Macroeconomic Variables and Stock Market

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ABSTRACT

The analysis looks at the relationship between macroeconomic variables such the Index of Industrial Production, Gold prices, Wholesale Price Index, and Diesel prices and the performance of the Indian stock market (BSE Sensex).

Secondary sources are used to compile the usage of monthly data for the time period of January 2015 to December 2021 as well as other essential data. The primary goal of this essay is to investigate how certain macroeconomic fundamentals affect the performance of the BSE Sensex.

A multiple regression method is employed in this. The formal statistical investigation is started with the Durbin-Watson test; no evidence of an autocorrelation between the independent variables is found, and the data set is made available for further analysis.

The executive summary of the regression model confirms a significant combined effect of independent factors on the Sensex. The Sensex is significantly boosted by both the wholesale price index and the industrial production indicator. As a result, it is clear that there is inflation and that the Covid-19 had a significant impact on the stock market, which supports the notion that inflation exists. Additionally, it shows how the shock experienced by the stock market is reflected in the cost of diesel.

INTRODUCTION

The financial system of the economy depends on stock markets. An efficient capital market fosters economic growth by keeping the financial system stable. The most recent information is what drives rapid price changes in an effective financial market for stocks. The stock prices reflect both stock information and corporate houses' hopes for future performance. As a result, if these expectations are reflected in stock prices, it can be utilised as a key indicator of economic growth. The intricate relationship between stock markets and macroeconomic issues is of academic interest and has regulatory ramifications.

Following the waves of structural reforms in the Indian economy after 1991, there have been a number of significant changes in the Indian stock market. As a result, the size and scope of the Indian stock market have dramatically increased. A significant influx of foreign institutional inflows has further intensified the phase of domestic stock market growth.

But unlike the major stock markets in industrialised economies, the financial markets. Developing economies like India are characterised by the most turbulent financial markets. Additionally, it is anticipated that developing nations like India will be sensitive to the financial markets. factors such adjustments to the speed

of economic activity, political and political adjustments to the global economic environment, as well as adjustments to other macroeconomic variables. In this perspective, the analytical question of how much the Indian stock market reacts to changes in macroeconomic conditions needs to be addressed.

Due to the lingering uncertainty, markets have been fearful ever since the COVID 19 strike. Global markets have plummeted to levels not seen since the 2008 Global Financial Crisis as a result. There was a close correlation between the 38% declines in the BSE Sensex and Nifty 50 and the patterns and indicators of the global market. Since the start of the year, the total market cap has decreased by an astounding 27.31%. The stock market has reflected the feelings that both domestic and foreign investors had as a result of this pandemic. There has been very little growth over the past few months as a result of businesses making cuts, increasing their use of layoffs, and altering employee compensation.

In response to the current unrest, the RBI and the Government of India have proposed a number of reforms, including a decrease in the repo rate, regulatory easing through the extension of a moratorium, and a number of measures to increase liquidity in the system, regardless of how the pandemic has affected the foundation of the corporate sector. Payment postponements, slow loan growth, an increase in bad loan cases, and sluggish business conditions have hurt the economy's ability to grow and stay healthy. During the lockdown, there was a slowdown in GDP growth, a tightening of the supply-demand chain, a reduction in discretionary spending, and an increase in CAPEX, which had a negative impact on household incomes, marketing expenditures, travel expenses, and hiring freezes.

We simply need to consider the market's past to determine its future. BSE sensitive index declines are momentary, and each one offers investors the chance to enter the market and achieve a better return, particularly for those with long-term investment horizons. Additionally, there are more opportunities to earn bigger returns when fluctuations are higher. While these crises are real and have an influence on the global economy, historically speaking, they have not persisted for very long since people are capable of finding solutions to these problems.

Literature Review

Over the past 20 years, a large number of academics, financial analysts, and professionals have made an effort to predict the relationship between stock market activity and macroeconomic conditions. Experimental research has been done to examine the relationship between stock price movements and macroeconomic variables. This section of the article addresses any such issues.

Here are a few earlier studies that our market research can learn from in terms of methodology.

Chen et al. (1986) examined equity returns for developing nations in relation to a set of macroeconomic variables and discovered that the group of macroeconomic variables that may be estimated Increases in industrial demand, changes in stock yields, the hazard premium, yield curve flips, and signs of unexpected events all significantly shed light on stock returns.

Muhammad and Rasheed (2002) used monthly data from 1994 to 2000 to analyse Pakistan's exchange rates and stock market linkages, as well as those of India, Bangladesh, and Sri Lanka. The results show that there is a bi-directional long-run causality between these variables, including Sri Lanka, but only for Bangladesh. For Pakistan and India, respectively, there are no connections between the stock markets and exchange rates.

The plethora of literature available on the impact of oil shocks on Macroeconomic variables in the Indian context provide the theoretical and empirical base for the present research, yet none of them have posited themselves in identification of variables through various lenses. Thereby, the present paper approaches the issue through a holistic and multi-disciplinary lens and therefore gives out an overall, in-depth analysis for the issue of concern. However, it seems valuable to survey the literature to enrich our understanding of the topic. In the paper The Macroeconomic Effects of Oil Price Shocks: Empirical Evidence for India, Surender Kumar, examines the impact of oil price shocks on macroeconomic variables such as the Index of Industrial Production (IIP), Real Effective Exchange Rate (REER), real oil prices, inflation, and short-term interest rates in the Indian economy from 1975Q1 to 2004Q3, coming in close to the present research design. Using the Vector Auto Regression (VAR) model, it was discovered that while an increase in real oil prices has a negative impact on the growth rate of industrial production, it has a positive impact on the inflation rate and the short-term interest rate

Empirical Evidence for India on the Macroeconomic Effects of Oil Price Shocks In his research, Surender Kumar looks at how changes in oil prices affect macroeconomic indicators including the Index of Industrial Production (IIP), Real Effective Exchange Rate (REER), and real oil prices.

From 1975Q1 to 2004Q3, the Indian economy's short-term interest rates and inflation came close to matching the current research design. While an increase in real oil prices has a negative influence on the growth rate of industrial production, it has a favourable impact on inflation and the short-term interest rate, according to research using the Vector Auto Regression (VAR) model. Additionally, he discovered an asymetric relationship between oil prices and the expansion of industrial output, which supports the connection seen in advanced nations.

The macroeconomic relationship between the diesel price in India and the impact it has on the price of oil. The paper describes the effects of the deregulated pricing regime for bulk purchases of diesel in January 2013 and how this policy affected the price of oil in India. The work effectively provides a theoretical and historical overview of diesel pricing in India, and through its comparative approach, it establishes itself in the extensive body of literature. It views the landmark decision as a turning moment in the Indian oil market and examines how crude oil price variations affect diesel prices there as well as how severely they affect India's macroeconomic situation before and after January 2013.

Using monthly data from March 1999 to June 2006, Robert (2008) examined the effects of the exchange rate and the price of oil on stock market returns for the four growing BRIC economies of Brazil, Russia, India, and China. The findings showed that there was no meaningful relationship between recent and historical stock performance and macroeconomic circumstances

Contrarily, there was no significant correlation between the respective exchange rate and the price of oil on the stock market index of the four countries that were the subject of the study.

Another study carried out by Sarkar (2005) looked at the connection between economic growth and development in India. Annual statistics were used to examine a variety of factors, including nominal and actual share prices, share market turnover ratio, the number of companies listed on the stock market, fixed capital development, real GDP growth, and industrial output growth. Findings, however, indicate that there is not a single

Studies by Kanakaraj et al. (2008), Ahmed (2008), Singh (2010), Ray (2012), Naik&Padhi (2012) and others have found a substantial correlation between economic variables and returns on stocks. Kanakaraj et al. (2008) have tried empirically to analyse and address that if the latest stock market rally can be clarified and concluded by proposing a close interaction between the two in terms of macroeconomic dynamics. Between 1997 and 2007, the research period covered

Using quarterly data for the period from March 1995 to March 2007, Ahmed (2008) examined the link between stock prices and macroeconomic variables using the Johansen co-integration method and Toda-Yamamoto Granger causality test. The results showed that the stock price, FDI, money supply, and industrial index had a long-term link. Running from stock market swings to movements in manufacturing development, causation was seen.

Using association, unit root stationarity tests, and causality tests from Granger, Singh (2010) attempted to analyse the causal relationship between the BSE Sensex and three key macroeconomic variables of the Indian economy in his research study. From April 1995 to March 2009, monthly statistics for all factors, including the BSE Sensex, the wholesale price index (WPI), the industrial development index (IIP), and the exchange rate (Rs/$), were used. The results showed that IIP and BSE Sensex had a bilateral causal relationship, but WPI and the stock market were thought to have a unidirectional relationship.

The empirical base for the present paper is provided by Tarak et al., (2013) who did an empirical study on the dynamic relationship between oil prices and Indian stock market by investigating the relationship between them, utilizing daily data from January 2001 to March 2013 and running various empirical tests such as Johansen's cointegration test, Vector Error Correction model (VECM), Granger Causality Test, Impulse Response Functions, and Variance Decompositions to illustrate the long run and short run relationship between them, along with stock market trends, which is a key arena in the current paper. Comparing the results obtained from performing these tests, the study revealed that there is a positive longterm relationship between oil prices and the volatility of stock market indices, despite the fact that crude oil prices have no significant casual effect on the Indian stock market in the short run.

The results of the study's multiple regression analysis indicate that while the balance of trade, interest rates, foreign exchange reserves, gross domestic product, the industrial development index, and the availability of capital have a positive influence on Indian stock prices, the prices of oil and gold have a significant negative impact on stock prices. On the other hand, it does not appear that there are any significant effects of inflation rates, foreign direct investment, currency exchange rates, or the wholesale price index on the price of stocks.

RESEARCH GAP

In the quick review of the chosen literature on the industry in the current analysis, there is no agreement on the impact of macroeconomic factors on the stock market. The review of the literature demonstrates that different investigations have produced different results. Different procedures, variables used for the research, lengths of time taken into consideration for the study, etc., could all contribute to different results in different trials. It also calls for further research to examine how fundamental macroeconomic factors relate to stock market trends.

OBJECTIVES

· To evaluate the effects of macroeconomic factors on the Indian stock market's performance.

· To review the path and the degree of association between the macroeconomic variables selected and stock returns.

-To test the relationship between Sensex and macroeconomic variables in India, the following

hypotheses are generated

H01: Average Gold Price has no significant impact on BSE Sensex

H11: Average Gold Price has a significant impact on BSE Sensex

H02: IIP has no significant impact on BSE Sensex

H12: IIP has a significant impact on BSE Sensex

H03: WPI has no significant impact on BSE Sensex

H13: WPI has a significant impact on BSE Sensex

H04 : Diesel prices has no significant impact on BSE Sensex

H14: Diesel prices has a significant impact on BSE Sensex

Research design

An analytical research design was employed in the creation of this study. Analytical research is a type of study that calls for the application of critical thinking abilities in the evaluation of data and facts pertinent to the research topic. The data and conclusions have been developed using a number of quantitative techniques, including the unit root test, correlation, and regression. This entails evaluating data and facts pertinent to the research project.

Method and Sources of Data Collection

To analyse and research the issue at hand, secondary data has been gathered.

The Reserve Bank of India's Handbook of Statistics on the Indian Economy, the Open Government Data Platform India, and the BSE India website are some of the sources from which the data was gathered.

Method/tools used for Analytics

The analysis uses monthly data containing 72 monthly measurements for the period from

January 2015- December 2020.

To investigate the impact of selected macroeconomic fundamentals on BSE Sensex, the multiple regression technique has been applied.

The regression model for predicting the BSE Sensex returns is

$$Y = a + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3$$

Where, Y= BSE Sensex a= Intercept of Y which is constant β_1, β_2, β_3=Beta coefficients ofX_1, X_2, X_3 respectively

X_1 = Average Gold Prices

X_2 = Index of Industrial Production

X_3 = Wholesale Price Index

X_4 = Average Diesel Prices

Selection Of Variables

Among the numerous macroeconomic variables, the analysis focuses on four crucial variables. The cost of gold, the IIP (Index of Industrial Production), the WPI, and Covid-19. The amount of actual economic operation of the economy, as well as its applications and observations in the current stock of scientific literature, are known to be the crucial determinants of returns on the stock exchange and are chosen based on their theoretical relevance, success metrics, and the variables.

The growth rate in the industrial sector is calculated using the Index of Industrial Production (IIP) as a the real economy. In theory, it is asserted that an increase in IIP increases benefits to industries and businesses.

Comparatively, inflation is another factor that might have an impact on the stock market. As inflation rises, there is a chance that the RBI would resume its strict monetary policies, which would improve the discount rate.

The stock market is similarly vulnerable to fluctuations in the price of gold (GP). The yield on foreign currencies rises when a country's currency depreciates against other currencies, which encourages investors to transfer money from the Indian stock market to foreign currency reserves and, in turn, causes a decline in stock prices.

Another significant factor anticipated to have a favourable impact on the price of local stocks is the exchange rate. India now has two significant stock exchanges: the Bombay Stock Exchange (BSE) and NASDAQ, the National Stock Exchange (NSE). The Indian stock market was represented in the analysis by BSE indices. The monthly average BSE Responsive Index (Sensex), which is based on the normal BSE closing index, was created for the base year of 1978–1979. In order to detect any shocks between the stock market and fuel prices, the average diesel price is used.

Period of the Study and Source of Data

The analysis uses monthly data containing 86 monthly measurements for the period from January 2015-December 2021. The Handbook of Statistics on the Indian Economy, published by the Reserve Bank of India, and the NSE provides all the required data concerning the variables under analysis for the sample period.

Analysis of Data

Unit root tests

Null Hypothesis: D(BSE_SENSEX) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.35498	0.0000
Test critical values:	1% level	-3.512290	
	5% level	-2.897223	
	10% level	-2.585861	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(BSE_SENSEX,2)
Method: Least Squares
Date: 11/25/22   Time: 17:20
Sample (adjusted): 2015M03 2021M12
Included observations: 82 after adjustments

Null Hypothesis: D(AVG_GOLD_PRICE) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-12.24509	0.0001
Test critical values:	1% level	-3.512290	
	5% level	-2.897223	
	10% level	-2.585861	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(AVG_GOLD_PRICE,2)
Method: Least Squares
Date: 11/25/22   Time: 17:21
Sample (adjusted): 2015M03 2021M12
Included observations: 82 after adjustments

Null Hypothesis: D(IIP) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.93156	0.0001
Test critical values:	1% level	-3.512290	
	5% level	-2.897223	
	10% level	-2.585861	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(IIP,2)
Method: Least Squares
Date: 11/25/22   Time: 17:22
Sample (adjusted): 2015M03 2021M12
Included observations: 82 after adjustments

Null Hypothesis: D(AVG_DIESEL_PRICE) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.426741	0.0000
Test critical values:	1% level	-3.512290	
	5% level	-2.897223	
	10% level	-2.585861	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(AVG_DIESEL_PRICE,2)
Method: Least Squares
Date: 11/25/22   Time: 17:23
Sample (adjusted): 2015M03 2021M12
Included observations: 82 after adjustments

Null Hypothesis: D(WPI) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.077575	0.0001
Test critical values:	1% level	-3.512290	
	5% level	-2.897223	
	10% level	-2.585861	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(WPI,2)
Method: Least Squares
Date: 11/25/22   Time: 17:24
Sample (adjusted): 2015M03 2021M12
Included observations: 82 after adjustments

From the above Unit root tests, we can see that the data is stationary.

Regression Analysis

Dependent Variable: BSE_SENSEX
Method: Least Squares
Date: 11/25/22   Time: 17:26
Sample: 2015M01 2021M12
Included observations: 84

| Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	106171.3	26708.24	3.975225	0.0002
AVG_DIESEL_PRICE	496.1663	227.4191	2.181727	0.0321
AVG_GOLD_PRICE	0.155957	0.178310	0.874638	0.3844
IIP	190.4738	67.15468	2.836345	0.0058
WPI	-1144.292	335.7041	-3.408634	0.0010

R-squared	0.929723	Mean dependent var	30300.96
Adjusted R-squared	0.171864	S.D. dependent var	7653.441
S.E. of regression	6964.784	Akaike info criterion	20.59280
Sum squared resid	3.83E+09	Schwarz criterion	20.73749
Log likelihood	-859.8976	Hannan-Quinn criter.	20.65096
F-statistic	5.306261	Durbin-Watson stat	0.367828
Prob(F-statistic)	0.000775		

- The R-squared (R2) value is 0.929723 or 92.973% which represents that the variance for a dependent variable that explained by independent variables is 91.6310%

- Akaike info criterion value is small which shows the data is significant.

- From the results we can see that it is indeed a good model and get a good idea of how the BSE is affected by various macroeconomic variables.

From the P values we can see that

- From the P value of the Average gold price and the average diesel price we can see that, it is not influencing the dependent variable significantly, but WPI and IIP are significant.

Bse Sensex

Avg gold price

Avg Diesel price

IIP

Wpi
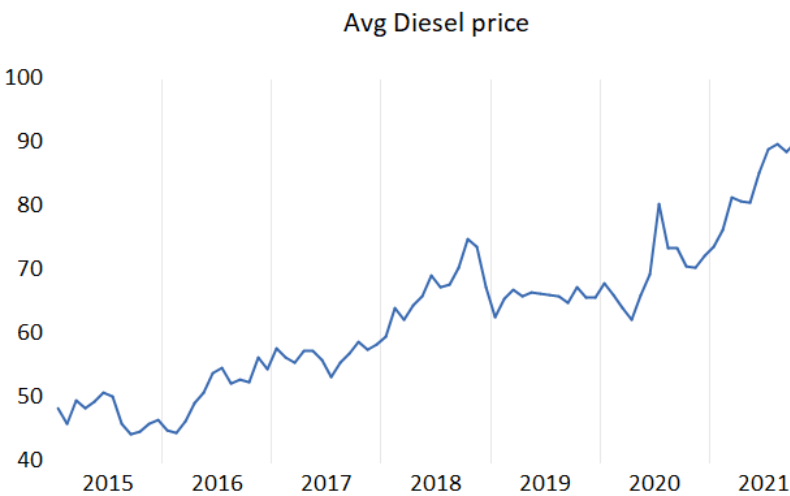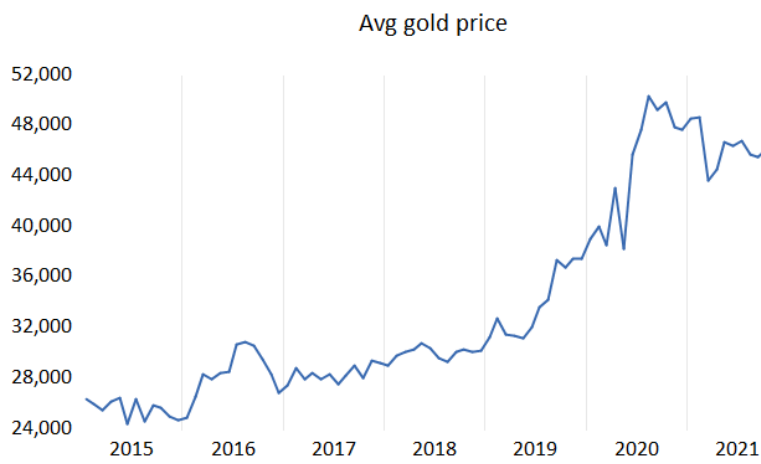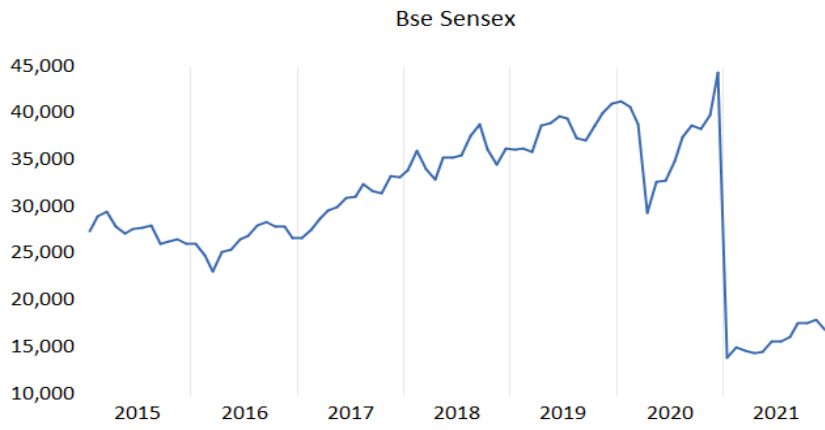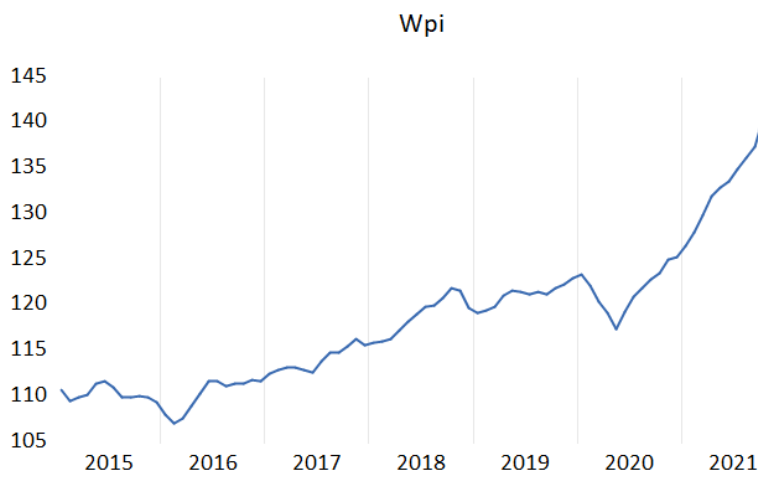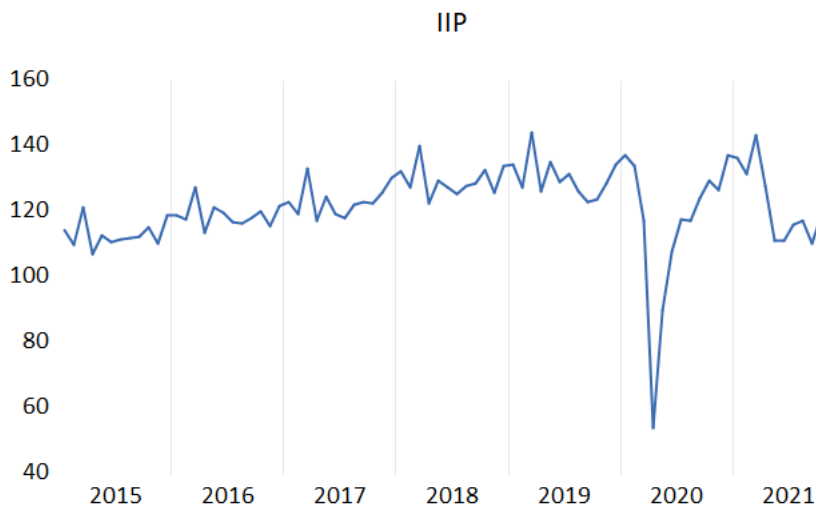
As it is clearly visible from the charts that in short run BSE is not affected by both the variables and the dip seen at the end in all three variables is because of the pandemic and which impacted all the other variables negatively too.

Heteroskedasticity Test: Breusch-Pagan-Godfrey
Null hypothesis: Homoskedasticity

F-statistic	10.14542	Prob. F(4,79)	0.0000
Obs*R-squared	28.50656	Prob. Chi-Square(4)	0.0000
Scaled explained SS	22.78724	Prob. Chi-Square(4)	0.0001

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 11/25/22   Time: 16:06
Sample: 2015M01 2021M12
Included observations: 84

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3.64E+08	1.97E+08	-1.847275	0.0685
AVG_DIESEL_PRICE	-3445387.	1678535.	-2.052616	0.0434
AVG_GOLD_PRICE	6202.845	1316.073	4.713146	0.0000
WPI	2262456.	2477765.	0.913104	0.3640
IIP	1214105.	495655.3	2.449494	0.0165

R-squared	0.339364	Mean dependent var	45620821
Adjusted R-squared	0.305914	S.D. dependent var	61702736
S.E. of regression	51405681	Akaike info criterion	38.40607
Sum squared resid	2.09E+17	Schwarz criterion	38.55077
Log likelihood	-1608.055	Hannan-Quinn criter.	38.46424
F-statistic	10.14542	Durbin-Watson stat	0.723155
Prob(F-statistic)	0.000001		

Here the heteroskedasticity test probability value for chi-square is less than 0.05 which states that there is no heteroskedasticity in the data.-square.

Conclusion

The aim of this paper is to study the impact of macroeconomic variables on Indian stock market. From the study it appears that the influence of WPI , Covid 19 on BSE Sensex is very strong in short run whereas GP and IIP do not have a significant impact in short run which is clearly visible through the graphs shown above. The reason as to why the Gold Price does not affect the BSE Index might be because of the market sentiments during a global crisis as people are not sure where to invest their money and sometimes hesitate to invest in both gold and BSE index in times of uncertainty. Also, if we think from a common investors mindset then when the BSE is going down, he would like to invest in Gold but when the BSE is shooting upwards, he would then also like to invest in gold as it acts as a safety net when the BSE will go down as it is not necessary that at the same time Gold Prices will also go down. We can also observe that there is no long run affect on the diesel prices, Stock immediately responds to the shocks in diesel prices. But this is a short-term response. The diesel prices don't have much of an impact on the output level although it has a significant impact on inflation. This study aids in our comprehension of the BSE Index's volatility, dependence on macroeconomic factors, and influence of the implementation of COVID-19 on the Indian Stock Market. Even while the IIP data is not as volatile as the Sensex, even a minor change could have a big impact on the stock market. Although there are numerous factors that affect the stock market, IIP offers a reliable indication of its course. The graphs above demonstrate that WPI has a high and considerable short-term impact on the Sensex.

"The Indian market's performance has been sub-par in comparison to other markets as some developed markets did much better than India, partly because of the larger stimulus provided by central banks. The Indian markets have started opening up and as the BSE and NSE are scaling new heights everyday. Towards the end of 2020 many new companies started to issue their IPOS. As the economy recovers stocks will continue to rise.

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