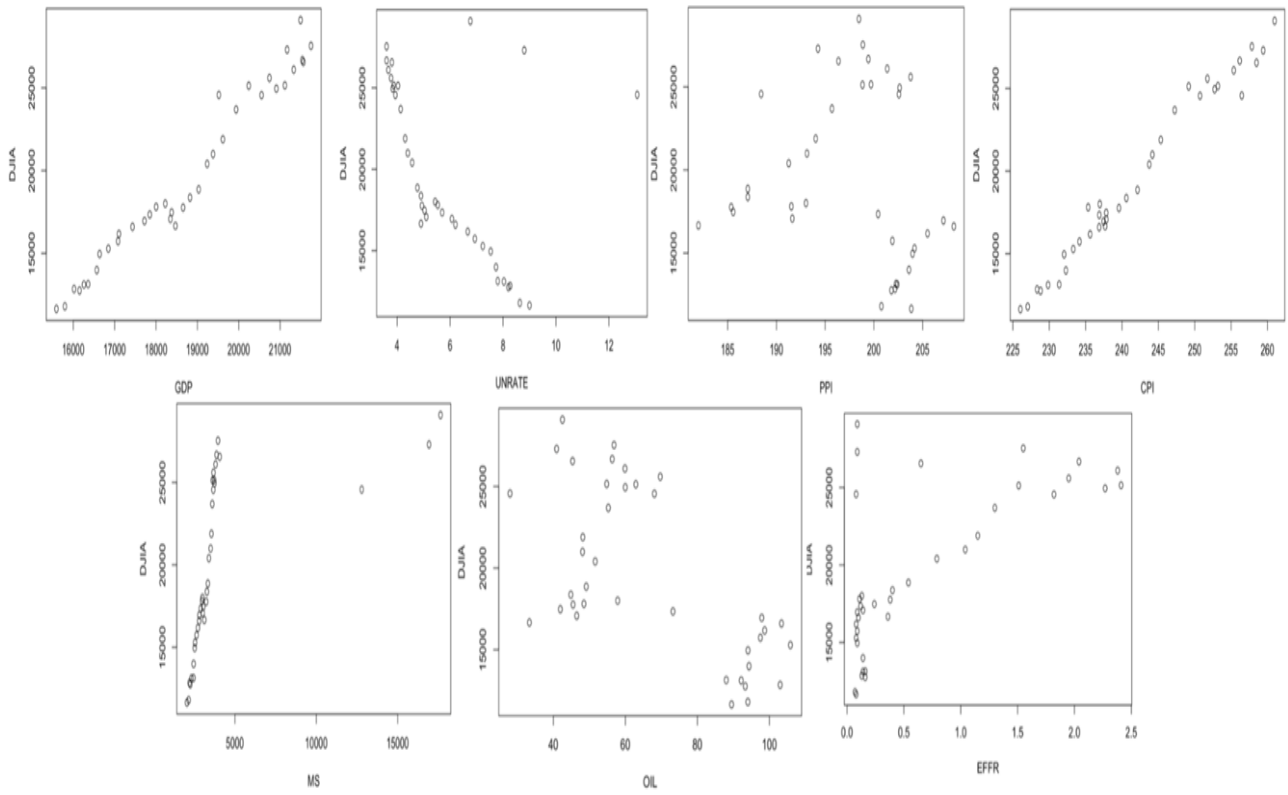

Figure 3. Dow Jones and Macroeconomic Factors

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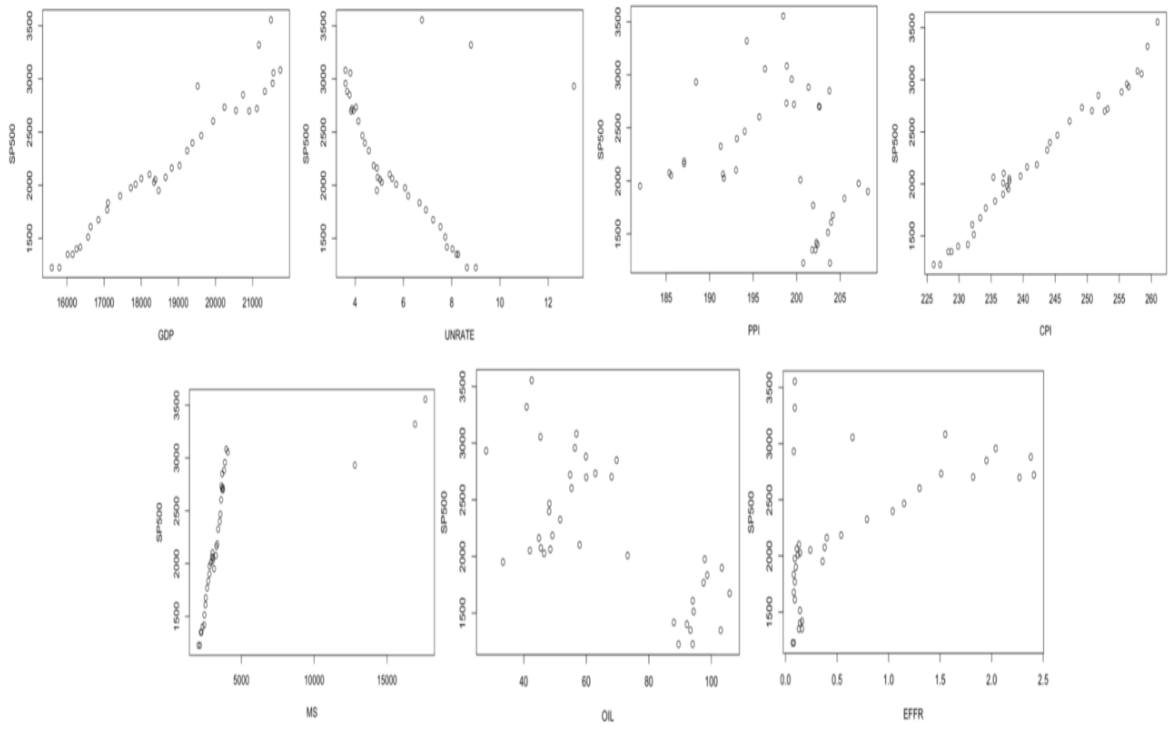

Figure 4. S&P 500 and Macroeconomic Factors

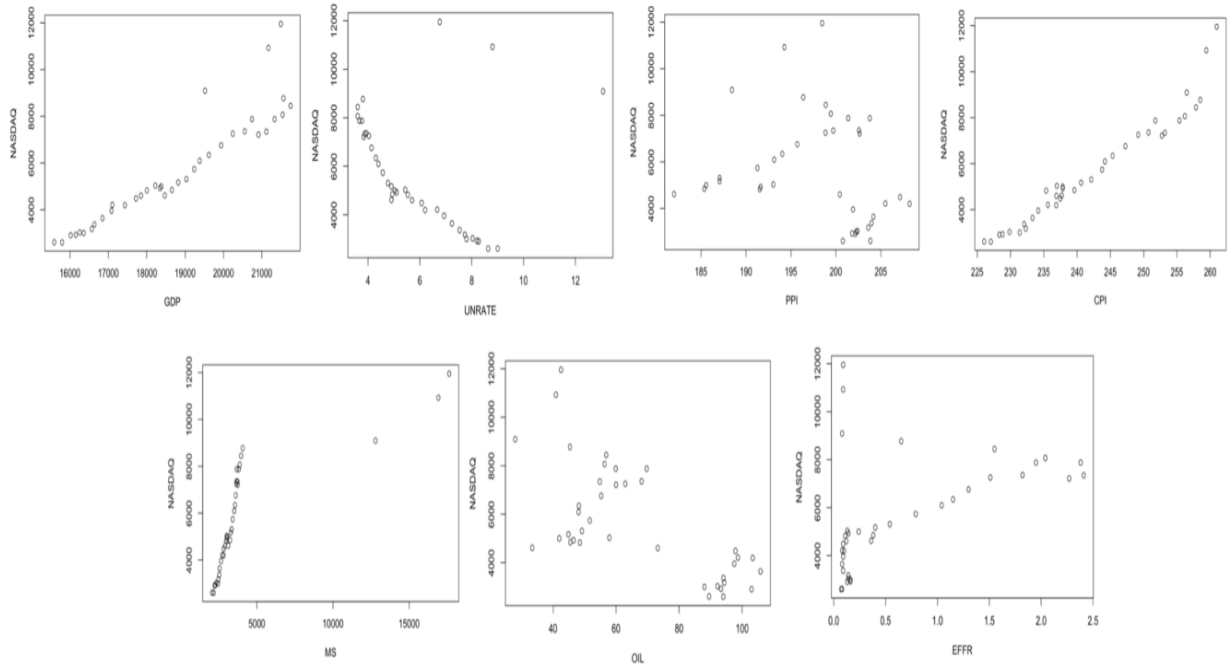

Figure 5. NASDAQ and Macroeconomic Factors

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In this section, we will briefly discuss the figures above. Table 1 is the summary statistics for the raw data before we transformed them into change from every period. Table 2 represents the data after this change. Figure 1 represents the change over time for each variable, while figure 2 illustrates the raw data of each factor and index. Figures 3-5 show the correlation between each variable and each index.

6. Empirical Methodology

The three different empirical models are as follows:

$$SP500 = (a + b)(UNRATE) + c(PPI) + d(CPI) + e(GDP) + f(EFFR) + g(OIL) + h(MS) + \varepsilon \quad (3)$$

$$DJIA = UNRATE + PPI + CPI + GDP + EFFR + OIL + MS \quad (4)$$

$$NASDAQ = UNRATE + PPI + CPI + GDP + EFFR + OIL + MS \quad (5)$$

Our model has not included microeconomic, psychological, and subjective factors. Leaving these out has reduced the detail to this model, but there are no theoretical consequences for not including them because we are testing how these factors relate to each index. We are also looking at a very undetailed model, focusing on the economy's overall trajectory. Others factors would be more appropriate when looking at day trading and short-term investments in the economy and stock market.

Checking the assumptions, we realized all of our data was not fit for regression analysis. So the data was changed again to a difference between each time period. The data does pass the condition of linearity. The data is now adjusted for normality by having a bell curve by measuring each variable's change rather than the progression over time. We can see that this model passes homoscedastically in figure 6. Some factors do correlate with each other, but this assumption will be ignored to measure their effect on each index. These factors also measure very different aspects of the economy, so we will not be removing them.

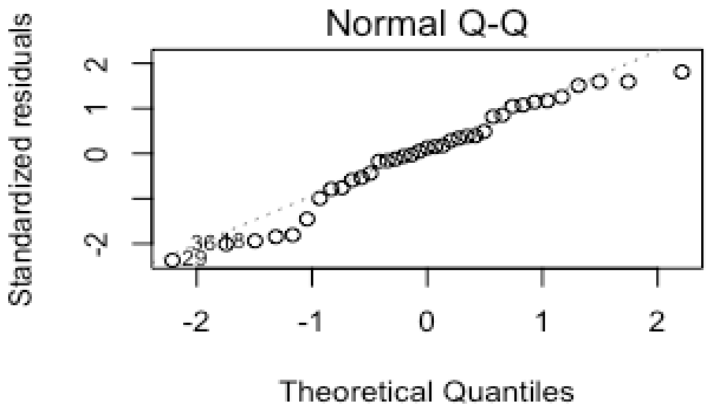

Figure 6. Test for Homoscedestity

7. Results and Discussion

There are some very interesting stats in these estimates. For one, the S&P model has the lowest standard errors, thus showing us it is the most realistic model. The Dow Jones model is on the other side of the spectrum with very high standard errors. The variables that seem to have the most effect on each model are the unemployment rate and the effective funds rate. This makes sense because if there are more people in the workforce, there will be more potential revenue in the future. As for the effective funds rate is controlled directly by the federal government and affects a lot of transactions between banks. The effective funds rate seems to have an effect on the NASDAQ index. This could be because the NASDAQ looks at a broader array of companies, not the ones at the top which are less reliant on banks. The consumer price index, which measures inflation, negatively affects each model. This is interesting because it shows the psychology that the stock market will drive down when inflation goes up. Gross domestic product and money supply seem to follow these indices the closest, with relatively no effect on the model. These seem to be the best indicators.

As for the R-squared of each model, it seems that the strongest correlation between these indices and macroeconomic variables is the NASDAQ. This is very interesting. This forces us to reject our hypothesis that the S&P and DJIA are better indicators of macroeconomic factors. This makes sense because the NASDAQ has a broader scope, in which more companies can be affected by these macroeconomic factors. As for the S&P and DJIA, it is focused on the best companies in the United States.

Other academics should use the NASDAQ to give a more accurate representation of the economy for the broader literature. In our research, many people only used the Dow Jones and the S&P. People should use NASDAQ to represent the economy more accurately.

Table 3: The Regression of SP&500 on control variables

S&P 500			
	Estimate	Standard Error	T-Value
(Intercept)	72.16281	30.27719	2.383
UNRATE	-24.35738	31.01935	-0.785
PPI	9.16166	7.06981	1.296
CPI	-30.04938	28.30622	-1.062
GDP	0.08196	0.11491	0.713
EFFR	-85.61275	59.08723	-1.449
OIL	3.21798	2.29195	1.404
MS	0.02391	0.01142	2.094
R-Squared		0.5529	

Table 4: The Regression of DIJA on control variables

Dow Jones Industrial Average (DJIA)			
	Estimate	Standard Error	T-Value
(Intercept)	556.5718	287.156	1.938
UNRATE	-154.2416	294.194	-0.524
PPI	48.7056	67.0516	0.726
CPI	-225.1034	268.462	-0.838
GDP	0.7643	1.0899	0.701
EFFR	58.4859	560.396	0.104
OIL	32.9144	21.7373	1.514
MS	0.1071	0.1083	0.989
R-Squared	0.5012		

Table 5: The Regression of NASDAQ on control variables

NASDAQ			
	Estimate	Standard Error	T-Value
(Intercept)	219.0976	107.8238	2.032
UNRATE	-154.7668	110.4668	-1.401
PPI	34.1705	25.17717	1.357
CPI	-63.94709	100.80473	-0.634
GDP	0.0908	0.40923	0.222
EFFR	-408.3395	210.42274	-1.941
OIL	5.5798	8.16214	0.684
MS	0.19544	0.04066	4.807
R-Squared		0.6262	

8. Conclusion

To conclude, our analysis covers the stock market indices, the Dow Jones, the S&P 500, and the NASDAQ, over the period of 10 years starting in 2011 and ending in 2021, compared against macroeconomic factors, such as gross domestic product, effective funds rate, oil prices, money supply, consumer price index, unemployment rate, and producer price index. In our analysis, NASDAQ became the best indicator for macroeconomic factors.

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