RELATIONSHIP BETWEEN STOCK VOLATILITY AND MACRO-ECONOMIC VARIABLES DURING COVID 19 AND ITS IMPACT ON INDIAN ECONOMY

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Abstract

Stock prices/indices have always played a very crucial role in any economy and in recent times it has also become an important parameter in defining the financial matrix of any country along with conventional measures such as interest rates, exchange rates, GDP growth rates etc.

The effects of the COVID-19 pandemic on economies are an ongoing study which includes through various simulations and forecasts. The financial markets have obviously been impacted and its manifestation can be seen in data trends since the first lockdown from March 2020 to June 2021. The uncertainty created by the pandemic has caused fluctuations in macroeconomic variables and has increased volatility in the developed as well as emerging stock markets. In India some of these factors are even mutually dependent and the interaction among them is worth studying. Hence, this paper is an attempt to study the relationship between macro-economic variables viz. GDP growth rate, exchange rate, etc. and volatility in stock exchange during the first lockdown period (24 May to 31 June 2020) in India. NIFTY 50 has been selected as the stock exchange under this study and the monthly data of all the variables as on 1 May to 31 June 2020 were collected from secondary sources. These data were analysed using linear regression analyses and it was found that there is a strong and significant relationship between the macro-economic variables and volatility of stocks of NIFTY 50 stock exchange even during the pandemic. The impact of stock volatility on Indian economy due to the pandemic was studied on other macro-economic variables based on data collected during the pandemic.

Keywords: Exchange rate, Macro-economic variables, GDP growth rate, NIFTY 50, Regression Analyses, COVID-19 pandemic etc.

Introduction

Proponents of economic reforms claim that India, over the last decade and a half, has been undergoing a measured, gradual, cautious, and steady process of efficient price discovery for interest rates, exchange rates and securities, in the overall functioning of the financial markets. While stock markets are subject to market forces, still for price determination the full convertibility of the rupee on current account and the partial convertibility of the rupee on capital account are used. It is a high time that the rupee should also be enabled to discover its price based more on market forces. A great degree of financial integration has also evolved over the past one decade which is expected to strengthen the interrelationship between the different variables of the financial matrix of the country. More importantly, Indian markets are increasingly getting recognized as destinations for investment by developed countries demanding greater level of integration with the global markets. Indian financial markets are not isolated from global happenings nor are they completely insulated from exogenous shocks.

The entire economy was proceeding well until the entire world was shook by the COVID 19 pandemic. The entire world is still struggling to cope up with the pandemic, which is caused. The effects of the pandemic on various macro and microeconomic variables in any economy is an ongoing study which includes various simulations and forecasts. The financial markets have obviously been impacted and its manifestation can be seen in data trends since the first lockdown from March 2020 to June 2021. India is no doubt one of the worst hit countries across the world because of its high population rate and not up to the mark healthcare system. In order to curb the spread of the disease, the central as well as the state governments-imposed series of lockdowns and other restrictions since 24 March, 2020. The paper aims to present the data of the trend of the macroeconomic aggregates during the Covid- 19 pandemic and also the possible rationale behind such trend. The share price volatility in the Indian capital market is apparently more pronounced since economic reforms kick started the liberalization process and more specifically after the rupee was freed from the administered price regime in 1993. Over the last two decades the rupee has been subjected to wide fluctuations which definitely indicates towards its dependence on market fluctuations. But after the pandemic hit the fluctuations have been ever more. In India some of these factors are even mutually dependent and the interaction among them is worth studying. No doubt, that the pandemic has created a sense ambiguity that has caused sudden oscillations in the macroeconomic environment and as a result the volatility has also increased. Hence, this research is an effort to study the association between variables such as gross domestic product growth rate, exchange rate, etc. and volatility in stock exchange, which are macroeconomic in nature, during the first lockdown period (24 May to 31 June 2020) and pre and post lockdown months in India.

Rationale behind the study

The progress and stability helped India and its stock market to become one of the preferred destinations for investment. Capital inflows from both domestic and international investors to the Indian equity market have become significant post 2000. India now attracts a chunky portion of the global portfolio that flows to the emerging markets. Mobility of capital, especially invested through portfolio investment seems to traffic between economies all over the globe, based on competitiveness of prices and returns. Hence, this research is an effort to study the association between variables such as gross domestic product growth rate, exchange rate, etc. and volatility in stock exchange, which are macroeconomic in nature, during the first lockdown period (24 May to 31 June 2020) and pre and post lockdown months in India. NIFTY 50 has been selected as the stock exchange under this study and the monthly data of all the variables as on 1 May to 31 June 2020 were collected from secondary sources. These data were analysed using linear regression analyses and it was found that there is a strong and significant relationship between the macro-economic variables and volatility of stocks of NIFTY 50 stock exchange even during the pandemic .The impact on Indian economy due to the pandemic was studied on variables other variables and the they too were negatively impacted .Now stock prices/indices have also become an important parameter in defining the financial matrix of any country, along with conventional measures such as interest rates, exchange rates, GDP growth rates etc. and can positively skew the competitiveness of any economy. Some of these factors are seen to be mutually dependent also. Hence, this paper makes an attempt to study the relationship between macro-economic variables such as GDP growth rate, exchange rate, etc. and National Stock Exchange index (NIFTY 50) volatility. The study of the fluctuation during 1st lockdown will give an idea of the stability of the markets in India and will indicate the safety in future investments.

Literature Review

According to Ajay and Mougoue (1996), there is a significant relationship between short run stock prices and exchange rate. They studied this relationship in ten major industries. They found that causal relationship exists between stock prices and exchange rate.

According to Duca, Gevit. (2007) a casual review of exchange prices and gross domestic product in developed and developing market economies discloses that both of these inclines to maneuver together over time. This raises the question on what's the rationale for such a relationship. Such relationships may be directly likewise as inversely related. Does the GDP growth can trigger the fluctuations available market or the securities market fluctuation results in GDP growth?

According to *Acikalin S. et. al*. (2008) the aim of their study was to analyse in Turkey, the relationships between returns in the Turkish securities market located in Istanbul and macroeconomic variables. The research that they performed was to test the causation between, stock exchange and the variables that were macroeconomic in nature i.e., gross domestic product, rate of exchange, the accounting balance. They had collected the data set that were quarterly collected from the Turkish stock exchange. What they found as the result of the study was unidirectional relationships between the three variables that were macroeconomic in nature and the stock exchange.

According to *Nazir, Mian Sajiid & Nawaz, Muhammad & Gillani, Usman. (2010)* the exchange and capital markets have a very important role to play in the growth and development of any economy. They researched the size of the market and the liquidity present in the market in terms of market capitalisation in a particular time i.e., between 1985-2010.They found that there was a significant relationship. It was again in accordance to the prevailing findings that confirms that changes in gross domestic product and exchange rate have a influence on stock index.

To study the impact of the pandemic of the emerging economy, Farankell (2020) researched and found that COVID-19 has significantly compacted the revenue of almost every emerging economy due to constrictive export -import, tourism, and payments of migrant workers. Raja S Ram et al. (2020) studied the Indian stock market extensively and found that the stock market experienced shrill volatility.

Osaigie et al. (2020) applied the Generalized Auto-Regressive Conditional Heteroskedasticity model and it showed that the lockdown during pandemic did reduce the stock returns in many countries and he recommended that a flexible regimen in terms of cross-country investment and financial markets can reduce the stock volatility.

Objective of the study

With the above background & keeping see-able the available literature on the topic matter, the research has been done keeping in mind the subsequent objectives:

a. To study the link between Macro-economic variables viz., GDP's rate of growth and exchange rate and volatility in National exchange index (NIFTY 50) during the lockdown.

b. To review the impact of the stock volatility on other variables like consumption, investment, taxes and Government deficit during the lockdown.

Hypothesis of the study

H0: There is no significant relationship between volatility in NIFTY-50 and Macro-economic Variables during the lockdown.

Research Design

In this research causal research design has been used to study the relationship between macro-economic variable and NIFTY 50. The causality testing is based on making hypothesis and then testing. In this research paper one hypothesis was made and then tested to know the interrelation od differences among the variables. Further to know the pre, post and lockdown period analysis of various variables in India, data was divided into quarters and then graphically analysed.

Data Collection

To conduct this research the data collection technique that was adopted was from secondary sources and accustomed to collect the information of GDP rate of growth which has been collected from the official website of Reserve bank of India. The speed of interchange has been collected from the official website of RBI and also the historical annual data of NIFTY 50 index were collected from National stock exchange website. The data on taxes, consumption, investment and debt were collected from Ministry of Statistics and Programme Implementation (MoSPI) and census and economic information centre, India.

The fundamental measure considered during this study in for twelve months from January to December 2020.The data collected were taken directly of were monthly averaged depending upon the need of study.

Data Analysis

In order to study the relationship between macro-economic variable and NIFTY 50, in this research, GDP growth rate and Foreign Exchange rates USD/INR are considered as macro-economic variables.

The data was analysed using the regression analysis and the data on Indian economy was analysed using the graphical measure,

a. Foreign Exchange Rate:

In this research, the exchange rate between the US dollar and Indian Rupee has been calculated on month end data from January – December 2020. The collected data has been represented using a graph below:

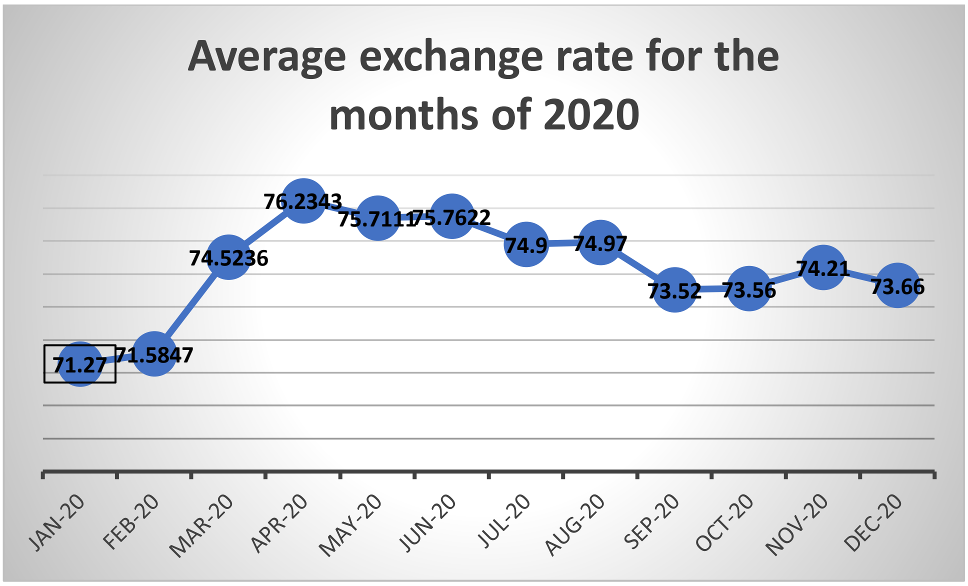

Fig. 1 (Exchange Rate between US Dollar and Indian Rupee from January – December 2020)
(Source: RBI press releases)

From the above fig. 1 it is found that the exchange rate of USD/INR has increased gradually from Rs. 71.27/$ in January to Rs. 76.23 in April 2020.This is a clear indication that the lockdown impacted the exchange rate. Although from the month of May the exchange rate was a bit improved after it had come down to Rs. 75.71/$ but still it was not able to come down pre pandemic rate of 71.58 /$. This indicated the increasing demand for the dollars from India which was due to its increasing Import and deficit Balance of Payment situation.

b. GDP growth Rate:

Gross domestic product is the value of all the products and services produced in an economy during a specific period. In India the period is of one year. Since inflation plays a key role within the GDP of an economy, it's vital to determine the results of inflation on GDP. The real GDP growth rate is taken into account. Real GDP is inflation adjusted and hence is a better measure than the nominal GDP. During this research the real GDP rate of growth (Quarter%) data from October 2019 to the December of 2020 has been collected from monthly economic report, IMF.

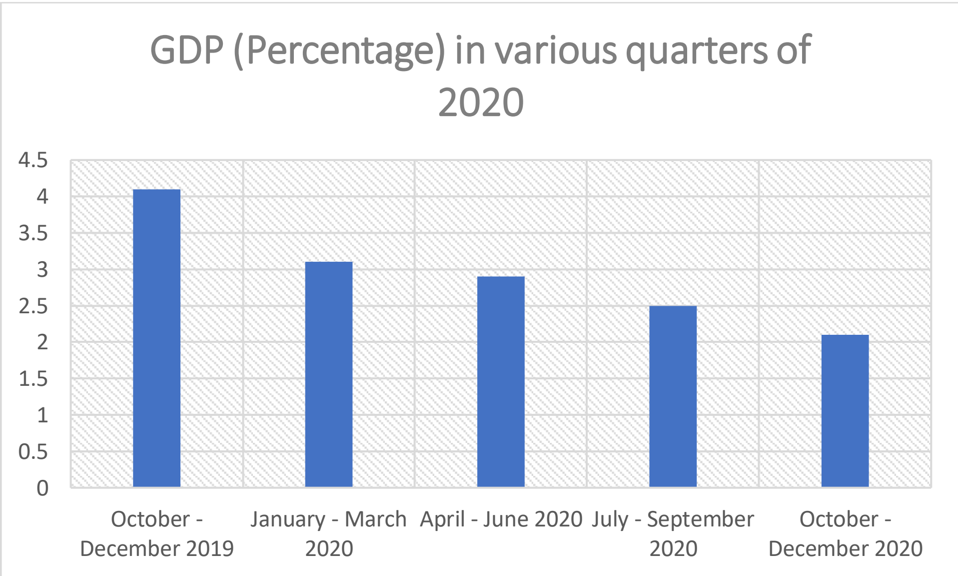

Fig. 2 (GDP growth (4 quarters %) of India January–December 2020)

(Monthly Economic report, Ministry of Finance Department of Economic Affairs Economic Division)

It is found from fig. 2 that the gross domestic product rate of growth in India was highest in the latter quarter of 2019 in comparison to any quarter of 2020.Rather the GDP kept decreasing in every quarter and it is evident that the economy was struggling severely due to due to employment instability and lack of demand. This indicates a negative economic growth of the country.

c. NIFTY-50 stock Index:

The NIFTY 50 is one the major Indian exchange index that represents the weighted average of fifty of the biggest Indian companies listed on the national securities market. It's one of the two main stock indices utilized in India, the other being the BSE SENSEX. The Nifty 50 index was launched on 22 April 1996. Here, during this research the closing values of each month from January to December 2020 has been collected and averaged for each month which is represented through following graph:

The graph shows that the volatility between the amount of January to December 2020. while from fig-2 it's clear that GDP of the country has been decreasing but still the volatility of securities market increased sharply in May then fell to its lowest in September 2020 and so began to increase again. I show a ‘U’ shaped volatility. Thus 2020 has proven to be the foremost volatile year. we are able to note that the charge per unit of the country was improving during now, that will have led to the increased volatility (Fig 1). To further examine the connection multivariate analysis was performed.

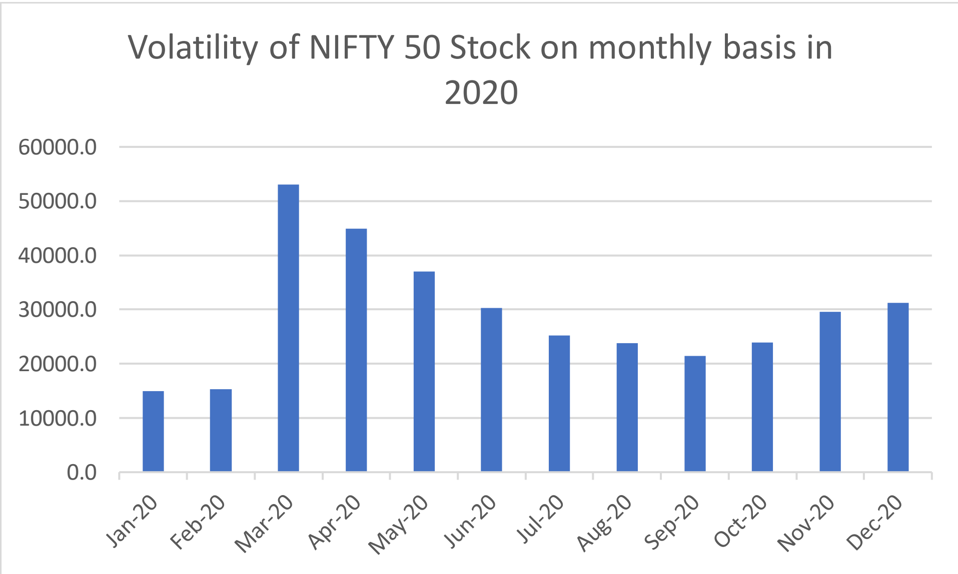

Fig 3. NIFTY 50 closing data as on 31st December every year (2010- 2019)

(Source: National stock exchange)

The graph shows that the volatility between the amount of January to December 2020. while from fig-2 it's clear that GDP of the country has been decreasing but still the volatility of securities market increased sharply in May then fell to its lowest in September 2020 and so began to increase again.

d. Relationship between Macro-economic Variables and NIFTY 50

In order to study the relationship between macro-economic variables and NIFTY 50, regression analysis has been applied taking GDP growth rate and Foreign Exchange Rate USD/INR as macro-economic variables that are independent variables and NIFTY 50 as dependent variable.

Independent Variable ------Exchange Rate and GDP

Dependent Variable ------ Stock price index (NIFTY 50)

Table 1.1 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.782[a]	.611	.500	1734.84913

a. Predictors: (Constant), GDP growth rate (Annual %), Foreign Exchange Rate USD/INR

Above Table 1.1 gives the co-efficient of correlation of 0.782 between macro-economic variable and NIFTY 50 which states there is strong relationship between the two variables. R Square value obtained from Table 1.1 indicates that the two indicators (Exchange rate and GDP growth) contribute to 61.1% impact on volatility in national stock exchange and remaining 38.9% is contributed by other factors. Hence, this model is taken into account as a robust model and also the relationship is additionally considered to be a powerful relationship.

Further ANOVA test was conducted to analyse the impact of which of the experimental variable had significant impact on the volatility of securities market.

Table 1.2 ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	33075283.374	2	16537641.687	5.495	.037[b]
	Residual	21067910.443	7	3009701.492		
	Total	54143193.817	9			

a. Dependent Variable: NIFTY 50
b. Predictors: (Constant), GDP growth rate (Annual %), Foreign Exchange Rate USD/INR

Table 1.2 i.e., ANOVA table shows the importance of the relationship between the two variables. ***F-value*** obtained from table 1.2 is **5.495** and therefore the significance value i.e., ***p-value*** obtained is **0.037** which is less than the alpha value of 0.05 ($F=5.495$, $p < 0.05$), which indicates that there is a major and significant relationship between the two variables.

Hence, the hypothesis i.e.
H0: There is no significant relationship between NIFTY-50 and Macro-economic Variables
is **rejected**.

Further the ***Beta coefficient test*** was conducted to search out the comparative strength of predictor variables on the volatility of Stock Exchange.

It was important to know which independent variable was impacting the volatility of the stock in NIFTY 50 the most. The positive value shows a positive relationship and a negative value can show inverse relationship but it is highly unlikely. Value of coefficient less than 1 shows less volatility than values that are greater than 1.

Table 1.3 Coefficients [a]

Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**T**	**Sig.**
		B	Std. Error	Beta		
1	(Constant)	-5322.623	5596.681		-.951	.373
	Foreign Exchange Rate USD/INR	226.560	70.594	.771	3.209	.015
	GDP growth rate (Annual %)	-84.920	411.432	-.050	-.206	.842

a. Dependent Variable: NIFTY 50

Above table 1.3 gives the ***beta co-efficient*** of the factors representing macro-economic variables. The beta of foreign exchange rate is found to be 226.560, with t-value of 3.209 and significance value i.e., p-value of 0.015, which is less than the alpha value of 0.05($p < 0.05$). The beta co efficient of Foreign Exchange is 0.771 and this indicates a significant relationship between Forex and volatility of NIFTY 50 stocks.

The beta of GDP growth rate is -84.920 with t-value -0.206 and significance value i.e., p-value of 0.842 which is greater than alpha value of 0.05 ($p > 0.05$), this indicates no significant relationship between the GDP growth rate and NIFTY 50. Also, the value of negative beta (-.050) indicates an inverse relationship between variables that is highly unlikely but can be further tested.

However, together both the independent variables show a significant relationship with the volatility stocks of NIFTY 50.

Bused on above data a **linear equation model** is formed which is as follows:

NIFTY 50 = -5322.623 + 226.560 (Forex) - 84.920 (GDP growth rate)

The review of impact of stock volatility on other macroeconomic variables of Indian Economy

The growth rates of consumption both public and private, investment and tax collection were graphically analysed quarter-wise to study any coherence in data due stock market volatility during the lockdown and pre and post lockdown.

1. **Private and public consumption expenditure**

   The expenditure on the final goods and services produced in an economy in a given period of time is defined as consumption. The consumption directly affects the aggregate demand of an economy and hence is very important parameter to know the health of any economy.

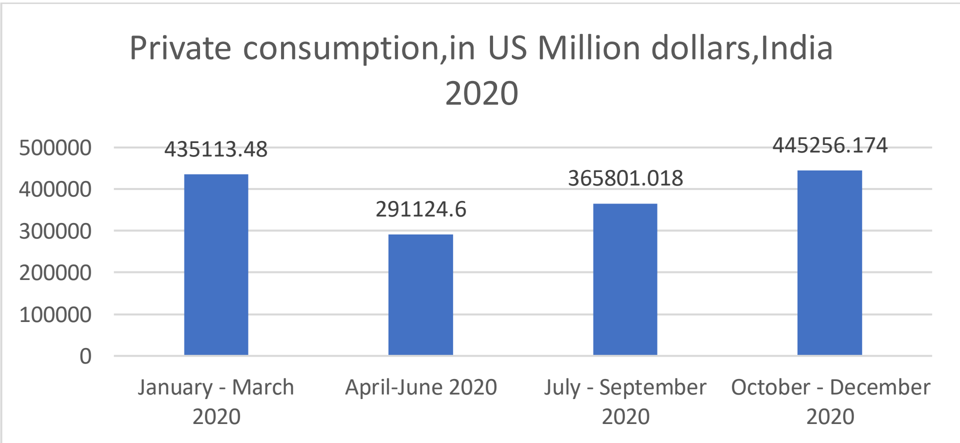

Fig 4. Private consumption expenditure (USD) million, India, Quarterly,2020

Source: CEICDATA.COM

Interpretation: From Fig 4 it is evident that the private consumption dipped in the second quarter from April to June 2020 and it was the time of complete lockdown. So, we can see clearly from the graph that the consumption and hence the aggregate demand was severely impacted. From figure 3 we can see that during the same period stock was very volatile. It can be further studied to find the correlation.

Though after the lockdown from July 2020 onwards the consumption started to increase but still even till the end of the year it could not re-bounce back to the consumption level pre pandemic.

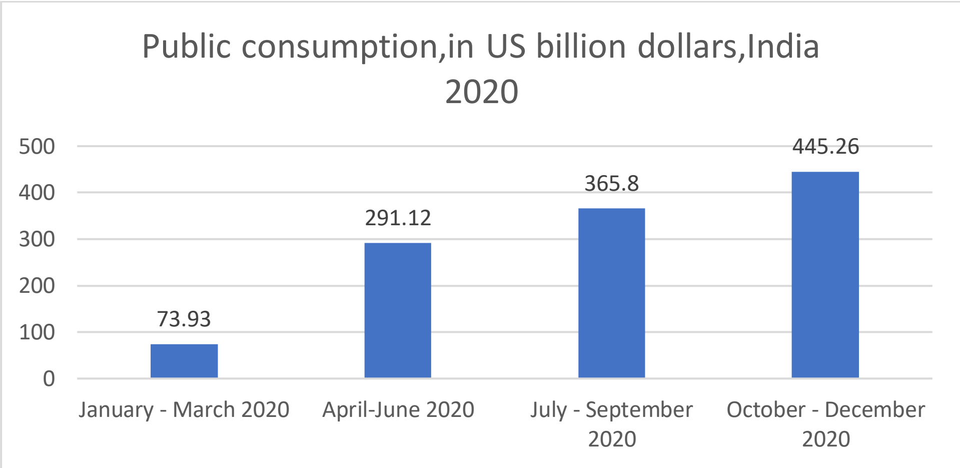

Fig 5. Public consumption expenditure (USD) billion, India, Quarterly,2020

Source: CEICDATA.COM

Interpretation: From Fig 5 it is evident that the public consumption dipped was low even before the lockdown and then it increased from April to June 2020 and it was the time of complete lockdown. This shows that the government had to infuse extra money in the economy and to the poor people to keep the demand and consumption up as the private investment was dipping. So, we can see clearly from the graph that the consumption and hence the aggregate demand was cushioned by the Government consumption expenditure.

2. Investment expenditure

Investment, which is an injection in the circular flow of economy, is defined as the value of fixed capital assets (plus stocks) produced in an economy over a period of time. Thus, investment refers to the creation of capital goods. Due to less foreign capital investment during the lockdown period has directly impacted the investment expenditure and hence indicates a clear.

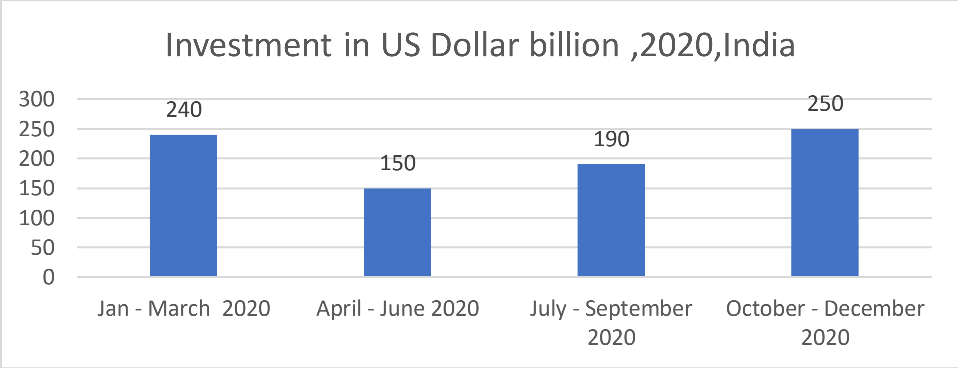

Fig-6. Investment spending in US Billion dollars in India in the quarters of 2020

Source: Ministry of Statistics and Program Implementation, India

Interpretation: Fig 6 shows that the investment spending was 240 billion USD at the end of Q1. It fell drastically to 150.17 billion USD at the end of Q2. It recovered and rose to 190.58 billion USD at the end of Q3 and further rose to 250.32 billion USD. Thus, the investment pattern was negatively affected due to the pandemic. From figure 3 we can see that during the same period stock was very volatile. It can be further studied to find the correlation.

3. Tax revenue:

Taxes whether direct and indirect are present in the economy to generate revenue for the government. As most of the revenue to the government comes through taxation, hence the study of impact of taxation on economy due to the pandemic is very important to study.

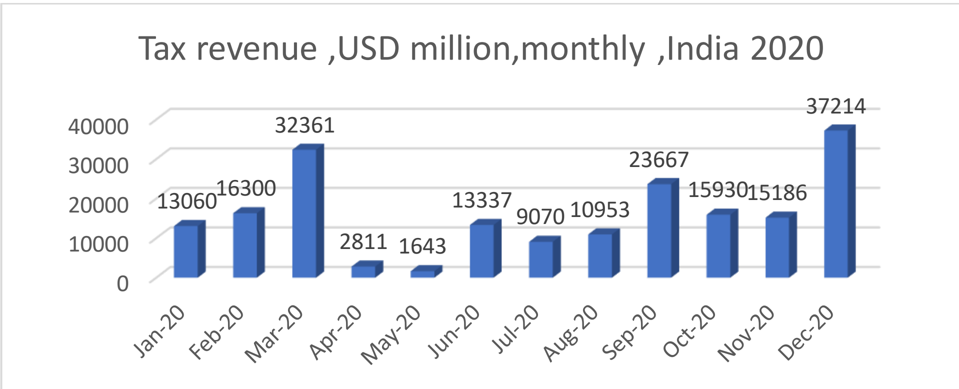

Fig 8. Tax revenue (USD) million, India, Quarterly,2020

Source: CEICDATA.COM

Interpretation: From fig 8 it can be analysed that the tax revenue drastically decreased in the month of April and May 2020 due to nationwide lockdown due to the pandemic. Though there has not been any evident research that shows that stock market volatility directly impacts the collection of taxes but during the lockdown due to job losses and slow business, less tax was collected.

4. **Fiscal Deficit & Government debt:** Fiscal deficit is defined as the gap between revenue and expenditure of the government budget. If expenditure is greater than the revenue than the government runs into fiscal deficit. To cover the expenses the Government has to borrow from the foreign countries that has increased the debt and hence widened the gap of fiscal deficit.

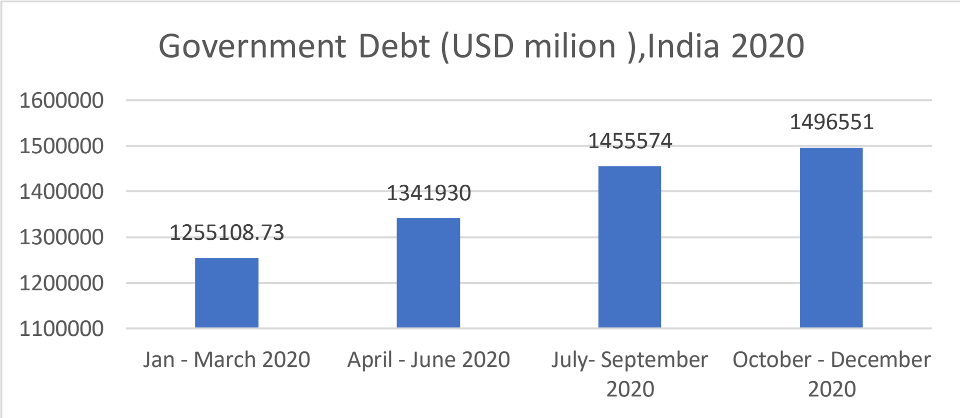

Fig 8. Government Debt (USD million), Quarterly, India 2020
Source: CIECDATA.COM

Interpretation: The government debt is the amount of loan taken by the central government from internal or external sources. The government debt was 1255.11 billion USD at the end of Q1 which rose extremely high to 1342 billion USD at the end of Q2. It kept on increasing in the quarter 3 and 4. This shows that the data on increased government expenditure and less tax collected pushed the government to take debts beyond a limit. This debt will definitely take time to settle and hence the time to heal the economy and bring it back to the trajectory of growth will take good amount of time. Though there has not been any evident research that shows that stock market volatility directly impacts the Government deficit but during the lockdown less investment and more Government spending the deficit widened.

Conclusions and Recommendations

On the basis of data collected and analysed it is evident that there is a significant impact of foreign exchange rate on volatility of National Stock Exchange index, however the impact of GDP growth rate on the volatility of National Stock Exchange index, is not significant, even when the data collected is in the desperate time of COVID 19 pandemic in 2020. The combined impact of both the macro-economic variables is found to be significant with strong co-efficient of correlation. Hence, it can be concluded that the volatility in stock market is depended on macroeconomic variables like foreign exchange rate and GDP growth rate.

The macroeconomic variables and aggregates worsened as the pandemic hit and the economy was forced to shut down. The macroeconomic theories suggest the GDP is driven by the consumption, investment and government spending that further depends of taxes. The research and data collected clearly show that the consumption decreased sharply during the lockdown period and if the waves of the pandemic keeps on hitting the economy then the consumption rate will keep fluctuating which is a bad news for business firms. This will clearly impact the circular flow of income as less consumption is a kind of withdrawal. The impact of the pandemic was felt in almost all the sectors and macroeconomic variables of India. The private consumption expenditure decreased drastically leading to lack of demand and thus the economy hanging on the roof of recession. To combat this situation Government had to increase its consumption that further increased the debt. The bis loss in tax revenue both direct and indirect was a shock that further widened the fiscal deficit gap of the country.

Although most of the variables like consumption, taxes and investment improved after the lockdown was lifted but still the rate is lower than pre-pandemic era. This might be due to speculative motive of the household and business that take time to make decisions, as per ‘Rational Expectation Theory’.

Thus, the research clearly indicates that the businesses and the trade cycle will take time to bounce back on the track. As the fact that the pandemic is still not over, this research paper can help track the impact on the economy that can again repeat itself in the future if the next wave of COVID 19 hits the economy.

The further scope can be to study the impact of the macroeconomic variables in the year 2021 and see if the economy has recovered as it should have been. This can give the idea of what lies for the economy in the decade ahead.

As far as the question of stabilising the economy is concerned, unchanging political environment, encouragement to native companies, broadening of economy, and flexible exchange rate regime be implemented to improve the financial market.

References

Abugri B.A. Empirical relationship between macroeconomic volatility and stock returns: Evidence from Latin American markets // International Review of Financial Analysis, 2006. doi:10.1016/j.irfa.2006.09.002.

Bilson C.M., T.J. Brailsford, V.J. Hooper. Selecting macroeconomics variables as explanatory factors of emerging stock market returns // Pacific-Basin Finance Journal, 2001. – ʋ9. – pp. 401-426.

Brahmasrene T., K. Jiranyakul. Cointegration and causality between stock index and macroeconomic variables in an emerging market // Academy of Accounting and Financial Studies Journal, 2007. – ʋ11. – pp. 17-30.

Cheung Y., L.K. Ng. International evidence on the stock market and aggregate economic activity // Journal of Empirical Finance, 1998. – ʋ5. – pp. 281-296.

Duca, Gevit. (2007). The Relationship between the stock market and the economy: experience from international financial markets. Bank Valletta Rev.. 36.

Hashemzadeh N., P. Taylor. Stock prices, money supply and interest rates: The question of causality // Applied Economics, 1998. – ʋ20. – pp. 1603-1611.

Ramsey and Ramsey 1995,Negative link between volatility and growth
Nazir, Mian Sajid & Nawaz, Muhammad & Gilani, Usman. (2010). Relationship between economic growth and stock market development. African Journal of Business Management. 4. 3473-3479.

Sezgin Acikalin, Rafet Aktaş and Seyfettin Unal (2008). Relationships Between Stock Markets and Macroeconomic Variables: An Empirical Analysis of the Istanbul Stock Exchange. Investment Management and Financial Innovations,5(1)
Reports and Publications, mospi.nic.in [9]. https://www.oecd-ilibrary.org/

https://www.thebalance.com/current-accountdefinition-and-4-components-3306265

https://www.economicsonline.co.uk/Definitions/Investment.html#:~:text=Investment%20is %20the%20value%20of,the%20circular%20f low%20of%20income.

https://www.ceicdata.com/en/indicators

https://www1.nseindia.com/products/content/equities/indices/historical_index_data.htm)