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Effect of United States Monetary Policy and Macroeconomics on the Dow Jones Industrial Average Pre, during and Post Covid-19 Period

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Abstract:
The impact of the US monetary policy and the US macroeconomic variables, on the stock market specifically in relation to the Dow Jones Industrial Average (DJIA), is a subject of ongoing debate. This paper seeks to investigate and examine the consequences of changes in monetary policy and some macroeconomic variables in the United States on the US stock market (only DJIA was selected) for the period of January 2017 to June 2023. By analyzing these relationships across different time frames, this research seeks to provide a comprehensive understanding of how various US monetary and US macroeconomic factors have influenced the stock market's behavior, corporate performance, and overall market trends, thus contributing to a deeper understanding of the interactions between central bank actions and financial markets and performance in the context of a significant global crisis. The Vector Error Correction Model (VECM) was used to study the short-run dynamics as well as the long-run relationship between the DJIA index and the five selected macroeconomic variables from the US economy. It is found that the coefficient of error correction term is (-0.225), indicating an annual adjustment of approximately 22.5 per cent towards the long-term equilibrium. This guarantees the existence of a stable long-run relationship between the variables. However, in the short-run, all selected explanatory variables do have a relationship with the DJIA index except real gross domestic product (RGDP) which is statistically insignificant which means RGDP does not have a short-run relationship with DJIA index.

Key Words: Federal Reserve, Covid-19, Dow Jones,

کاریگەری سیاساتی نەختینەیی ئەمەریکا و ئابوری هەموەکی لەسەر پێنوێنی داوجۆنسی پیشەسازی پێش، لە ماوەی، دوای پەتایی کۆرۆنا.

کامەران قادر يعقوب

بەشی تەکنیکی ژمێریاری، کۆلێژەی تەکنیکی کارگێری، زانکۆی پۆلیتەکنیکی سلێمانی، سلێمانی، هەرێمی کوردستان، عیراق .

پوختە:

کاریگەری سیاساتی نەتینەیی و ئابوری هەموەکی وڵاتە یەکگرتوەکانی ئەمریکا لەسەر پێنوێنی داوجۆنس دیبەیتێکی بەردەوامە. لەبەرئەوە ئەم توێژینەوەیە لەسەر کاریگەری سیاساتی نەختینەیی و ئابوری هەموەکی وڵاتە یەکگرتوەکانی ئەمەریکا دەکۆڵێتەوە لە ماوەی مانگی یەکی ۲۰۱۷ بۆ مانگی شەشی ۲۰۲۳. لەسەر بنەمای ئەدەبیاتی پێشو، هەریەک لە بڕی خراوەڕوی دراوی وڵات و، نرخی سودی بانکی و، ڕێژەی هەڵئاوسان، ڕێژەی بێکاری و بڕی بەرهەمی ڕاستەقینەیی ناوخۆ، کاریگەریان دەبێت لەسەر هەڵکشان و داکشانی پێنوێنی داوجۆنسی پیشەسازی ئەمریکا. لەم توێژینەوەیەدا، هەمو گۆراوەکان گۆردراون بۆ یەکەی ڕەگ لە ڕێگەی ئۆگمێنتێت دیکی فولەر ئەنجامدراوە. هەروەها ڕێگەی ئیختیباری جۆهانسێن کۆنتێگرەشن تێست. هەروەها مۆدێلی ڕاستکردنەوەی هەڵە ئاراستەکراوەکان بەکارهاتوە لە توێژینەوەیەدا لە هەردو مەودای ماوەکورت و ماوەدرێژدا بۆ دیاریکردنی پەیوەندی نێوان گۆڕاوە سەربەخۆکان و گۆڕاوە پشتبەستراوەکە. لە دەرئەنجامی توێژینەوەکە ئەوە دەرکەوتوە کە بۆ ماوە درێژ پەیوەندییەکی بەهێز لە نێوان گۆڕاوە سەربەخۆکان و گۆڕاوە پشت بەستراوەکەدا هەیە. بۆماوە کورت دەرئەنجامەکەی جیاوازە، لە دەرئەنجامەکە وادەرکەوتوە کە بەرهەمی ناوخۆی ئەمەریکا پەیوەندی نییە بە بەرزی و نزمی پێنوێنی داوجۆنس، لە کاتێکدا گۆڕاوە سەربەخۆکانی تر پەیوەندییەکی توند و تۆلیان لەگەڵ پێنوێنی داوجۆنسی پیشەسازیدا هەیە.

کلیلە وشەکان: سیاساتی نەختینەیی، داوجۆنس، ئابوری هەموەکی.

1) Introduction,

The Dow Jones Industrial Average is a widely followed index that tracks the performance of 30 large, publicly traded companies listed on stock exchanges in the United States. The US monetary policy has a significant impact on the Dow Jones Industrial Average (DJIA) and other stock market indices. Monetary policy, implemented by the US Federal Reserve, influences various variables (interest rates and money supply) that can affect the DJIA index. Some other variables such as the rate of inflation, money supply and the rate of unemployment also affect the economic activities in the United States stock market. It is noticed that the Stock markets have historically been responsive to relevant information that influences the movement of individual stock prices. This information can encompass various types of news that investors consider when making decisions to buy or sell specific stocks. Particularly in recent times, marked by significant market fluctuations, investors have been extremely cautious about any information coming from fed reserve that could impact the future trajectory of stock prices.

Many economists and researchers recognize the crucial role of monetary policy as a key component of macroeconomic management. Central banks utilize monetary policy instruments in conjunction with real economic activities, acknowledging their importance in shaping the overall economic landscape. Consequently, it is vital to consider the effects of monetary policy on the stock market as a critical factor in promoting economic development.

Numerous studies have extensively investigated the notable connection between U.S. monetary policy and the stock market index within the United States. However, only a limited number of studies have explored the relationship between U.S. monetary policy and DJIA (Bailey, 1990) and (Conover et al. 1999). discovers relatively not much evidence of foreign equity market reactions to surprises in Federal Open Market Committee (FOMC) announcements.

Fundamental analysis supports the idea that changes in macroeconomic indicators such as money supply, interest rates, and inflation can significantly influence stock prices. This approach emphasizes the interconnectedness of various sectors, which is essential for understanding the co-movement of macroeconomic time-series. While a considerable body of economic literature explores the relationship between stock market returns and real macroeconomic activities in developed economies like the US and Japan.

Therefore, this study aims to explore the relationship between specific macroeconomic variables (money supply, inflation, real GDP, interest rate, and unemployment rate) and the stock market index in the United States (in our case is Dow Jones Industrial Average).

2) Review of Related Literature,

Global stock markets play a dual role in the global capital market. On one hand, they have an impact on the overall market, while on the other hand, they are influenced by developments in the global market. Some authors, such as Bilson et al., (2001), emphasize that domestic factors have a greater influence on stock market performance compared to global (international) factors. While fundamental analysis is the primary tool used to examine the factors driving stock price movements, which can be conducted at three levels: global, segment, and company-specific. Depending on the chosen type of fundamental analysis, various factors are considered. The goal of global fundamental analysis is to evaluate the impact of the overall economy and market on individual stock prices. Key macroeconomic indicators, factors, and variables are used to describe the state and progress of the economy and the market. Examples, as mentioned by Sirucek (2012), include interest rates, inflation, gross domestic product (GDP), money supply, international capital flows, exchange rate fluctuations, and political and economic shocks.

Even very earlier literature such as King (1966) also reached a similar conclusion, asserting that macroeconomic factors have a significant influence, accounting for up to 50% of stock price movements. Similar findings were also observed in the Chinese market by Yuanyuan (2004), who concluded that monetary policy has an impact on stock prices. The authors noted that a "loose" monetary policy leads to rising stock markets, while a restrictive policy results in a decrease in stock prices. According to the authors, stock markets fluctuate in line with changes in the money supply.

Numerous studies have been conducted to examine the relationship between monetary policy and stock markets, however with different conclusions. For instance, the impact of money supply on stock market price is a subject of debate among economists, particularly regarding how it responds to the anticipated and unanticipated components of money supply. One of the early empirical analyses was conducted by Sprinkel (1964), who found a significant connection between money supply and stock prices in the United States. Gupta (1974) also argued that changes in money supply can serve as a predictor of stock price movements. His research found that 59% of the variability in stock indexes could be predicted based on changes in money supply. However, this viewpoint is contradicted by Rapach et al., (2005), who conducted an analysis across 12 countries to predict stock market trends using macroeconomic factors. They concluded that the most reliable macroeconomic indicator for predicting stock market trends is the interest rate. The relationship between money supply and stock markets in the Asian market was also explored by Ho (1983), who demonstrated a direct unidirectional association between money supply and stock markets in Japan and the Philippines. Furthermore, the disparity in these relationships stems from the discounted cash flow model, which provides insights into how monetary policy affects stock markets. According to the present value or discounted cash flow model, stock returns are influenced by market participants' expectations of the discount rate (Ioannidis and Kontonikas, 2006). Keynesians posit that changes in money supply will impact stock prices if they alter expectations about future money supply. A positive money supply shock creates expectations of tighter monetary policy. Investors bidding for funds drive up current interest rates, which, in turn, increases the discount rate. Consequently, the present value of future earnings declines, leading to a decrease in stock prices. A positive correlation between money supply and stock prices can be explained in three distinct ways.

Firstly, there can be an ex-post correlation wherein stock prices rise due to increased productivity in the real economy, coupled with the central bank's provision of money to prevent deflation.

Secondly, an increase in money supply, leading to enhanced liquidity, prompts stockholders to adjust their portfolios to achieve their desired balance between liquid assets and other investments. With more available funds, stockholders are able to purchase additional assets, thereby driving up stock prices while maintaining a constant stock quantity.

Thirdly, an expanded money supply results in lower interest rates, subsequently reducing the discount rate applied to future cash flows based on expected profits of enterprises. As interest forms a significant part of production and investment costs for businesses, lower interest rates imply higher profits (Kramer and Baks, 1999).

Regarding the impact of monetary policy on the US stock exchange rate, there has been considerable research conducted to understand the effects of US monetary policy actions on both the real economy and financial asset prices. Thorbecke (1997) found that stock prices decrease by 0.8% when there is an unexpected 1% increase in the federal funds rate. Rigobon and Sack (2004) estimated that the S&P 500 index lost 1.7% due to a 0.25% increase in the 3-month rate, with a higher effect observed for the Nasdaq index, resulting in a 2.4% decrease. Studies other than the United States such as, Kganyago and Gumbo (2015) conducted a study examining the long-term relationship between money market interest rates and stock market returns in Zimbabwe from April 2009 to December 2013. Their analysis controlled for factors such as money supply growth rate, inflation, manufacturing index volume, crude oil price, and political stability. They discovered compelling evidence of a strong and statistically significant inverse causal relationship between money market interest rates and stock market returns. Ito and Iwaisako (1995) demonstrated that the catalyst for the bubble was an expansive monetary policy combined with productivity increases in the Japanese economy and a higher demand for real estate in Tokyo. These factors led to increased credit provided by banks. However, in the first half of the 1990s, prices mostly returned to their original levels. Furthermore, Safar and Siničáková (2019) demonstrated a statistically significant influence of money supply on stock market indices in the US and EU. Pícha (2017) identified an influence of money supply on the valuation of S&P 500 indices with a 6-month lag. However, contradictory findings exist.

Sellin (2001), in his reviewed studies, attributed the differing findings to the level of market efficiency. Supporters of the efficient market hypothesis (EMH) argue that stock prices already reflect all available information, implying that anticipated changes in money supply would not affect stock prices. Only unanticipated changes would have an impact. On the other hand, opponents of the EMH argue that not all available information is fully reflected in stock prices. Consequently, anticipated changes in money supply can influence stock prices (Corrado and Jordan, 2005). Positive correlations between money supply and stock prices were demonstrated in studies conducted by (Evans and Baxendale, 2010).

Consequently, there is a change in portfolio allocations as the value of liquidity relative to stocks owned by investors increases. The infusion of new money flows into the stock markets, driving stock prices ever higher. Since interest rates function as both an asset yield and a discount factor, they contribute to an artificial reduction in interest rates during an upswing in stock prices, leading to excessive allocation of resources to stock values. This effect can result in the system becoming overheated. The elevated stock prices indicate profit potential and provide a sense of security to banks, enabling them to extend credit and indirectly create money. This self-perpetuating upward movement in the stock market is fueled by the excessive supply of liquidity from central banks, supporting a boom. However, if the central bank decides to reverse the interest rate decreases, it can have the opposite effect (Conrad and Lamla, 2010).

Moreover, Studies conducted in the 1970s demonstrated that in the short run, changes in money supply have a positive impact on stock prices. However, Bianying (2004) opposes this idea by discovering an inverse relationship between the money supply, which significantly increased, and the SSE index, which dropped during the short period of 2001-2003. Conversely, when analyzing a longer period from 1993 to 2001, the same author found a synchronous development between the Chinese SSE index and the money supply. In a separate study, Pearce and Roley (1984) examined the relationship between anticipated money supply and stock index performance. They discovered a negative correlation between unanticipated changes in money supply and stock index movements. According to their findings, unexpected increases in money supply are viewed by investors as negative news, resulting in a decline in stock prices.

On the flip side, there exists another variable (the rate of interest) that is deemed crucial and serves as a potent instrument within the context of monetary policy. Changes in interest rates set by the Federal Reserve can directly also influence the expenses associated with borrowing for both companies and consumers, as well as impact investment decisions Conrad & Stahl, 2002. When interest rates are lowered, it usually stimulates economic activity, leading to improved corporate profits and a positive effect on the Dow Jones. Conversely, higher interest rates can raise borrowing costs, potentially slowing down economic growth and putting downward pressure on stock prices (Caruana, 2013). Additionally, it's worth noting that during periods of economic weakness or financial crises, the Federal Reserve may employ quantitative easing measures, such as purchasing government bonds or other assets. These actions aim to inject liquidity into the economy, provide support to financial markets, and encourage economic growth, which could benefit Dow Jones. It is important to mention that a low interest rate policy could encourage excessive risk-taking by financial market participants, potentially leading to a buildup of leverage or asset bubbles (Stiglitz, 2016).

Moreover, Hasan and Zaman (2017) pointed out that the interest rate plays a crucial role in determining stock prices, and there is an expected inverse relationship between the two. This implies that changes in the interest rate have a direct impact on stock prices through the discount rate, as well as an indirect influence by altering the market risks faced by investors. As stock prices are believed to be forward-looking and based on expected future earnings, monetary policy shocks can affect stock prices both directly and indirectly (Alshogeathri, 2011). When the interest rate increases, it leads to a rise in the risk and required rate of return for investments. This, in turn, increases the cost of capital and reduces the profitability of companies. Consequently, stock prices tend to decrease as a result. Moreover, higher interest rates also diminish the present value of future dividends. As a result, investors are less willing to pay a higher price for stocks, leading to a decline in stock prices (Conrad, 2019).

On the other hand, Inflation levels can affect the Dow Jones. Low and stable inflation is generally viewed positively as it can provide a conducive environment for economic growth and corporate earnings. However, high or accelerating inflation can create uncertainty and erode investor confidence, potentially leading to lower stock prices. The Fisher effect, by Fisher (1930), also known as the Fisher hypothesis, originally established the understanding of the connection between inflation and stock returns. According to this economic theory developed by Fisher in 1930, there should be a positive correlation between stock prices and expected inflation, offering protection against rising prices. However, Reilly and Brown (1997) present an alternative viewpoint, highlighting how inflation influences stock market performance by creating discrepancies between real and nominal interest rates, thereby impacting the spending and saving behaviors of individuals and companies. This perspective is further supported by an article from The Economy Watch, which asserts that increasing inflation leads to reduced company earnings, subsequently negatively affecting stock prices and returns. The article also argues that the influence of inflation is evident through its impact on interest rates, as higher inflation rates tend to coincide with higher interest rates.

When both inflation and interest rates are high, creditors tend to adjust by charging higher interest rates on loans, discouraging individuals from investing in the stock market. Additionally, a substantial injection of money into the market by the government usually leads to a rise in the cost of goods and services, resulting in decreased purchasing power for individuals and a decline in the value of money. To ensure a thriving economy, it becomes crucial for inflation and the stock market to exhibit a more consistent and predictable relationship.

However, Fama (1981) and Schwert (1981) presented an alternative perspective on the relationship between inflation and stock prices, suggesting a negative correlation between the two. They found evidence supporting this negative correlation, which can be attributed in part to the inverse relationship between inflation and expected real economic growth. In other words, when expected inflation rates become significantly high, investors tend to reallocate their portfolios towards tangible assets (Alshogeathri, 2011). Moreover, the study's findings indicated that prior to 1972, investors had confidence in nominal stock prices rising alongside the general price level, seeing it as a dependable hedge against inflation. However, post-1972, Pearce and Roley (1984) observed a diminishing significance in the link between stock prices and inflation expectations. This change can largely be attributed to the increased volatility of the US economy and the rise in inflation rates during the 1970s, mainly triggered by the OPEC crisis.

Likewise, Niemira and Klein (1994) conducted a study that supports Pearce and Roley 's findings regarding the shifting correlation between inflation expectations and the stock market after 1972. Their research revealed an opposite relationship between inflation expectations and the stock market, using the leading indicator of inflation as the source for inflation expectations. While they didn't offer specific reasons, it is likely that the Federal Reserve's manipulation of interest rates to influence potential changes in inflation played a significant role in this inverse relationship. Since this study examines the economy's connection to the stock market since 1972, it predicts an inverse correlation between inflation expectations and the S&P 500.

More inherently Gross Domestic Product (GDP) is the primary measure used to evaluate an economy's performance. It represents the total income generated within a country, including both domestic and foreign earnings (Mankiw, 1997). The importance of GDP lies in its ability to gauge economic well-being, making it a crucial indicator for the stock market. As a rational investor, observing an increase in GDP (positive growth rate) from one period to another indicates that companies are performing well collectively. This positive performance encourages higher reinvestment, leading to anticipated growth in future earnings and, consequently, driving up stock prices.

Furthermore, an upswing in GDP is also expected to boost the stock market as it enhances consumers' purchasing power, prompting them to allocate more income to stock market investments (ceteris paribus) (Mankiw, 1997). In this way, GDP can serve as a proxy for assessing the investors' ability to make purchases.

Apart from GDP, another crucial metric used to assess the economy's well-being is the unemployment rate. A high unemployment rate not only affects the unemployed, creating financial insecurity but also concerns those who are employed due to the risk of job cuts and downsizing. This decline in financial security impacts both employed and unemployed individuals, leading to reduced investments in the stock market as investors seek safer ways to preserve their income. Therefore, the unemployment rate serves as a vital indicator for investors, providing insights into the overall health of the economy. The expected relationship with stock market investment is negative, meaning that as the unemployment rate increases, investment in the stock market tends to decrease.

Alternatively, based on economic literature, the unemployment rate can have an impact on the DJIA index. When the unemployment rate is low, it indicates a strong labor market and higher consumer spending, leading to positive effects on corporate profits and stock prices. Conversely, when the unemployment rate is high, it may lead to decreased consumer spending and lower corporate earnings, potentially exerting a negative impact on the Dow Jones. Moreover, taking cues from these discoveries, Flannery and Protopapadakis (2002) undertook research to investigate the influence of 17 macroeconomic variables, such as the unemployment rate, on both the average and fluctuation of stock returns. They utilized a daily equity returns GARCH model, wherein the actual returns and their conditional volatility were influenced by the announcements of the 17-macro series. The results of their study demonstrated that the unemployment rate primarily impacted the volatility, not the average, of stock returns. It is pointed out that the rate of unemployment is selected in this study as a representation of the real economy due to its accuracy and its ability to measure the growth rate of the economy. It serves as a crucial indicator for the Federal Reserve (Fed) when formulating monetary policy, as it helps assess the overall health of the economy.

Overall, the impact of US monetary policy and macroeconomics on the Dow Jones Industrial Average is a subject of ongoing research and analysis. Understanding these relationships is crucial for investors, policymakers, and analysts in assessing and interpreting stock market movements.

3) Methodology and Data

This section presents a concise summary of the model applied, the econometric tests conducted, as well as the source and type of data employed. It is generally believed that macroeconomic factors are anticipated to influence stock market performance to a large extent.

Most research on the stock market's reaction to monetary policy and macroeconomic variables primarily focuses on all stock markets in the United States (e.g., Pearce and Roley, (1984); (Patelis, 1997); (Thorbecke, 1997); (Ehrmann and Fratzscher, 2004); (Bernanke and Kuttner, 2005); (Chuliá et al., 2010); (Kontonikas and Kostakis, 2013); (Unalmis and Unalmis, 2015). This study focuses only DJIA index and examines how this index responds to the policies of the FED.

The sample period for this study spans from January 1, 2017, to June 30, 2023, encompassing 78 monthly observations for each variable. Encompassing the time span preceding, during, and subsequent to the Covid-19 outbreak. This inclusion has three implications. Firstly, in normal circumstances (from January 1, 2017, to October 31, 2019), when monetary easing occurs, it tends to increase stock prices. However, during times of Covid 19 pandemic (from November 2019 to March 2022). Third, during post Covid 19 pandemic (tightening monetary policy period). Therefore, this study examines the impact of US monetary policy decisions by the FED reserve and some macroeconomic variables during and post-pandemic on DJIA. The data analyzed in this study represents economic indicators and information specifically obtained from the United States economy. Before moving to the details of the model that will be used in this study, it is important to show and analyses the DJIA index in the chart.

A Dow Jones chart typically represents the performance of the Dow Jones Industrial Average (DJIA) over a specific period. The DJIA is an index that tracks the stock prices of 30 large and well-established companies listed on the New York Stock Exchange. It serves as an indicator of the overall health and performance of the U.S. stock market. The chart is divided into three different period of time which are pre-COVID-19, COVID-19, and post-COVID-19.

- Pre-COVID-19:

This phase would show the Dow Jones chart from a time before the COVID-19 pandemic began, likely before the end of 2019 or early 2020. During this period, the market may have been experiencing steady growth and reaching new all-time highs. The chart would show a general upward trend with minor fluctuations, reflecting the overall positive sentiment in the economy and stock markets.

- COVID-19:

This phase would depict the Dow Jones chart during the height of the COVID-19 pandemic, which emerged in early 2020 and caused significant disruptions to global markets. The chart would show a sharp and dramatic decline as panic and uncertainty spread among investors, leading to a market crash. This crash is likely to have occurred in late February or March 2020 when governments around the world implemented lockdowns and travel restrictions to contain the virus's spread.

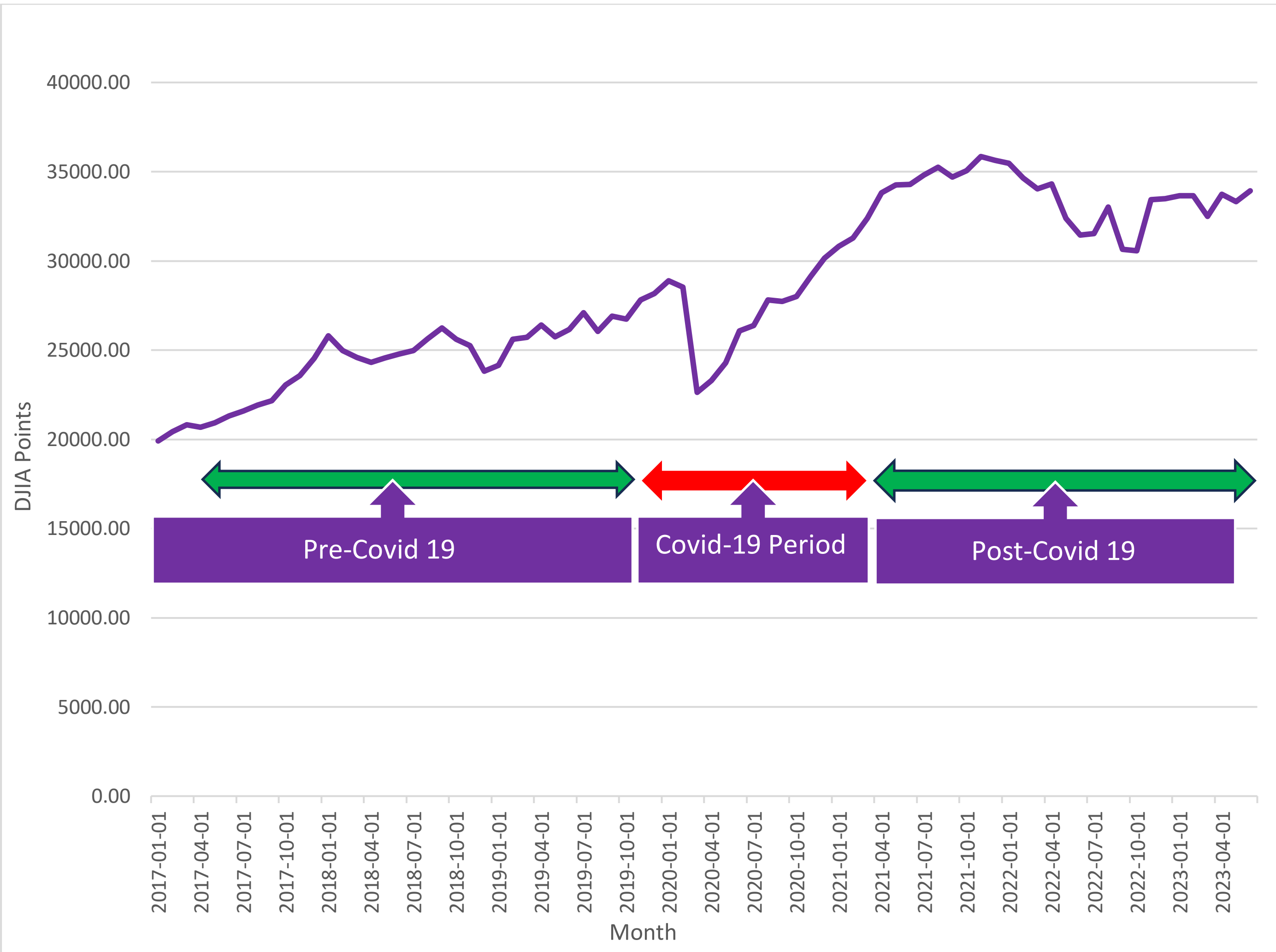
- Post-COVID-19:

This phase would cover the period after the initial impact of the pandemic on financial markets. It would show how the Dow Jones chart gradually recovered from the COVID-19-induced crash and started to rebound. The market might experience volatility during this phase as investors continue to assess the economic recovery and the effects of government stimulus measures. Over time, the chart would likely show a more stabilized and upward trend, indicating a return to growth and confidence in the markets.

The divisions of pre-COVID-19, COVID-19, and post-COVID-19 in the chart would help illustrate the market's response to the pandemic's unique challenges and its subsequent recovery. However, for the most current and accurate representation of the Dow Jones chart and its performance, it is always best to refer to up-to-date financial sources and platforms.

The methodology for this study necessitates specific data, including secondary data pertaining to key macroeconomic variables in the US economy. These variables comprise the Dow Jones Industrial Average (DJIA) index, Inflation Rate, Interest Rate (IR), Money Supply (MS), unemployment rate and Real Gross Domestic Product (GDP).

Dow Jones Industrial Average (January 2017 till June 2023)



Source: Bureau of Labor Statistics, 2023.

It is also noted that only the money supply and the rate of interest are related to FED, the rest of the variables are related to the US macroeconomics. It is important to mention that money supply and interest rates are also part of macroeconomic variables. In order to investigate the impact of these five independent variables on the DJIA index. Prior to performing our analyses, it is essential to construct our model using insights from existing economic literature.

3.1 The Model,

The equation presented is founded on the logical assumption that stock prices, and consequently the stock market index, can be attributed to external factors, specifically market fundamentals. The modelling approach used to represent the correlation between Selected independent variables and DJIA was as follows:

The model is defined in its functional form as follows:

DJIAI = f (MS, INF, IR, UEM, GDP)

The given model can be reformulated as follows:

$$DJIAI = a_0 + \beta_1 MS + \beta_2 INF - \beta_3 IR + \beta_4 UEM + \beta_5 GDP + \varepsilon_t \qquad \text{(Eq, 1)}$$

The variables are defined as follows:

- **Dependent Variable**

DJIAI: The market-value weighted average index, calculated using the month-end closing prices for the Dow Joes Industrial Average.

- **Independent variables**

MS: Money supply growth rate monthly (measured by the money aggregate M2).

It is hypothesized that variations in the money supply might exert an influence on the performance of the DJIA. Specifically, an increase in the money supply could potentially lead to higher liquidity in the market, which might contribute to positive movements in the DJIA. Conversely, a decrease in the money supply might lead to reduced market liquidity and potentially result in negative impacts on the DJIA. By analyzing historical data and employing appropriate statistical methods, we seek to gain insights into the nature and strength of the relationship between these two variables.

INF: Monthly inflation rate (Natural logarithm of monthly consumer price index).

It is hypothesized that changes in the inflation rate might have an impact on the performance of the DJIA. Specifically, higher inflation rates could lead to increased uncertainty and reduced purchasing power, potentially resulting in negative movements in the DJIA. Conversely, lower inflation rates might contribute to greater economic stability and potentially lead to positive trends in the index. Through a comprehensive analysis of historical data and the application of appropriate statistical methods, we seek to uncover the potential relationship between these two variables and its potential implications."

IR: US Interest Rate (Average Interest Rate on Time Deposits).

It is hypothesized that alterations in interest rates can influence the performance of the DJIA. Specifically, when interest rates are lowered, borrowing becomes more attractive, potentially leading to increased investment and positive movements in the DJIA. Conversely, higher interest rates might lead to reduced borrowing and investment, which could potentially result in negative impacts on the DJIA. By analyzing historical data and employing suitable statistical methods, we aim to uncover insights into the nature and strength of the relationship between these two variables.

UEM: Monthly rate of unemployment.

It is hypothesized that fluctuations in the unemployment rate could have an impact on the performance of the DJIA. Specifically, higher unemployment rates might lead to reduced consumer spending and economic uncertainty, potentially resulting in negative movements in the DJIA. Conversely, lower unemployment rates might indicate a healthier economy with increased consumer spending and potentially positive trends in the index. Through a comprehensive analysis of historical data and appropriate statistical methods, we aim to uncover the potential relationship between these two variables and their implications for market performance.

GDP: Natural logarithm of monthly Gross Domestic Product in real terms.

It is hypothesized is that variations in real GDP could be linked to the performance of the DJIA. Specifically, higher real GDP growth rates might indicate a robust economy with increased production and consumption, potentially leading to positive movements in the DJIA. Conversely, lower real GDP growth rates might suggest economic contraction, reduced consumer spending, and potentially negative impacts on the DJIA. Through an analysis of historical data and the application of appropriate statistical methods, we seek to uncover insights into the nature and strength of the relationship between these two variables.

- **Constant, Error and Coefficient**

ξ: Disturbance term expected to be zero

a_0= Intercept of the regression.

β: The coefficients of determination

All relevant variables were included in the data collection process on a monthly basis. All variables have been transformed into their natural logarithm. A variable is considered dependent when its value is influenced by another variable, which is referred to as the independent variable (Kothari, 2004). In this case, the dependent variable is the DJIA index.

To ensure accuracy, the stock indexes were recalculated using the market value-weighted series, which involved deriving the initial total market value of the stocks included in the series. The calculation of stock return is based on the monthly index value (Reilly and Brown, 2011).

The two most explanatory variables in our equation interest rates and money supply are directly related to US monetary policy. According to the traditional economic perspective, there is a claim that interest rates have a negative impact on the stock market index. This is primarily because investors tend to shift their investments from the higher-risk stock market to safer options like savings accounts or fixed deposits, where they can obtain higher returns. When interest rates are very low, investors then move their funds from savings to stock market investments in hopes of achieving a better rate of return. On the other hand, the growth of money supply indicates healthy liquidity, making resources available for purchasing securities, which in turn leads to higher security returns due to increased demand (Maysami et al., 2004). Therefore, the relationship between money supply and stock market prices has been analyzed in various ways. The Keynesian economists claim that the impact of a change in the money supply on stock prices is dependent on whether the change influences people's expectations regarding future monetary policy. They argue that if there is an increase in the money supply, it will make people anticipate a future tightening of monetary policy., whereas real activity economists argue for a positive relationship (Sellin, 2001).

In terms of the analysis method, this study will utilize co-integration and the Error Correction Modeling (ECM) technique due to the non-stationary nature of time series data. Similar studies in other capital markets, such as Maysami and Sim (2001), Islam and Watanapalachaikul (2003), Akbar et al., (2012) and Dasgupta, (2014), have also employed the ECM technique. It is important to mention that the application of ordinary least squares (OLS) regression may produce misleading results. Therefore, this approach (ECM) involves assessing the time series properties of the data, conducting cointegration tests among the variables, and subsequently specifying an error correction model. This model will enable the investigation of both short-run and long-run effects of the identified variables on the stock market index. Before proceeding with the primary analyses and implementing this approach, it is crucial to conduct some diagnostic tests.

3.2 Hypothesis of the research

Hypothesis 1: Monetary Policy (Monetary policy utilizes instruments such as the money supply and interest rates) and Dow Jones Performance

Null Hypothesis (H0): United States monetary policy and its Macroeconomic variables changes have no significant effect on the fluctuations of the Dow Jones Industrial Average across different time periods.

Alternative Hypothesis (H1): United States monetary policy changes significantly influence the fluctuations of the Dow Jones Industrial Average across different time periods (pre-, during, and post-COVID-19).

Hypothesis 2: Macroeconomic Indicators (such as real gross domestic product, the unemployment and the rate of inflation) and Dow Jones Performance

Null Hypothesis (H0): Macroeconomic indicators (GDP growth, inflation rates, unemployment) do not have a statistically significant impact on the variations in the Dow Jones Industrial Average throughout distinct time frames.

Alternative Hypothesis (H1): Macroeconomic indicators have a statistically significant impact on the variations in the Dow Jones Industrial Average throughout distinct time frames.

3.3 Multicollinearity problems,

Multicollinearity refers to a high degree of correlation or interdependence among independent variables in a statistical model. It occurs when two or more independent variables in a regression model are highly correlated, making it difficult to distinguish the individual effects of each variable on the dependent variable (Gujarati, 2004). Multicollinearity can pose several challenges. Firstly, it reduces the reliability and stability of the regression coefficients, making them sensitive to small changes in the data. This instability can lead to difficulties in interpreting the significance and magnitude of individual variables. Secondly, multicollinearity inflates the standard errors of the regression coefficients, which can result in misleading hypothesis tests and confidence intervals. Lastly, multicollinearity can make it challenging to identify the true relationship between the independent variables and the dependent variable (Yaqub, 2019). Below, the independence variables are examined for correlations to identify the presence of multicollinearity.

Based on the information presented in Table 1, the results of the pairwise cross-correlation analysis among the independent variables revealed relatively weak correlations. This finding suggests that there is no significant multicollinearity issue between the explanatory variables.

(Table. 1) Correlation coefficient between explanatory variables

	MS	INF	IR	UEM	RGDP
MS	1				
INF	0.41	1			
IR	-0.39	0.30	1		
UEM	0.19	-0.45	-0.45	1	
RGDP	-0.15	0.35	0.31	0.32	1

Author's calculation based on E-view software.

3.4. Data Description,

Table 2 displays the descriptive statistics of the variables covering the period from January 2017 to June/ 2023 for all variables. One of the main ways to comprehend the characteristics of a series is by examining their descriptive statistical values (Table 2).

Table 2. Shows descriptive statistics for the full sample.

	DJIA	MS	INF	IR	UEM	RGDP
Mean	0.006447	0.003631	0.005014	0.014296	-0.020856	58952592
Median	0.010527	0.002705	-0.025465	0.000000	-0.028171	0.000450
Maximum	0.089052	0.069722	0.764923	0.916291	0.228842	3.12E+09
Minimum	-0.230992	-0.011985	-0.678873	-2.564949	-0.194156	-0.046677
Std. Dev.	0.044809	0.014193	0.097560	0.043139	0.071277	0.09E+08
Skewness	0.814415	0.723597	0.029732	0.616286	0.934473	0.072428
Kurtosis	0.000674	0.001025	0.000043	0.00005	0.004672	0.000923
Jarque-Bera	456.2461	256.5661	47.54875	1043.484	36.24897	5533.914
Probability	0.000000	0.000000	0. 000000	0.000000	0.000000	0.000000
Sum	0.341702	0.192417	0.265760	0.757686	-1.105361	3.122709
Sum Sq. Dev.	0.104406	0.010475	4.604187	10.21133	0.264179	9.586118
Observations	78	78	78	78	78	78

Author's calculation based on E-view software.

The descriptive statistics reveal that all the markets exhibited varying degrees of variation or volatility, with DJIA displaying the highest level of volatility, while the MS showed the lowest level of variation. The acceptance of the Jarque-Bera statistics indicates that all of the series are normally distributed. In a perfectly normal distribution, the kurtosis values would be zero. Although the observed kurtosis values are significantly high, they exhibit leptokurtic characteristics.

3.5 Identification of Research Gap,

Upon examining the theoretical and empirical frameworks, it is evident that there is a lack of consensus among researchers regarding this particular topic. Various schools of thought exist in terms of the underlying theory, and researchers have obtained different findings when investigating the same subject. Hence, this study aims to address these gaps by providing a contemporary perspective on the matter, employing advanced analytical tools for analysis.

3.6 Unit Root Test,

The purpose of conducting stationarity tests is to confirm that the variables remain stable over time and that any shocks experienced are temporary, eventually returning to their long-term average (Phillips, 1987). The augmented Dickey-Fuller (ADF) test is employed to assess stationarity or the presence of unit roots in both the original variables and their first differences. In order to establish cointegration, it is necessary for all variables to be integrated in the same order. To assess unit roots, we will utilize the ADF test. Analysis of Stationarity As explained by Gujarati (2004), a stochastic process is considered stationary if its mean and variance remain constant over time, and the covariance between two periods depends solely on the time gap or lag between them, rather than the specific time at which the covariance is computed. If |p| > 1, the series y is nonstationary and its variance will increase indefinitely. Conversely, if |p| < 1, the series y is stationary (Phillips and Perron, 1988). The purpose of the unit root test is to determine whether the series is consistent with an autoregressive (AR) process with a stochastic trend. If a series has a unit root, it indicates non-stationarity (Phillips, 1987).

Here is an example of applying the Augmented Dickey-Fuller (ADF) test to an equation:

Consider the following autoregressive model:

$$Y_t = \alpha + \beta * Y_{t-1} + \varepsilon t \qquad \text{(Eq 2)}$$

To test whether the variable Yt contains a unit root, you can transform the equation into a first-difference form:

$$\Delta Y_t = \alpha + (\beta - 1) * Y_{t-1} + \varepsilon t \qquad \text{(Eq 3)}$$

The null hypothesis for the ADF test is that (β - 1) = 0, indicating the presence of a unit root. If the estimated coefficient (β - 1) is significantly different from zero, it suggests evidence against the presence of a unit root, implying stationarity of Y_t. To perform the ADF test, you would estimate the transformed equation and conduct a t-test on the coefficient (β - 1). If the t-test rejects the null hypothesis at a chosen significance level (e.g., 5%), it indicates evidence against the presence of a unit root, suggesting that Y_t is stationary (Phillips and Perron 1988).

It is important to note that in practice, the ADF test typically includes lagged difference terms to account for serial correlation and ensure the robustness of the test (Phillips, 1987). The augmented regression equation includes lagged first differences of Y_t to capture any autocorrelation in the data.

The equation for the augmented ADF test would be:

$$\Delta Y_t = \alpha + \Sigma (\gamma i\ \Delta Y_t) + \beta(Y_{t-1}) - Y_{t-2} + \varepsilon t \qquad \text{(Eq 4)}$$

In this equation, Δ represents the first difference operator, γi represents the coefficients of the lagged difference terms, and β is the coefficient on the lagged level term. You would estimate this augmented equation and conduct a t-test on the coefficient β. If the t-test rejects the null hypothesis of β = 0, it provides evidence against the presence of a unit root, indicating the stationarity of Y_t (Phillips and Perron, 1988).

To examine the properties of time series variables, an initial step involves assessing their stationarity. This involves conducting a preliminary analysis to determine if the series exhibits a unit root (Phillips, 1987). The Augmented Dickey Fuller (ADF) unit root test was utilized for this purpose, and the outcomes are presented in Table 3. Below is a summary of the results obtained from the Augmented Dickey Fuller (ADF) unit root test conducted on the variables. The empirical findings from the Augmented Dickey Fuller (ADF) unit root test, as presented in Table 3, indicate that the 5 per cent critical levels, were found to be non-stationary at the levels. However, after applying the first differencing, all variables demonstrated stationarity. Therefore, the variables can be classified as integrated of order I (1). This conclusion is based on comparing the Augmented Dickey Fuller statistics with the critical values provided by (Mackinnon, 1996). Since the variables are I(1) series, it allows for the use of the Johansen cointegration test to determine whether a long-term relationship exists among the variables.

Table 3: Augmented Dickey-Fuller ADF test (Test for stationarity)

Variables	Order of integration	ADF test statistics	Critical ADF statistics	Lag Length (AIC)
DJIA	I (1)	-7.101823	-4.144584 at 1%	2
MS	I (1)	-4.697822	-4.148465 at 1%	1
INF	I (1)	-11.56204	-4.144584 at 1%	2
IR	I (1)	-4.960648	-3.278467 at 1%	2
UEM	I (1)	-5.224525	-4.144584 at 1%	2
RGDP	I (1)	-8.308619	-4.152511 at 1%	1

Source: Author's calculation based on E-view software.

3.7 Lag Length,

The determination of lag lengths can be accomplished using the Sims likelihood ratio test. Selecting the appropriate lag length is crucial, as having too many lags can decrease the test's power due to the estimation of additional parameters and a reduction in degrees of freedom.

Table 4. VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-772.1591	NA	2506421.	31.76159	31.99325*	31.84948
1	-711.6823	48.20894	1136597.	30.76254	32.38410	32.03534
2	-678.8734	103.6745*	93364.4*	30.40039*	33.90426	31.37776*
3	-642.1674	44.94618	1320489.	30.86397	35.26535	32.53385
4	-594.8096	46.39124	1210749.	30.89279	36.19168	32.59760

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Source: Author's calculation based on E-view software.

Conversely, having too few lags may not capture the dynamics of the error correction process adequately, leading to imprecise estimates of regression and its standard errors (Taylor and Peel 2000). This study employs the Akaike information criterion (AIC) to determine the lag lengths. Both criteria are model selection techniques developed for maximum likelihood estimation methods.

3.8 Cointegration Test,

To conduct a cointegration test, it is necessary to confirm that the variables we are interested in have achieved stationarity through first differencing (Johansen 1988). Consider a system of *p* stationary time series variables denoted as:

Yt = [y-1t, y-2t, ..., ypt] ………. (Eq 5)

where t represents the time index. The goal of the Johansen test is to determine the number of cointegrating vectors (r) present in the system.

The Johansen test is based on vector autoregressive (VAR) models. Specifically, it employs the following VAR(p) model:

$$\Delta Y\_t = \Pi Y(t-1) + \Sigma(i=1)^{(p-1)}\ \Gamma i\ \Delta Y(t-i) + \varepsilon t \text{ .... (Eq 6)}$$

where ΔYt represents the differenced series, Π is a (p x p) matrix of coefficients capturing the short-run dynamics, Γi is a (p x p) matrix of coefficients for the lagged differenced series, and εt is a vector of error terms. To test for cointegration, we need to estimate the rank (r) of the matrix Π, which indicates the number of cointegrating vectors (Elliott 1998). The Johansen test employs two statistics: the trace statistic (λ_trace) and the maximum eigenvalue statistic (λmax).

The trace statistic is calculated as follows:

$$\lambda \text{ trace} = -T * \Sigma(i=1)\ ^{(r)} \log(1 - \lambda i) \text{ .... (Eq 7)}$$

where T is the number of observations and λi represents the eigenvalues of the matrix Π.

The maximum eigenvalue statistic is calculated as:

$$\lambda max = -T * \log(1 - \lambda(r+1)) \text{ .... (Eq 8)}$$

where λ(r+1) is the (r+1) is the eigenvalue of Π.

Under the null hypothesis of no cointegration (r = 0), both λ trace and λ max follow a chi-square distribution with dimensions r(r+1)/2 and r, respectively.

To determine the number of cointegrating vectors, critical values from chi-square tables are compared to the calculated test statistics. If the calculated statistic exceeds the critical value, the null hypothesis of no cointegration is rejected in favor of the alternative hypothesis of cointegration (Granger, 1986) and (Engle and Granger, 1987). The number of cointegrating vectors is determined by counting the statistically significant eigenvalues.

Table 5. Johansen Co-integration test

TRACE TEST

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.546090	107.7723	95.75366	0.0058
At most 1	0.495294	68.27952	69.81889	0.0659
At most 2	0.272859	34.09059	47.85613	0.4969
At most 3	0.162987	18.15888	29.79707	0.5543
At most 4	0.123593	9.263097	15.49471	0.3416
At most 5	0.051940	2.666864	3.841466	0.1025

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level

* Denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

MAXIMUM EIGENVALUE TEST

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.664186	53.46865	40.07757	0.0009
At most 1	0.185256	20.81118	29.79707	0.3695
At most 2	0.243820	13.69434	27.58434	0.8431
At most 3	0.185256	10.03917	21.13162	0.7410
At most 4	0.138565	7.308609	14.26460	0.4533
At most 5	0.068242	3.463399	3.841466	0.0627

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Source: Author's calculation based on E-view software.

Table 3, above displays the two types of test statistics, namely the trace and maximum eigenvalue statistics, indicating the presence of two cointegrating equations. With this information, we can proceed to estimate our vector error correction regression model.

3.9 Vector Error Correction Model (VECM),

To explore the dynamic relationships between some macroeconomic variables in the United States and the Dow Jones Industrial Average (DJIA), Johansen's VECM (Vector Error Correction Model) provides more efficient estimators of cointegrating vectors. Johansen and Juselius (1990) Vector Error Correction Model (VECM) is widely regarded as a valuable econometric tool for several reasons:

The advantage of Johansen's VECM stems from its utilization of a full information maximum likelihood estimation model, enabling the testing of cointegration in a system of equations in one step, without requiring a specific variable to be normalized. This eliminates the need to propagate errors from the first step to the second step, unlike the Engle and Granger approach. This method also explicitly addresses the issue of cointegration among variables. Cointegration implies that multiple non-stationary variables have a long-term equilibrium relationship (Johansen, 1988). By considering cointegration, VECM allows researchers to analyze the relationship between variables even if they individually exhibit unit roots (non-stationarity). This is crucial as it captures the underlying long-term dynamics and provides more accurate and meaningful results. VECM also allows for the simultaneous estimation of both the short-term dynamics and the long-term equilibrium relationship among variables. By estimating the cointegrating vectors and the adjustment coefficients in one step, VECM provides a comprehensive framework to understand the relationships between variables over different time horizons.

Moreover, VECM introduces the concept of the error correction term (ECT). The ECT captures the speed at which variables adjust to their long-run equilibrium after experiencing shocks or deviations. This feature allows researchers to study the dynamic adjustment processes and the short-run interactions among the variables. Regarding the Rank Determination, Johansen’s VECM offers methods to determine the number of cointegrating vectors, also known as the rank. The rank test provides insights into the long-term relationship structure among variables (Johansen and Juselius, 1990). It helps identify the appropriate number of cointegrating vectors to include in the model, which is essential for accurate estimation and interpretation of the VECM parameters.

In addition, VECM enables impulse response analysis, which examines how shocks or innovations in one variable affect the other variables in the system over time. This analysis helps researchers understand the dynamic responses of the variables and their interdependencies, providing valuable insights for policy analysis, forecasting, and decision-making. With regard to forecasting capabilities, VECM can be utilized for forecasting future values of the variables based on the estimated model parameters. By considering both the short-term and long-term dynamics, VECM improves the accuracy of forecasts and provides a more comprehensive understanding of the relationships among variables over time. Furthermore, Johansen's VECM allows for the avoidance of a priori assumptions regarding the endogeneity or exogeneity of variables (Johansen 1988).

Overall, Johansen's VECM framework has proven to be valuable in capturing the long-term equilibrium relationships, short-term dynamics, adjustment mechanisms, and forecasting capabilities among multiple non-stationary variables. Its incorporation of cointegration and error correction makes it a robust and widely used tool in empirical econometric analysis.

The VECM equation for a system of p variables can be represented as follows:

$$\Delta Y_t = \Pi Y_{t-1} + \Sigma\{i=1\}^\wedge\{p-1\}\Gamma_i \, \Delta Y_{t-i} + \varepsilon t \quad \text{......... (Eq 9)}$$

where:

ΔY_t is a vector of differenced variables at time t.

ΠY_{t-1} is a vector of lagged levels of the variables.

Π is a (p x p) coefficient matrix that captures the long-term equilibrium relationships (cointegrating vectors) among the variables.

Γi for i = 1 to p-1 are (p x p) coefficient matrices that capture the short-term dynamics or the adjustment mechanisms to restore the long-term equilibrium.

ε_t is a vector of error terms.

The cointegrating vector(s) can be obtained by estimating a VAR model on the levels of the variables and conducting a rank test, such as the Johansen trace test or maximum eigenvalue test. The number of cointegrating vectors determines the rank of the Π matrix.

The error correction term (ECT) in Johansen's VECM is calculated as:

$$\Delta ECT_t = \Delta \text{Y}_t - \Pi\Delta Y_{t-1} \qquad \text{(Eq 10)}$$

The ECT measures the short-term dynamics that adjust the variables back to their long-run equilibrium relationship. It represents the discrepancy between the actual and predicted values of the dependent variable in the cointegrating equation (Johansen and Juselius, 1990).

The specific form of the VECM equation depends on the number of variables in the system (p) and the lag length. The coefficients in Π and Γ matrices are estimated using methods like Ordinary Least Squares (OLS) or Maximum Likelihood Estimation (MLE).

By estimating the VECM parameters, researchers can examine the short-term and long-term relationships among variables, analyze the adjustment processes, conduct impulse response analysis, and make forecasts based on the model. The Johansen VECM framework provides a comprehensive approach to studying the dynamics of cointegrated variables and has become a standard tool in econometric analysis.

Cointegration Tests: Cointegration analysis applies to time series data that exhibit stationarity both at the levels and in their first differences. Cointegration is conducted to identify long-term relationships between variables. Two variables, xt and yt, are considered cointegrated if there exists a parameter $\propto$ such that $\mu t = yt - \propto xt$ forms a stationary process. Cointegration tests determine not only the presence of cointegration but also the number of cointegration relationships. If variables are cointegrated, it implies they move together in the long run, indicating the existence of an error correction model. The Johansen cointegration test will be used to test for cointegration, with the null hypothesis stating no cointegration equation. The null hypothesis is rejected if the p-value is less than 5%.

3.10 Result and Discussion,

An error correction model is created, utilizing the computed t-values of the regression coefficients. The outcomes of this model are subsequently showcased in Table 6. The estimated coefficient of error-correction term (ECM (-1)) in the DJIA equation is statistically significant at a 1% level and also has a negative sign. Around 22% of disequilibrium will be corrected yearly; it denotes the speed of adjustment toward equilibrium. which confirms that there is a long-run equilibrium relation between the dependent and explanatory variables. Essentially, the negative response of the error correction term is necessary to achieve equilibrium in the long-term for the DJIA series. Since the error correction term is both negative and statistically significant, it suggests the presence of causality in at least one direction.

Regarding the short-term outcomes, Table (6) presents the results of the VECM estimates for various independent variables. The coefficients of the first difference reveal that two variables, namely money supply (MS) display statistical significance at a 1% level with the expected positive effects. Specifically, a 1% increase in money supply (MS) is associated with a 1.9-point rise in the Dow Jones Industrial Average index (DJIA) during the study period.

This positive relationship between MS and the DJIA index is attributed to the fact that an increase in the money supply within the economy has a substantial impact on overall price levels, including stock prices and, consequently, the market index. The positive nature of this relationship is expected, as a rise in money supply boosts liquidity, leading to a significant push in the general price level across the entire economy.

On the contrary, the rate of inflation is negatively related the DJIA index, Specifically, a 1% increase in the inflation rate (INF) leads to a 1.3-point decrease in the DJIA index over the same period, thus the null hypothesis is rejected.

Concerning the inflation rate, it also exhibits a positive association. This connection can be explained by the fact that when inflation rises within the economy, it tends to drive stock prices, and consequently, the market index, higher, especially when there are expectations of increased stock returns. However, it was anticipated that a high and increasing inflation rate would diminish the real value of financial assets, including stock prices. As a result, individuals holding wealth would likely divert their investments towards real assets, while showing less interest in financial assets. Conversely, the real gross domestic product (RGDP) also shows a positive effect, as a result, the null hypothesis cannot be rejected for this particular variable.

Likewise, the other two independent variables, namely interest rate (IR) and unemployment rate (UEM) statistically significant at 1% and 10% respectively, and also have a negative effect on the DJIA index, which aligns with economic theory. there is a negative relationship between the interest rate and unemployment rate on the one hand and the stock market on the other hand. Specifically, an increase in the interest rate and unemployment rate is associated with a decline in the stock market. In this study, the coefficients of the first difference of IR and UEM are found to be statistically significant at the 1% level. Among all the variables studied, the interest rate has the most substantial impact. Specifically, a one percentage point increase in the interest rate set by the US Federal Reserve results in a decrease of 2.85% in the DJIA index. Similarly, a 1% increase in the unemployment rate leads to a 0.85% decrease in the DJIA index.

The coefficients of the second difference between MS and INF in Table 6 are statistically significant at 1%, indicating the existence of short-run causality from the mentioned independent variables (MS, INF) to the DJIA index. Again, the RGDP is statistically insignificant indicating there is no short-run causality between RGDP and DJIA index. The rest of the explanatory variables (IR and UEM) in the second difference are also significant at 5%. There is an existing relationship between these two variables namely interest rate and unemployment rate on one hand and the DJIA index on the other hand.

Upon analyzing the data comprehensively, it is typically observed that there is a correlation between explanatory variables and the dependent variable, both in the short-run and long-run, with the exception of RGDP, which is statistically insignificant.

Table 6: Vector error correction model only for equation DJIA

Vector Error Correction Estimates: Sample (adjusted): January/2017 to June/2023: Included observations: 72 after adjustments. Dependent Variable: Dow Jones Industrial Average (DJIA)

Variables	Coefficient	Std. Error	t-Statistic	Prob.
CointEq1	-0.225160	0.02410	-2.22402	0.0442
D(DJIA(-1))	0.283809	0.30017	0.94550	0.0089
D(DJIA(-2))	0.111026	0.27582	0.40253	0.0115
D(MS(-1))	1.902134	6.94934	0.27371	0.0514
D(MS(-2))	0.987617	0.65829	1.50027	0.0158
D(INF(-1))	-1. 323171	1. 81112	-0.73058	0.0015
D(INF(-2))	-2. 715238	1. 83344	-1.48095	0.0145
D(IR(-1))	-2. 856275	1. 75023	-1.63194	0.0154
D(IR(-2))	-1. 804452	1. 56963	-1.14961	0.0547
D(UEM(-1))	-0.8604548	0. 44209	-1.94633	0.0714
D(UEM(-2))	-0.4824472	2. 43324	-0.33658	0.0485
D(RGDP(-1))	0. 631049	0. 756334	0.83435	0.1267
D(RGDP(-2))	0.8865610	0. 710791	1.24729	0.2412
C	0. 4810078	0. 275691	1.74474	0.1247

R-squared =	0.845570	Serial Correlation LM Tests:	0.10
Adj. R-squared =	0.718063	Heteroscedasticity =	0.43
F-Statistics=	13.589073 (0.00126)	Normality (J.B)=	0.16548 (0.9618)
		Durbin-Watson=	1.9

Source: Author's calculation based on E-view software.

4) Conclusion,

The study has analyzed the reaction of the DJIA index to US monetary policy and some US macroeconomics in the period January/2017 to June/2023. It is expected that there is a relationship between DJIA represents for Dow Jones Industrial Average and selected macroeconomic variables namely, money supply, interest rate, inflation rate, unemployment rate and real gross demotic product (RGDP), using the Johansen co-integration test. The empirical results of the Johansen cointegration test have indicated that there is at least one cointegrating vector among the DJIA index and selected macroeconomic variables. Moreover, the VECM framework. The model was tested using Federal Reserve data and it was found that the DJIA index is influenced by most macroeconomic variables. The time period of the study is from January. 2017 to June/2023. Vector Error Correction Model (VECM) was used to estimate the short-run dynamics and long-term equilibrium of the relationship. One cointegration vector and speed of adjustment coefficients were estimated as a result. The findings of the study have shown that the speed of adjustment in the VECM is significant and relatively slow. This implies that long-run movements of the variables are determined by one equilibrium relationship.

In the short-run, an increase in money supply leads to an increase in the DJIA index based on the result shown above. Each inflation rate, interest rate and unemployment rate have a negative relationship t DJIA index. It is noted that RGDP does not influence the DJIA index since its *P* value is statistically insignificant in the short-run. There has been an expansive monetary policy or strong interest rate cuts during covid 19 followed by an increasing stock process, the exit from this policy has to be slow to prevent a subsequent crash (boom and bust cycle).

In order to address the validation of the results from this study, it is vital to use other methods such as ARDL. Pesaran and Shin (1997) proposed the Autoregressive Distributive Lag (ADRL) method. They presented that the ARDL model remains valid when the underlying variables are non-stationary, provided the variables are cointegrated. The study suggests that policy makers and investors should give considerable attention to the mentioned variables to determine the most effective approach for understanding the behavior of the DJIA index, particularly during times of economic instability.

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