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Research Article

MACROECONOMIC DETERMINANTS OF CNX NIFTY 500: AN ARDL APPROACH

Jay A. Sathavara *
Research Scholar, Shri D.N. Institute of P.G. Studies in Commerce, Anand, Gujarat.
Dr. Jayesh G. Poojara*
Principal, Government Arts College, Ranipura, Jhagadia, Gujarat.

*Corresponding authors | Received: 02/01/2022 | Accepted: 20/02/2022 | Published: 28/02/2022

Abstract: *Does the 500-CNX index have any relationship to macroeconomic variables? When used in combination with economic indicators, NIFTY has already proven to be a useful, but it is still useful to examine if economic indicators forecast NIFTY index. This paper has tried to examine and identify the macroeconomic factors that contribute to the movement of the Nifty 500 Index for the period starting from 1998 to 2021. The study was tried to analyze the significant relationship between NSE 500 index and macro-economic variables of India, like gross domestic product, manufacturing output, foreign direct investment, export, inflation, agriculture growth, WPI and exchange rate. The analysis has been started by the descriptive analysis of variables. In order to determine if the NSE 500 index follows the macro-economic factors, a unit root test has been carried out. The relationship between the variables was estimated using the ADF, ADF-GLS test, ARDL bound test, and Error correction model. The data are stationary at first difference in ADF and ADF-GLS test except inflation. GDP, manufacturing output, FDI, export, inflation, WPI and exchange rate are the main determinants of NSE 500 index. GDP, Exchange rate, inflation and export have a positive significant long-run relationship with NSE 500 index whereas manufacturing output and WPI have a negative impact. The result of this research would be of importance to investors who invest in the stock market as well as others who do future studies on stock market indices.*
Keywords: NSE500, GDP, FDI, inflation, exchange rate, ARDL, ADF, macroeconomic

Introduction

The stock market not only allows businesses to obtain valuable money from markets but also allows them to exchange stock publicly. Stock market indices are crucial to every country's economic development. Because of its importance, it has been studied by businessmen, economists, and academic scholars from various perspectives. The most important consideration for every economy is the growth of a country's manufacturing and services industry. The CNX Nifty 500 index represents the development of India's small, medium-sized and large-sized 500 companies. For investors, CNX Nifty 500 is a core benchmark. However, due to changes in the internal factors and fundamental economic factors of the companies, the index of CNX Nifty 500 has extremely fluctuated. As CNX Nifty 500 index depended on the financial performance of 500 companies that are in Nifty 500 and the financial performance of these companies is affected by numerous factors of the company as well as macroeconomic factors of the economy. Sometimes the markets and our

economy often differ significantly from each other but most of the time they are moving in the same direction. If the economy falls, the market falls with it and if the economy rises, the market rises with it. The stock market has always had an effect on the economy, but macroeconomic variables have both a positive and negative impact on the stock market (Beltratti & Morana, 2006). Inflation affects the stock market negatively, moving the opposite way to the return of the stock market (Kyereboah & Tettey, 2008). Macroeconomic factors both positively and negatively predict stock market returns where certain variables move in the same direction as each other and others move in the opposite direction (Bekhet & Mugableh, 2012). Inflation, money supply, and exchange rate were the main economic factors that influenced the stock market's return (Rjoub et al., 2009). The most dominant macroeconomic variable GDP is positively associated with stock market return meaning that GDP volatility and stock market volatility are moving in the same direction (Diebold & Yilmaz, 2008). Stock market return influenced by treasury bills rate, CPI and money supply whereas treasury bills rate strongly impacted to stock market return and impact of macroeconomic variables did not persevere for a long time (Gunasekarage et al., 2004). Figure 1 shows the CNX Nifty 500 index's return from 1998 to 2019, with positive returns. As a result of the worldwide financial crisis of 2008, the NIFTY-500 index is destroyed. Some of the global stock market return is impacted by the macroeconomic variables. Stock market return of stock exchange in Thailand, Philippians and Singapore have a negative long-run relationship with interest rates (Wongbangpo & Sharma, 2002).

Figure 1: CNX Nifty 500 Index

(Source: www.investing.com)

There are too much research has been done with macroeconomic variables and stock market return focusing on well-developed countries but in India lack of sufficient research has been done with CNX Nifty 500 and macroeconomic variables so its a good time to research that to predict the future direction and to find out the relationship of CNX Nifty 500 index and macroeconomic variables of India. The finding and results of this study will help investors, policymakers and governments.

Review of Literature

Many researchers (Adam & Tweneboah, 2008; Gan et al., 2006; Garcia & Liu, 1999; Gay, 2008; Maysami et al., 2005; Rahman et al., 2009) investigated stock market return as well as their pattern and indication to find out determinants of the stock market return. The common determinants influencing stock market returns were GDP, inflation, money supply and interest rates. (Brahmasrene & Jiranyakul, 2007) investigated stock index and macroeconomic variable in Thailand during pre and post-financial crisis period and founded that money supply has positive and oil price has a negative impact on stock indexes. One of the studies is conducted by (Humpe & Macmillan, 2009) in USA and Japan and found that stock prices were positively affected by industrial output and negatively affected by money supply. (Ozcan, 2012) analyzed macroeconomic determinants of ISE index of Istanbul and found that interest rate and CPA have a long-run relationship with index as per Johansen's cointegration test. (Osamwonyi & Evbayiro-Osagie, 2012) found that the stock market index is affected by macroeconomic variables and suggested that adopting a suitable policy will help to the stock market return. (R. P. Singh, 2013) founded that key macroeconomic variable has not only factors to determine S&P CNX Nifty but some other economic factors are also affecting the S&P CNX Nifty. (talla tagne josep, 2013) studied the impact of macro-economic variables on the stock market return of the Stockholm stock exchange and founded that interest rate and inflation are negatively affecting stock prices. (P. Singh, 2014) analyzed the effect of macroeconomic variables on Sensex and nifty by using Granger causality test and founded that gold price has an inverse relationship with Sensex and Nifty index whereas FDI and money supply has a positive impact. (Kibria et al., 2014)analyzed the impact of macroeconomic variables on KSE 100 and founded that GDP of a country's unidirectional Granger causes the index return of KSE. The study also suggested that the government should pay attention to inflation for getting a desirable return on the stock market. (Suganthi & Dharshanaa, 2014) analyzed stock market return and founded that there is a significant relationship between WPI, inflation and FII on BSE Sensex. (Megaravalli &

Sampagnaro, 2018) investigated the impact of Exchange rate, inflation and consumer price index on the stock market return of India, China and Japan by using the Granger causality test. The result of the study revealed that there is a relationship between variables is in the long term whereas there is no relationship in short term. (Misra, 2018) analyzed macroeconomic factors affecting the stock return of BSE and founded that there is a long-run relationship between all variables and BSE Sensex whereas only inflation and money supply have short-run relationship with BSE Sensex. (Kumar & Gupta, 2019)founded that BSE Sensex and gold price have significant relationship in long run period. The research conducted by (Singh Arvinder & Kaur Navjot, 2020) on macroeconomic determinants of gold price and founded that there is a long run significant relationship between gold price and macroeconomic variables except interest rate.

Objectives of the research study

1) To evaluate the impact of macroeconomic variables on NSE500.
2) To analyze the short-run and the long-run relationship between NSE500 and macroeconomic variables.

Research Methodology

This research study includes NSE500 as a dependent variable whereas variables like GDP, manufacturing production, FDI, export, inflation, WPI, exchange rate and agriculture growth as independent variables. The research period is 22 years starting from 1998 to 2021. This research study used descriptive statistics, ADF test, ADF-GLS test, ARDL bound test and ECM test to investigate the significant relationship between the variables. All essential tests for this research study have been carried out in Eviews 11 student version software.

The data of all variables except agriculture growth are converted in log transformation to make normality between the data. Table 1 provides the explanation of dependent and independent variables.

Table: 1 Explanation of Variables

Variables	Explanation	Unit
LNSE500	Log of CNX Nifty 500	In Index
LGDP	Log of Gross Domestic Product	In US Billion $
LMP	Log of Manufacturing Production	In US Billion $

LFDI	Log of Foreign Direct Investment	In US Billion $
LX	Log of Export Data	In US Billion $
LI	Log of Inflation	In Percentage
LWPI	Log of Wholesale Price Index	In Index
LXR	Log of Exchange Rate	In Indian Rupees
AG	Agriculture Growth	In Percentage

The relationship between the dependent variable NSE500 and macroeconomic variables is defined by the equation below.

$$LNSE500 = LGDP + LMP + LFDI + LX + LI + LWPI + LXR + AG + \theta \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

The ARDL F-bound cointegration test is used to determine whether or not a long-run relationship exists between the variables. When the F value is greater than the upper bound value in an F bound test, the long-run relationship between variables exists. An error correction model was used to perform the ARDL analysis. The following is an approximation of the ARDL model:

$$LNSE500_t = \alpha_0 + \Sigma_{i=1} b_1 NSE500_{t-1} + \Sigma_{i=1} b_2 LGDP_{t-1} + \Sigma_{i=1} b_3 LMP_{t-1} + \Sigma_{i=1} b_4 LFDI_{t-1} + \Sigma_{i=1} b_5 LX_{t-1} + \Sigma_{i=1} b_6 LI_{t-1} + \Sigma_{i=1} b_7 LWPI_{t-1} + \Sigma_{i=1} b_8 LXR_{t-1} + \Sigma_{i=1} b_9 AG_{t-1} + \mathcal{E}_t \ldots\ldots\ldots (2)$$

A specific lag length selection is needed to determine the optimal relationship between the variables. The ECM model's lag length parameters are chosen using Schwarz Bayesian and Akaike knowledge criteria.

Analysis and Result

Table 2 shows descriptive statistics for the dependent variable NSE500 index when all macroeconomic variables are taken into account. Skewness and kurtosis statistics were used to determine the normality of the variables. All of the variables' skewness values are close to 0, indicating that the data is normally distributed. All variables, except AG, have a platykurtic kurtosis value of less than 3, while AG has a kurtosis value of more than 3, meaning that AG data is leptokurtic. Since the probability value of all variables is greater than 0.05, the null hypothesis of the Jarquebera test is dismissed, meaning that the results are normally distributed.

Table: 2 Descriptive Statistics

Variables	Mean	Standard Dev.	Skew-ness	Kurt-osis	Jarque Bera	Prob.	Obs.
NSE500	4203.719	2973.490	0.502	2.125	1.626	0.444	22
GDP	1411.162	812.950	0.308	1.796	1.677	0.432	22
MP	219.364	118.192	0.056	1.579	1.862	0.394	22
FDI	24.142	16.947	-0.066	1.475	2.149	0.342	22
X	287.720	180.845	-0.062	1.423	2.293	0.318	22
I	6.657	3.051	0.711	2.337	2.256	0.324	22
WPI	84.932	25.986	0.026	1.454	2.194	0.334	22
XR	52.238	10.288	0.710	1.859	3.043	0.218	22
AG	3.132	3.495	-0.680	3.941	2.506	0.286	22

When operating with panel statistics, it's important to look at the unit root of all variables' data. In this study, one of the most well-known unit root tests, the Augmented Dickey Fuller test, was used to ensure that the data were stationary. Table 3 displays the results of the ADF test at rank, first difference, and second difference. The following is the ADF research hypothesis:

H0 = unit root is available (stationary)

H1 = unit root is not available (not stationary)

Table: 3 Result of ADF Test

Variables	Code	ADF Test					
		Level		First Diff.		Second Diff.	
		Inter.	Trend & Inter.	Inter.	Trend & Inter.	Inter.	Trend & Inter.
LNSE500	1	-0.8153	-3.3335	-6.5760	-6.3658	-5.0986	-5.0940
	2	-0.7916	0.0882***	0.0000*	0.0003*	0.0009*	0.0043*
LGDP	1	-0.8264	-1.1187	-3.8576	-3.8466	-5.7640	-5.7469
	2	0.7906	0.9013	0.0090*	0.0352**	0.0002*	0.0011*
LMP	1	-1.3457	-0.4497	-2.8369	-3.0828	-5.5700	-5.7314
	2	0.5883	0.9777	0.0710***	0.1367	0.0003*	0.0012*
LFDI	1	-1.3100	-1.4880	-4.2627	-4.4582	-7.5897	-7.3290

	2	0.6050	0.8010	0.0038*	0.0108**	0.0000*	0.0001*
LX	1	-2.1949	-0.2345	-2.8241	-3.4657	-5.0123	-4.9583
	2	0.2136	0.9872	0.0727***	0.0709***	0.0010*	0.0049*
LI	1	-2.3809	-1.9705	-1.4596	-1.1786	-4.7980	-4.4079
	2	0.1603	0.5773	0.5289	0.8821	0.0015*	0.0136**
LWPI	1	-1.4993	-1.2215	-2.5443	-2.8570	-5.8156	-5.6366
	2	0.5133	0.8777	0.1206	0.1954	0.0002*	0.0012*
LXR	1	-0.1497	-1.3631	-3.9217	-3.9483	-5.9803	-5.7833
	2	0.9312	0.8417	0.0079*	0.0291**	0.0001*	0.0011*
AG	1	-7.6674	-7.4976	-3.9987	-3.8490	-5.5508	-5.4968
	2	0.0000*	0.0000*	0.0075*	0.0377**	0.0004*	0.0021*

Significant at * 1%, **5% and ***10% level

The probability value of LNSE500 and AG is less than the critical value 10% and are stationary at a level whereas all the variables are stationary at first difference except LI and LWPI at 1%, 5% and 10% significant level. The result also indicates that all data are stationary at the second difference of intercept and trade and intercept so the null hypothesis is rejected. From the above ADF test, we can conclude that all the data of variables are significant at second difference whereas LI and LWPI are not significant at first difference.

Table: 4 Result of ADF-GLS Test

Variables	**Code**	**ADF-GLS Test**					
		Level		**First Diff.**		**Second Diff.**	
		Inter.	**Trend & Inter.**	**Inter.**	**Trend & Inter.**	**Inter.**	**Trend & Inter.**
LNSE500	1	-0.8982	-3.4841	-5.6394	-6.3653	-1.1437	-5.0689
	2	0.3798	0.0023*	0.0000*	0.0000*	0.2794	0.0001*
LGDP	1	-0.9088	-1.3207	-3.9543	-4.0611	-5.5136	-5.8209
	2	0.3788	0.2015	0.0009*	0.0007*	0.0000*	0.0000*
LMP	1	-1.4451	-2.3080	-2.8609	-3.2283	-5.7515	-6.1130
	2	0.1704	0.0368**	0.0100*	0.0044*	0.0000*	0.0000*
LFDI	1	-0.7507	-1.6312	-4.1328	-4.4901	-6.2835	-7.3732
	2	0.4616	0.1185	0.0006*	0.0003*	0.0000*	0.0000*
LX	1	-0.7378	-1.1173	-2.9106	-3.6253	-5.1547	-5.3058
	2	0.4701	0.2786	0.0090*	0.0018*	0.0001*	0.0001*

LI	1	-2.4621	-2.4844	-0.8896	-1.4680	-1.2681	-1.5265
	2	0.0274**	0.0262**	0.3877	0.1659	0.2255	0.1492
LWPI	1	-0.6038	-1.6935	-2.5788	-2.9500	-5.5514	-5.7586
	2	0.5535	0.1076	0.0184**	0.0082*	0.0000*	0.0000*
LXR	1	-0.0458	-1.4667	-4.0127	-4.1392	-6.1281	-6.1533
	2	0.9639	0.1580	0.0007*	0.0006*	0.0000*	0.0000*
AG	1	-7.1769	-7.6458	-10.1119	-10.4280	-5.2280	-5.7962
	2	0.0000*	0.0000*	0.0000*	0.0000*	0.0001*	0.0000*

Significant at * 1%, **5% and ***10% level

Another more powerful and modified ADF test namely the ADF-GLS test has been done to check whether data is stationary or not in the unit root test. Table 4 provides the result of the ADF-GLS test. The ADF-GLS test confirms that LNSE500, LMP, LI and AG are stationary at level whereas all data are stationary at first difference and second difference except LI at 1% and 5% significant level. LI is stationary at level but it is not stationary in first and second difference. From the above result, it can be seen that the all variable has probability value less than 5% except LI so null hypothesis is rejected for the same. We conclude that all the data are stationary in first difference in ADF-GLS test except LI.

Table 5: Result of ARDL Bound test (Cointegration)

F- Bounds Test				
Test Stat.	**Value**	**Sign.**	**I(0)**	**I(1)**
			n=1000	
F-stat.	17.20742	10%	1.95	3.06
k	8	5%	2.22	3.39
		2.50%	2.48	3.7
		1%	2.79	4.1
Actual Sample Size	21		n=35	
		10%	-1	-1
		5%	-1	-1
		1%	-1	-1
			n=30	
		10%	-1	-1

		5%	-1	-1
		1%	-1	-1
t-Bounds Test				
Test Stat.	**Value**	**Sign.**	**I(0)**	**I(1)**
t-stat.	-1.28067	10%	-2.57	-4.4
		5%	-2.86	-4.72
		2.50%	-3.13	-5.02
		1%	-3.43	-5.37

Table 5 provides the result of ARDL bound test. ARDL test has been completed in two phases wherein first phases lag length has been estimated and in phase two wald bound test has been estimated. The hypothesis and equation for bound test cointegration are stated as:

H0 = There is no cointegration in equation

H1= There is cointegration in equation

*EC = LNSE500 - (31.0990*LGDP -30.7648*LMP + 0.5486*LFDI + 5.0704*LX-0.1442*LI + 0.0269*AG -14.1481*LWPI -1.6562*LXR)*

From the above result, it can be seen clearly that the F-statistics value is higher than the critical value of upper bound *I*(1) of 10%(3.06), 5%(3.39), 2.50%(3.7) and 1%(4.1) so null hypothesis is rejected. It can be concluded that there is co-integration in the equation and there is a long-run relationship between the dependent and independent variables.

Table 6: Result of Long Run Co-efficient using ARDL Bound Test

ARDL: (1, 0, 1, 1, 1, 1, 0, 0, 1)		**Dep. Var.**		**LNSE500**
Variables	**Co-efficient**	**Standard Error**	**t-Stat.**	**Prob.**
LGDP	8.5101	1.6179	5.2599	0.0019*
LMP	-7.0909	1.3736	-5.1623	0.0021*
LFDI	0.3825	0.1591	2.4038	0.0530***
LX	1.1147	0.3186	3.4984	0.0129**
LI	0.2163	0.0713	3.0324	0.0230**
AG	0.0073	0.0057	1.2970	0.2423
LWPI	-3.8716	1.4416	-2.6855	0.0363**
LXR	5.1721	1.0014	5.1646	0.0021***
C	-3.5127	2.4650	-1.4250	0.2040

Significant at * 1%, **5% and ***10% level

Table 6 provides the result of the long run co-efficient using the ARDL bound test. The result showed that LGDP, LMP, LFDI, LX, LI, LWPI, and LXR are the main determinants of NSE 500 index. LGDP is significant at 1% level and has a positive impact on NSE500 index whereas LMP is also significant at 1% level but has a negative impact on NSE500 index. LX and LI have a positive impact and LWPI has a negative impact on NSE500 at 5% significant level. LFDI and LXR have a positive relationship with NSE500 and significant at 10% level. Only AG variable found insignificant and does not have any impact on NSE500 index.

Table 7: Result of ECM model for Selected ARDL Model

ARDL: (1, 0, 1, 1, 1, 1, 0, 0, 1)			**Dep. Var.**	**LNSE500**
Variables	**Co-efficient**	**Standard Error**	**t-Stat.**	**Prob.**
C	-0.0432	0.1949	-0.2216	0.8296
LGDP	-1.6470	2.0915	-0.7875	0.4512
LMP	2.5714	1.7452	1.4734	0.1747
LFDI	-0.2373	0.1855	-1.2788	0.2329
LX	3.7366	0.8983	4.1596	0.0024
LI	0.1982	0.1589	1.2475	0.2437
AG	-0.0035	0.0074	-0.4743	0.6466
LWPI	-10.7242	3.0614	-3.5030	0.0067
LXR	6.4186	2.4239	2.6480	0.0266
ECM	-1.6817	0.2682	-6.2710	**0.0001**
R^2	0.8899	**Mean dep. Var.**		0.1052
Adj. R^2	0.7676	**S.D. dep. Var.**		0.3530
S.E. of reg.	0.1702	**F-stat.**		7.2738
		Prob.		0.0032
Breusch Godfrey Serial Correlation LM Test				
F-stat.	1.664597	**Prob. F(1,8)**		0.233
Obs R^2	3.444731	**Prob. Chi-Square(1)**		0.0635

Table 7 provides the result of error correction model for the selected ARDL model. The result showed that ECM is significant at 1% level and has a negative impact on NSE500 index. The value of the coefficient for ECM is -1.68, so we can conclude that around 16% of the deviation in NSE500 index from the long run steadiness in next year NSE500 index. Breusch-Godfrey serial correlation LM test shows the stability of the model. The result

showed that null hypothesis is not rejected of no serial correlation. The equation of ECM model is stated below:

$$\boldsymbol{ECM}=LNSE500-(8.51*LGDP - 7.09*LMP + 0.38*LFDI + 1.11*LX + 0.22*LI + 0.0073*AG - 3.87*LWPI + 5.17*LXR$$

The R^2 and adjusted R^2 of ECM model is 0.88 and 0.76 respectively, so it can be conclude that 76% difference in NSE500 is jointly explained by independent variables of ECM model.

Figure 2: Result of CUSUM Test

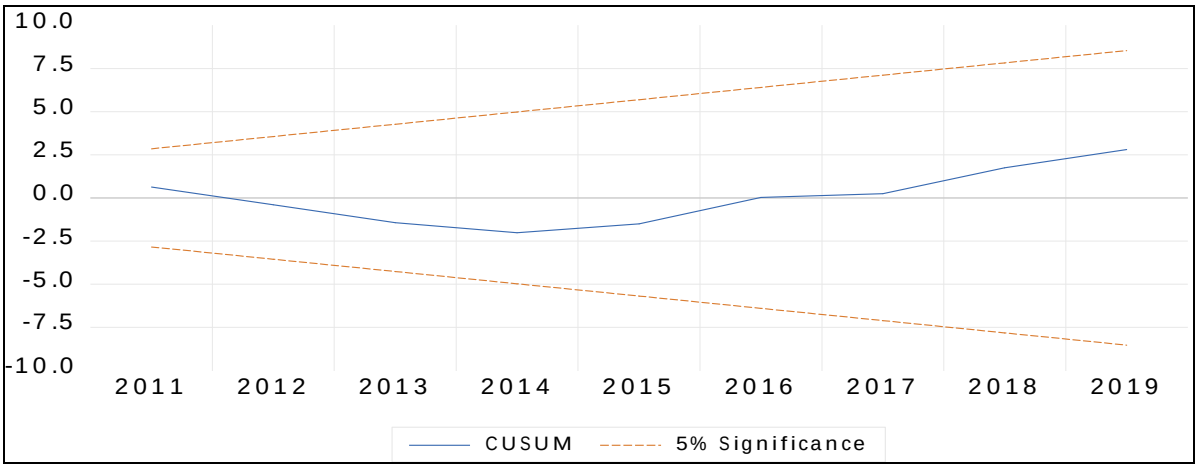

Figure 3: Result of CUSUM of Squares Test

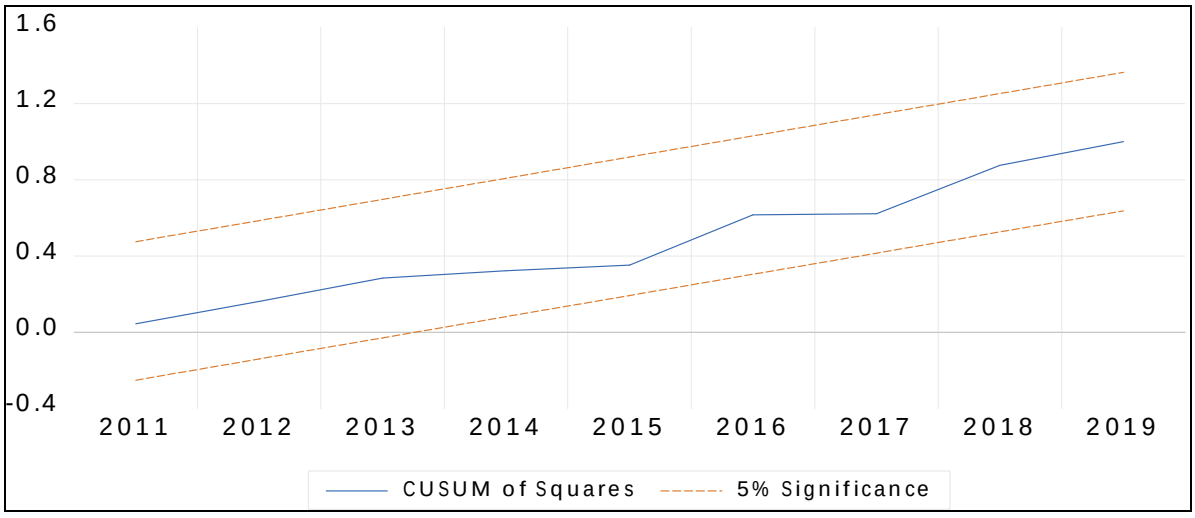

Figure 2 and 3 provides the result of CUSUM and CUSUM square test. To check the stability of the ECM model, a Cumulative sum and Cumulative sum square test has been done. The result showed that CUSUM and CUSUM square plots in figures 2 and 3 falls between upward and downward plots and not crossing plots of 5% significant level so it can be concluded that the ECM model is stable and perfectly-identified.

Conclusion

The Nifty 500 index includes India's largest fully market-capitalized manufacturing and service firms. The aim of this study is to determine the effect of macroeconomic determinants on the NSE 500 index, such as GDP, manufacturing production, FDI, export, inflation, WPI, exchange rate, and agriculture output. In the ADF test, the data are stationary at first difference except for LI and LWPI, while in the DF-GLS test, all data are stationary at first and second difference for LI. The ARDL co-integration test revealed that the dependent and independent variables had a long-term relationship. The key determinants of the NSE 500 index are GDP, manufacturing output, FDI, export, inflation, WPI, and exchange rate. GDP and the NSE500 index have a positive correlation, which means that the NSE500 index and GDP are going in the same direction, while production production and the wholesale price index have a negative correlation and have a significant effect on the NSE 500 index. Since export-driven sector companies benefited from the rise in the exchange rate and export, India's exchange rate and export have a significant positive long-run relationship with the NSE 500 index. Finally, this research study concludes that, with the exception of agriculture development, all variables have a significant long-run relationship with the NSE 500 index.

Limitations and Future Implication

Since only a few macroeconomic variables were included in this analysis, the limitation on all macroeconomic variables was applied. Only secondary data were included in this analysis, and the period was restricted to only 24 years, from 1998 to 2021. The potential analysis will contain all macroeconomic factors and be performed over a prolonged period. The study can be used to assess macroeconomic determinants in other stock market indices. Investors, economists, governments, and policymakers would benefit from the result of the research. The results of this research would also assist analysts in evaluating the fundamental factor of the CNX Nifty 500 index.

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