Link between Spot and Subsequent Closing Prices with Subsequent of Stock and Index in India

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Abstract--- This research examines whether a relationship exists in India between spot and subsequent closing prices for NIFTY 50 stock and index subsequent on NSE. To achieve this objective, Nifty 50 Index & 25 select stocks are listed on the NIFTY 50 Index traded on NSE India for a period from April 2005 to December 2015, taking into account the inclusions and exclusions of the constituents of the Nifty 50 Index during the study period. The sample used in this study includes for Nifty Index & 25 select stocks traded on NSE (www.nseindia.com) daily subsequent close prices and spot closing prices. Since most trading activity occurs in near-month contracts, only near-month contracts are analyzed using econometric tools descriptive statistics, unit root check, granger causality, and correction of vector errors. The analysis reveals that spot-to-subsequent markets have a bidirectional relationship. The study also provides evidence of a long-run balance link between the index of spot market prices and their subsequent prices. This means that either of these two historic prices would help predict the other.

Keywords--- price closing subsequent, price closing spot, causality of grangers, co-integration, correction of vector errors.

I. INTRODUCTION

Financial derivatives have been playing a central role in the global financial markets. The derivatives market size has surpassed growth in other regions. Since its inception in 2000, the advent and growth of India's derivatives market has been phenomenal. Indian markets and Indian derivative products are listed in the Global rankings within the specified span of time. Generally, market participants are commonly utilizing derivative products on volatility indexes as tools for risk management and hedging toward market volatility. (SEBI, Yearly Report). Trading in derivatives has evolved more and more on NSE since its inception. In terms of price discovery, portfolio diversification and risk management, the derivatives industry assists in various functions on the financial market.

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Trading in derivatives has therefore brought about a major change in the spot market. Spot market fluctuations were mainly due to the practices of trading, hedging and arbitration on the subsequent market. Therefore, in the short run it is important to investigate the cause and effect connection between the spot and the subsequent as well as in the long run. In addition, which market first reacts is the reaction spot or subsequent market in India's dynamic financial market.

II. LITERATURE REVIEW

Dr. Jain Mathew, Dr. K. Srinivasan, Miss. Aditi Davidson (2012) this paper analyzed the effect on the underlying spot market volatility due to the introduction of a subsequent market in India for the period 1 January 1995 to 31 December 2011. The study concluded that index subsequent have a very significant role to play in mitigating market volatility and have contributed to improved market efficiency and spill over on the subsequent market leading to spot market, making the spot market unstable.

SahuDhananjay, (2012), this paper analyzed the effects of equity derivatives trading on spot market volatility, in particular the effect of the implementation of equity derivatives on spot market volatility in the Indian stock market by using the daily returns of 73 companies from April 01, 1998 to March 31, 2008, except holidays when no transactions occurred. Applied to the study of market volatility was the GARCH (1, 1) model capturing heteroscedasticity in returns. All the companies under review, however, showed asymmetric response and accordingly the GJR GARCH model that captured the asymmetric response was applied using CNX Nifty index return as the independent variable to reduce the effect of market-wide factors on equity returns. The results indicated that the dummy variable coefficient was large and negative and therefore it suggested that the advent of equity derivatives trading decreased the volatility of the spot market.

KapilChoudhary, Sushil Bajaj, Intraday (2012), this study examined whether spot and subsequent markets play an important role in assimilating the Indian stock market's knowledge and price discovery. The research applied the co-integration of Johansen and the residual-based approach of Engle and Granger to assess the long-term equilibrium between the two markets. In addition, the Granger causality test and VECM (Vector Error Correction Model) were used to determine causality direction and the leading market. The study results showed that there is a bi-directional flow of information or feedback between the spot and subsequent markets.

Mall Manmohan (2011), this paper based from 2000 to 2011 on analyzing India's stock index subsequent market. It also empirically checked the efficiency of the Indian spot and index subsequent market, analyzed the time-varying properties of Indian spot and index subsequent market volatility using the co-integration test of GARCH, ADF, PP, VECM and Johansen for the period from June 2000 to May 2011 after collecting the closing prices of the near-month subsequent contract and the daily closing prices of S&P CNX NIFTY. The conclusions drawn were that the capital market efficiency check provides evidence of the Indian spot market's poor form inefficiency and that the subsequent market forms the spot market relatively productive. The relative success of the subsequent market was the product of index subsequent being implemented. High volatility persistence in the subsequent market has resulted in unidirectional volatility flowing from index subsequent to spot market. It also concluded that there is long-term causality from index subsequent to spot market prices.

ShiqingXie, Jiajun Huang (2013), this paper presented an empirical analysis using the Vector Error Correction Model (VECM) on the price discovery function of index subsequent in China for the study's CSI 300 index period from April 2010 to April 2012. The conclusions drawn were that there is a long-term solid co-integration relationship between the CSI 300 index and its index subsequent; where prices deviate from the long-term equilibrium, the stock index reverses slightly, while the index subsequent reversal is much stronger; the daily lead-lag relationship between the prices of the CSI 300 index and its index subsequent contracts is not significant in the short term; spot-market shocks have a lasting impact on the subsequent market, but not vice versa because of the spot-market's limited short-term adjustment capacity.

GoyalNiti (2012), this paper analyzed the volatility estimate prevailing on the Indian stock market, whether volatility is static or has changed over time, the effect on price discovery of derivatives trading, has the effect of derivatives trading on indices volatility on the stock market and that of individual shares been examined and has the introduction of derivatives been successful in reducing stock market volatility or has some other macroeconomic factors led to changes in volatility? The study concluded that there was volatility in the Indian stock market, adjustments in stock market volatility after derivatives were introduced, derivatives trading were not helpful in finding equity stock prices, trading derivatives had an effect on stock market volatility, and the introduction of derivatives was ineffective in reducing volatility.

III. RESEARCH METHODOLOGY

The research is performed for Nifty 50 Index & 25 select stocks on NIFTY 50 Index traded on NSE India for a period from April 2005 to December 2015, taking into account inclusions and exclusions from the constituents of the Nifty 50 Index during the study period, using various tools to achieve the objective. The research period is kept standardized from 1st April 2005 to 31 December 2015 in order to assist in comparative analysis. The sample used in this study includes Nifty Index & 25 select stocks traded on NSE's regular subsequent close prices and spot closing prices. Since most of the trading activity happens in contracts close to the month, only contracts close to the month are reviewed. All values are converted to natural logarithms, calculated as $R_t = LN(P_t / P_{t-1})$ where P_t and P_{t-1} are natural logarithms on day t and t-1 respectively to prevent non-stationary in order to obtain accurate results for the incorporated test.

Table 3.1: Sample Description

INDEX	Nifty 50		
	Company Name	**Industry**	**Symbol**
	ACC Ltd.	CEMENT & CEMENT PRODUCT	ACC
	Ambuja Cement Ltd.	CEMENT & CEMENT PRODUCT	AMBUJACEM
	Bank of Baroda	FINANCIAL SERVICES	BANK BARODA
	Bharat Heavy Electricals Ltd.	INDUSTRIAL MANUFACTURING	BHEL

	Bharat Petroleum Corporation Ltd.	ENERGY	BPCL
	Cipla Ltd.	PHARMA	CIPLA
	Gail (India) Ltd.	ENERGY	GAIL
	HCL Technologies Ltd.	IT	HCLTECH
	Housing Development Finance Corporation Ltd.	FINANCIAL SERVICES	HDFC
	HDFC Bank Ltd.	FINANCIAL SERVICES	HDFC BANK
	Hero MotoCorp Ltd.	AUTOMOBILE	HEROMOTOCO
	Hindalco Industries Ltd.	METALS	HINDALCO
	Hindustan Unilever Ltd.	CONSUMER GOODS	HINDUNILVR
	ICICI Bank Ltd.	FINANCIAL SERVICES	ICICIBANK
	Infosys Ltd.	IT	INFY
	ITC Ltd.	CONSUMER GOODS	ITC
	Mahindra & Mahindra Ltd.	AUTOMOBILE	M&M
	Maruti Suzuki India Ltd.	AUTOMOBILE	MARUTI
	Oil & Natural Gas Corporation Ltd.	ENERGY	ONGC
	Reliance Industries Ltd.	ENERGY	RELIANCE
	State Bank of India	FINANCIAL SERVICES	SBIN
	Tata Motors Ltd.	AUTOMOBILE	TATAMOTORS
	Tata Power Co. Ltd	ENERGY	TATAPOWER
	Tata Steel Ltd.	METALS	TATASTEEL
	Tata Consultancy Services Ltd.	IT	TCS
DATA VARIABLE	- Futures Close Prices - Spot Closing Prices		
PERIOD	April 2005 – December 2015		
TOOLS	- Descriptive Statistics - Unit Root Test - Ganger Causality - Co-integration - Vector error correction		

Objective

To investigate the cause-effect relationship in India between Stock Index Subsequent& Stock Subsequent and Spot Index & Spot Subsequent.

Hypothesis

H0- The relationship between Spot Close Price and Subsequent Close Price is not important

H1- Subsequent Close Price and Spot Close Price are not significantly related

IV. STATISTICS DESCRIPTIVE

To investigate the cause and effect relationship between subsequent close price and spot close price, we measure the NIFTY Index's daily log returns and the selected 25 stocks based on its subsequent daily close price and spot close price between 1st April 2005 and 31st December 2015. To know the pattern of distribution and also the output of stocks, we analyze the descriptive analysis of the spot close price. The descriptive spot close price statistics are summarized in the table below 1.9 in terms of mean, standard deviation, Skewness, Kurtosis and JarqueBera for the Nifty 50 Index and select 25 stocks for the period from April 1st, 2005 to December 31st, 2015.

Table 4.1: Statistics descriptive of Log Spot Close Price (LSCP)

	Mean	Standard deviation	Skewness	Kurtosis	Jarque-Bera	Probability	Observance
ACC	0.000495	0.021014	-0.35346	7.948804	2772.894	0	2669
AMBUJACEM	-0.00028	0.045406	-33.5038	1498.646	2.49E+08	0	2669
BANKBARODA	-7.70E-05	0.040686	-23.5047	938.7657	97406699	0	2669
BHEL	-0.00058	0.04264	-22.6509	835.1935	77071457	0	2669
BPCL	0.000327	0.027625	-6.12171	166.6597	2988596	0	2669
CIPLA	0.000349	0.026196	-17.0018	604.9623	40334996	0	2669
GAIL	0.000195	0.023552	-2.62723	54.5215	297598.5	0	2669
HCLTECH	0.000291	0.032185	-8.14585	185.2833	3716286	0	2669
HDFC	0.000207	0.038727	-25.3167	1036.782	1.19E+08	0	2669
HDFC BANK	0.000252	0.03718	-30.1994	1307.906	1.89E+08	0	2669
HEROMOTOCO	0.000605	0.020006	0.498345	9.347388	4580.662	0	2669
HINDALCO	-0.00104	0.053104	-29.6867	1274.177	1.80E+08	0	2669
HINDUNILVR	0.000689	0.018713	0.437624	7.204359	2046.371	0	2669
ICICI BANK	-0.00016	0.041202	-22.0019	856.0108	80951178	0	2669
INFY	-0.00027	0.031061	-13.123	296.5476	9637733	0	2669
ITC	-0.00053	0.0558	-39.7117	1840.265	3.75E+08	0	2669
MAHINDRA	0.000344	0.030417	-8.20243	190.9113	3947872	0	2669
MARUTI	0.000898	0.021448	-0.07396	5.98711	992.4896	0	2669
ONGC	-0.00047	0.036193	-24.2226	954.9631	1.01E+08	0	2669
RELIANCE	0.00023	0.026607	-8.11114	216.4365	5083923	0	2669
SBIN	-0.0004	0.050065	-35.539	1621.337	2.91E+08	0	2669
TATAMOTORS	-3.50E-05	0.042242	-22.5655	883.9484	86337445	0	2669

TATAPOWER	-0.0062	0.051322	-34.8822	1580.987	2.77E+08	0	2669
TATASTEEL	-0.00018	0.029114	-0.27824	6.386945	1307.207	0	2669
TCS	0.000217	0.028535	-11.2354	282.1195	8700533	0	2669
NIFTY 50	0.000522	0.01536	-0.04439	12.23048	9447.621	0	2669

Source: Computed Value

Table 4.1 displays the spot-close return sequence descriptive statistics for selecting 25 stocks and the NIFTY50 index. It shows positive mean returns for ACC, BPCL, CIPLA, GAIL, HDCLTECH, HDFCBANK, HEROMOTOCORP, HINDULVR, MAHINDRA, MARUTI, RELIANCE, TCS & NIFTY50 Index showing superior spot close prices while negative mean returns for MBUJJACEM, BANKBARODA, BHEL, HINDALCO, ICICIBANK, INFOSYS, ITC, ONGC, SBI, TATAMOTORS, TATAPOWER & TATASTEEL. The standard deviation for ITC stock is high with 0.0558 and lowest with 0.018713 for HINDULVR followed by NIFTY50 as 0.01536. With the exception of HERO & HINDULVR stock, the skewedness for all stocks is found to be negatively skewed. The kurtosis value exceeds 3, showing that the unconditional return distributions are not normal. JB test confirms that normality is rejected at a meaning level of nearly 1 percent at p-value.

Table 4.2: Statistics Descriptive of Log Subsequent Close Price (LNFCL)

	Mean	Standard deviation	Skewness	Kurtosis	Jarque-Bera	Probability	Observance
ACC	0.000495	0.021327	-0.37702	8.171455	3037.38	0	2669
AMBUJACEM	-0.00027	0.045586	-33.6615	1509.123	2.53E+08	0	2669
BANKBARODA	-0.00013	0.040924	-23.1398	920.5788	93870142	0	2669
BHEL	-0.00058	0.042624	-22.3122	819.2022	74306883	0	2669
BPCL	0.000332	0.027364	-5.85755	157.921	2684320	0	2669
CIPLA	0.000342	0.026352	-17.3538	622.7336	42845723	0	2669
GAIL	0.000199	0.023739	-2.62723	54.03742	292754.5	0	2669
HCLTECH	0.000302	0.032135	-7.39226	165.5796	2963780	0	2669
HDFC	0.00021	0.038564	-25.8802	1068.587	1.27E+08	0	2669
HDFC BANK	0.000255	0.037103	-30.4198	1321.784	1.94E+08	0	2669
HEROMOTOCO	0.0006	0.019482	0.43559	8.927979	3992.366	0	2669
HINDALCO	-0.00104	0.053214	-29.6213	1271.6	1.79E+08	0	2669
HINDUNILVR	0.0007	0.018351	0.373241	7.438357	2252.663	0	2669
ICICI BANK	-0.00017	0.041191	-22.1308	863.7654	82614012	0	2669
INFY	-0.00026	0.030506	-13.4926	308.3661	10450990	0	2669
ITC	-0.00053	0.056071	-40.0418	1862.726	3.85E+08	0	2669
MAHINDRA	0.000343	0.03037	-8.12283	201.7414	4426443	0	2669
MARUTI	0.000887	0.021347	-0.12623	6.341993	1249.164	0	2669
ONGC	-0.00049	0.036324	-23.5156	920.9992	93963760	0	2669

RELIANCE	0.000217	0.02658	-8.12283	216.8377	5114523	0	2669
SBIN	-0.00041	0.050314	-35.114	1596.692	2.83E+08	0	2669
TATAMOTORS	-3.56E-05	0.042239	-22.8511	898.3168	89376019	0	2669
TATAPOWER	-0.0063	0.051452	-34.5541	1562.17	2.71E+08	0	2669
TATASTEEL	-0.00017	0.029492	-0.28732	6.2517	212.589	0	2669
TCS	0.000195	0.028387	-11.5283	291.1232	9291074	0	2669
NIFTY 50	0.000505	0.016255	-0.13364	11.26912	7612.185	0	2669

Source: Computed Value

Table 4.2 provides the following relevant observations

The mean returns of the subsequent close prices of the stocks namely ACC, BPCL, CIPLA, GAIL, HECLTECH, HDFC, HDFCBANK, HEROMOTOCORP, HINDULVR, MAHINDRA, MARUTI, RELIANCE, TCS & NIFTY INDEX are optimistic, suggesting that the price series had increased and that of AMBUJACEM, BANKBARODA, BHEL, HINDALCO, ICICIBANK, INFOSYS, ITC, ONGC, SBI, TATAMOTORS, TATAPOWER & TATASTEEL are negative, implying that the price series had dropped from April 2005 to December 2015. The volatile nature of stocks is evident from the statistics on the standard deviation of the close price returns of the daily subsequent. The least volatile stock is HINDULVR with 0.018351 & 0.016255 NIFTY50 Index standard deviation. At 0.056071 suggesting the highest volatile stock in terms of subsequent close values, the highest standard deviation is observed in the ITC. Negative skewed implies that the return distribution of stock subsequent has a heavier tail of higher values and hence a higher likelihood of receiving higher returns for all stocks except for HEROMOTOCORP & HINDULVR having positive skewedness, which means there are higher chances of lower returns. The Kurtosis value exceeds 3, showing that the unconditional return distributions are not natural. JB check indicates that normality is rejected at a significance point of approximately 1 percent at p-value.

V. UNIT ROOT TEST

5.1. Important Deckey Fuller test

This study uses the standard Augmented Dickey-Fuller (ADF) test to determine whether the presumed time series is I, a prerequisite for further testing. Next, check the unit roots when interception is present in regression, then when interception and trend are present, and finally without interception and trend. If the null hypothesis about the unit root cannot be rejected, run the ADF on the initial time series differences. In this step, to infer that the original time series is I, we should reject the null hypothesis about the unit root. The data used are closing prices for the daily subsequent and closing prices for the period 1st April 2005 to 31st December 2015. All the regular values are translated to natural logarithms, measured as $R_t = LN (P_t / P_{t-1})$, where P_t and P_{t-1} are natural logarithms on day t and t-1. The variables for the analysis are found to be stationary at rates after translating the series to natural logarithms and therefore we reject the null concluding that the series has a root unit. Therefore, since the null hypothesis is rejected that the data is non-stationary or has a unit root as shown in table 4, the sequence is stationary.

H0: Has a unit root (i.e. non-stationary data)

H1: Has no unit root (i.e. stationary data)

Table 5.1.1: Test Result of ADF for Spot Close Price & Subsequent Close Price

Company	Subsequent Close Price			Spot Close Price		
	Intercept	Trend & Intercept	None	Intercept	Trend & Intercept	None
ACC	- 49.4427*	- 49.45073*	- 49.42802*	- 48.89827*	- 48.90490*	- 48.88198*
AMBUJACEM	- 53.1746	- 53.18925*	- 53.18269*	- 53.03973*	- 53.05376*	- 53.04769*
BANKBARODA	-50.92400*	-50.94875*	- 50.93301*	-50.78092*	- 50.80379*	- 50.79029*
BHEL	- 49.80415*	-49.82187*	- 49.80461*	-49.69829*	- 49.71556*	- 49.69897*
BPCL	- 51.00927*	-51.00404*	- 51.01144*	-51.10742*	- 51.10160*	- 51.11013*
CIPLA	- 50.54330*	-50.53977*	- 50.54443*	-50.33647*	- 50.33316*	- 50.33749*
GAIL	- 53.82910*	-53.82450*	53.83524*	-53.32427*	-53.32001*	-53.33054*
HCLTECH	-51.26471*	-51.25646*	-51.26982*	-50.66872*	-50.66025*	-50.67479*
HDFC	- 51.65956*	- 51.65341*	- 51.66772*	-51.64434*	- 51.63831*	- 51.65264*
HDFC BANK	-51.36043*	-51.35435*	-51.36765*	-51.19196*	-51.18559*	-51.19912*
HEROMOTOCO	-50.38299*	-50.37687*	-50.34587*	-32.88722*	-32.88477*	-32.82099*
HINDALCO	-51.39215*	-51.40389*	-51.38235*	-51.13204*	-51.14356*	-51.12202*
HINDUNILVR	-51.67432*	-51.66463*	-51.60887*	-51.70824*	-51.69850*	-51.64709*
ICICI BANK	-49.88977*	-49.91406*	-49.89833*	-49.44036*	-49.46400*	-49.44911*
INFY	-52.20194*	-52.20519*	-52.20778*	-52.20384*	-52.20689*	-52.20957*
ITC	-51.51800*	-51.53465*	-51.52308*	-51.27931*	-51.29644*	-51.28419*
MAHINDRA	-48.91175*	-48.90294*	-48.91500*	-48.71005*	-48.70123*	-48.71327*
MARUTI	-49.36379*	-49.35789*	-49.29166*	-49.05111*	-49.04524*	-48.97982*
ONGC	-51.32418*	-51.31807*	-51.32469*	-50.72645*	-50.72007*	-50.72765*
RELIANCE	-50.59414*	-50.59995*	-50.60032*	-50.09545*	-50.10025*	-50.10128*
SBIN	-51.17824*	-51.22239*	-51.18442*	-50.73245*	-50.77628*	-50.73895*
TATAMOTORS	-45.56743*	-48.55966*	-48.57650*	-48.10293*	-48.09518*	-48.11196*
TATAPOWER	-52.42049*	-52.43148*	-52.42237*	-52.29445*	-52.30516*	-52.29656*
TATASTEEL	-49.56544*	-49.56415*	-49.57308*	-48.06210*	-48.06097*	-48.06954*
TCS	-51.33602*	-51.34425*	-51.34323*	-51.29086*	-51.29920*	-51.29807*
NIFTY 50	-50.78146*	-50.78380*	-50.74270*	-48.46953*	-48.47072*	-48.42591*

Source: Computed Value. Note: * denotes rejection of null hypothesis at 5% level of significance

5.2. Granger Test Causality

A direct "Granger-causality" test proposed by C is the method for evaluating statistical causality between subsequent close prices and spot close prices. J. Granger was used in 1969. Granger causality in the usual sense may have more to do with precedent, or inference, than with causation.

H_0: Spot Close Price is not the cause of Subsequent Close Price

H_{01}: Subsequent Close Price is not the cause of Spot Close Price

Table 5.2.1: Results of Granger Causality Test

COMPANY	LAGS	LNSCL ->LNFCL	LNFCL ->LNSCL
ACC	7	1.91156(0.0638)	**2.14629(0.0361)***
AMBUJACEM	7	0.71746(0.6573)	0.51418(0.8245)
BANKBARODA	3	0.04576(0.9870)	2.27094(0.0784)
BHEL	8	0.39637(0.9231)	**2.25243 (0.0214)***
BPCL	7	**2.02020(0.0491)***	**2.89409(0.0052)***
CIPLA	8	0.61831(0.7632)	**2.04400 (0.0380)***
GAIL	8	1.34921(0.2143)	**2.02504(0.0400)***
HCLTECH	7	**3.03596(0.0035)***	0.94464(0.4705)
HDFC	7	0.96561(0.4546)	0.86443(0.5339)
HDFCBANK	6	0.50583(0.8044)	0.93952(0.4653)
HEROMOTOCO	7	1.14032(0.3346)	**2.08086(0.0424)***
HINDALCO	7	1.45562(0.1786)	1.13607(0.3372)
HINDUNILVR	8	**2.04364(0.0381)***	**2.90439(0.0032)***
ICICIBANK	7	0.63679(0.7258)	0.32267(0.9441)
INFY	7	0.92503(0.4857)	0.98560(0.4397)
ITC	5	0.66073(0.6533)	0.28123(0.9236)
MAHINDRA	8	1.43996(0.1746)	1.16155(0.3187)
MARUTI	8	**2.10917 (0.0318)***	1.73602(0.0853)
ONGC	8	0.52971(0.8349)	0.41292(0.9138)
RELIANCE	8	0.54803(0.8208)	0.46205(0.8833)
SBIN	7	1.37511(0.2113)	0.74493(0.6338)
TATAMOTORS	7	0.48140(0.8487)	1.01644(0.4173)
TATAPOWER	7	0.33248(0.9394)	0.71093(0.6628)
TATASTEEL	8	1.73528(0.0855)	1.21700(0.2846)
TCS	8	1.38038(0.1999)	0.59523(0.7826)
NIFTY50	7	1.59808(0.1312)	1.05738(0.3886)

Source: Computed Value. Note: * denotes rejection of hypothesis at 5% level of significance

Table 5.2.1 reflects the results of the Granger Causality test in which it is shown that a bi-directional causality exists for BPCL & HINDULVR stocks from spot to subsequent close price returns. There is unidirectional causality for ACC, BHEL, CIPLA, GAIL & HEROMOTOCORP from subsequent to spot, whereas in HCLTECH & MARUTI it is observed from spot to subsequent. No causality has been found between spot and subsequent for AMBUJACEM, HDFC, HDFCBANK, HINDALCO, ICICIBANK,

INFOSYS, ITC, MAHINDRA, ONGC, RELIANCE, SBI, TATAMOTORS, TATASTEEL, TCS & NIFTY50 indicates that spot causes no subsequent, so the subsequent does not affect the spot for the study period.

5.3. Co-integration

H_0: Subsequent Close Price & Spot Close Price

H_1: It is not co-integrated: Subsequent Close Price & Spot Close Price is co-integrated.

Table 5.3.1: Results of Johansen Co-integration

STOCK	NO.OF CE(S)	EIGENVALUE	TRACE STATISTIC	PROBABILITY
ACC	NONE	0.049589	138.5750	0.0001*
	AT MOST 1	0.001510	3.997541	0.0456*
AMBUJACEM	NONE	0.056096	173.3701	0.0001*
	AT MOST 1	0.007760	20.61387	0.0000*
BANKBARODA	NONE	0.048216	134.0132	0.0001*
	AT MOST 1	0.001229	3.255016	0.0712
BHEL	NONE	0.060916	167.7986	0.0001*
	AT MOST 1	0.000566	1.497355	0.2211
BPCL	NONE	0.075849	210.4941	0.0001*
	AT MOST 1	0.000672	1.778567	0.1823
CIPLA	NONE	0.063727	176.1511	0.0001*
	AT MOST 1	0.000724	1.916928	0.1662
GAIL	NONE	0.045385	130.3821	0.0001*
	AT MOST 1	0.002824	7.483884	0.0062*
HCLTECH	NONE	0.066850	185.9320	0.0001*
	AT MOST 1	0.001079	2.857813	0.0909
HDFC	NONE	0.068227	191.8367	0.0001*
	AT MOST 1	0.001833	4.853971	0.0276*
HDFCBANK	NONE	0.046008	129.8842	0.0001*
	AT MOST 1	0.001985	5.257821	0.0218*
HEROMOTOCO	NONE	0.061570	168.8129	0.0001*
	AT MOST 1	0.000252	0.666425	0.4143
HINDALCO	NONE	0.051596	167.8520	0.0001*
	AT MOST 1	0.010407	27.68205	0.0000*
HINDULVR	NONE	0.068383	187.4304	0.0001*
	AT MOST 1	1.59E-06	0.004204	0.9470
ICICIBANK	NONE	0.047472	135.1798	0.0001*
	AT MOST 1	0.002450	6.489613	0.0108*

INFOSYS	NONE	0.047302	134.1244	0.0001*
	AT MOST 1	0.002229	5.905144	0.0151*
ITC	NONE	0.077393	231.1271	0.0001*
	AT MOST 1	0.006774	17.98619	0.0000*
M&M	NONE	0.044750	124.7318	0.0001*
	AT MOST 1	0.001356	3.591730	0.0581
MARUTI	NONE	0.066764	187.2785	0.0001*
	AT MOST 1	0.001679	4.447678	0.0349*
ONGC	NONE	0.050252	138.6104	0.0001*
	AT MOST 1	0.000826	2.187188	0.1392
RELIANCE	NONE	0.057926	161.5341	0.0001*
	AT MOST 1	0.001376	3.643175	0.0563
SBIN	NONE	0.048992	136.2750	0.0001*
	AT MOST 1	0.001269	3.359951	0.0668
TATAMOTORS	NONE	0.040291	110.8295	0.0001*
	AT MOST 1	0.000760	2.011177	0.1561
TATAPOWER	NONE	0.049731	136.4213	0.0001*
	AT MOST 1	0.000547	1.447487	0.2289
TATASTEEL	NONE	0.052245	146.2656	0.0001*
	AT MOST 1	0.001618	4.284046	0.0385*
TCS	NONE	0.065401	179.2513	0.0001*
	AT MOST 1	0.000107	0.282574	0.5950
NIFTY50	NONE	0.049519	135.6209	0.0001*
	AT MOST 1	0.000584	1.543138	0.2142

Source: Computed Value. Note: * denotes rejection of hypothesis at 5% level of significance

To examine the long-term relationship, the Johansen Co-integration test is used. Johansen Co-integration is well known to be very sensitive to choosing the length of the lag. In order to find a suitable lag structure, a VAR model is first fitted to the time series data. The number of lags required in the co-integration test is selected using the AIC, SC, LR. The co-integration test indicates that at the meaning level of 5 percent there is one co-integrating vector. This indicates the long-term co-integration of the subsequent close price and spot close price. The trace test shows the presence at 5 percent level of significance of two co-integrating equations. This result is confirmed by the Maximum Eigen Value test. Thus the study's two variables have a long-term relationship of balance between them. But there may be short-term deviations from this equilibrium, and we have to check whether or not such equilibrium converges to long-term equilibrium. VECM can therefore be used to generate the dynamics of the short run.

Table 5.3.2: Results of Vector Error Correction

	C(1) LNF CL (-1)	C(2) D LNF CL(-1)	C(3) D LN F CL(-2)	C(4) D LNSCL(-1)	C(5) D LNSCL(-2)	C(6) C
ACC	**-1.06405**	0.054286	-0.06243	**-0.68117**	**-0.25671**	2.85E-05
	-4.56783	0.302587	-0.56562	**-3.77518**	**-2.30433**	0.059816
	0*	0.7622	0.5717	**0.0002***	**0.0213***	0.9523
AMBUJACEM	1.085462	**-1.66052**	**-0.70006**	0.983805	0.3632	5.41E-05
	2.243769	**-4.4762**	**-3.19113**	2.611804	1.636261	0.05291
	0.0249*	**0***	**0.0014***	**0.0091***	0.1019	0.9578
BANKBARODA	0.088536	**-0.62739**	-0.22467	-0.0288	-0.1111	1.60E-05
	0.211452	**-1.93522**	-1.16031	-0.08817	-0.57061	0.017421
	0.8326	**0.0531***	0.246	0.9297	0.5683	0.9861
BHEL	-0.08157	-0.26729	-0.09651	-0.3637	-0.22224	6.03E-06
	-0.17709	-0.75674	-0.46371	-1.03273	-1.07244	0.006285
	0.8595	0.4493	0.6429	0.3018	0.2836	0.995
BPCL	**-0.95534**	0.019178	0.098869	**-0.6756**	**-0.41478**	3.49E-05
	-3.2871	0.086275	0.740379	**-3.04981**	**-3.12483**	0.056866
	0.001*	0.9313	0.4591	**0.0023***	**0.0018***	0.9547
CIPLA	**-0.97781**	0.114521	0.058378	**-0.75754**	**-0.39906**	3.18E-05
	-2.59069	0.39971	0.350912	**-2.63438**	**-2.39143**	0.053591
	0.0096*	0.6894	0.7257	**0.0085***	**0.0169***	0.9573
GAIL	-0.12142	**-0.75202**	**-0.36928**	0.06773	0.009082	3.23E-05
	-0.55397	**-4.47104**	**-3.57275**	0.39547	0.086548	0.060111
	0.5796	**0***	**0.0004***	0.6925	0.931	0.9521
HCLTECH	**-1.21413**	-0.08533	-0.09829	**-0.54003**	-0.21472	9.45E-06
	-3.99119	-0.36871	-0.72456	**-2.34542**	-1.58496	0.012961
	0.0001*	0.7124	0.4688	**0.0191***	0.1131	0.9897
HDFC	-0.14234	-0.67221	-0.19102	0.019917	-0.14216	3.53E-05
	-0.2539	-1.58509	-0.76597	0.046843	-0.56959	0.04043
	0.7996	0.1131	0.4438	0.9626	0.569	0.9678
HDFCBANK	0.079437	**-0.88717**	-0.39177	0.23329	0.055773	1.05E-05
	0.156036	**-2.30488**	-1.76737	0.605254	0.251452	0.012586
	0.876	**0.0213***	0.0773	0.5451	0.8015	0.99
HEROMOTOCO	**0.572622**	**-1.08862**	**-0.53412**	**0.500009**	**0.22756**	2.44E-05

	4.044371	**-9.80837**	**-7.45515**	**4.362621**	**3.15004**	0.054954
	0.0001*	**0***	**0***	**0***	**0.0017***	0.9562
HINDALCO	**-1.79636**	0.441034	0.080947	-1.10248	-0.40079	4.13E-06
	-2.35142	0.770268	0.24732	-1.92408	-1.22237	0.00345
	0.0188*	0.4412	0.8047	0.0545	0.2217	0.9972
HINDULVR	-0.20736	**-0.64863**	**-0.3319**	-0.01589	0.003136	2.60E-05
	-0.98263	**-3.99703**	**-3.39474**	-0.09854	0.03244	0.062974
	0.3259	**0.0001***	**0.0007***	0.9215	0.9741	0.9498
ICICIBANK	-0.78251	-0.25594	-0.06704	-0.3727	-0.25743	1.28E-05
	-1.79936	-0.76615	-0.33482	-1.1199	-1.28831	0.013797
	0.0721	0.4437	0.7378	0.2629	0.1977	0.989
INFOSYS	**1.856668**	**-2.37324**	**-1.17131**	**1.709242**	**0.851672**	-3.05E-06
	3.656638	**-6.10658**	**-5.11143**	**4.40844**	**3.741565**	-0.00441
	0.0003*	**0***	**0***	**0***	**0.0002***	0.9965
ITC	**-2.02594**	0.598906	0.355924	**-1.24985**	**-0.68267**	1.80E-05
	-2.83536	1.088138	1.082868	**-2.26606**	**-2.06944**	0.014222
	0.0046*	0.2766	0.279	**0.0235***	**0.0386***	0.9887
M&M	**-1.65834**	0.429311	0.081386	**-1.03886**	**-0.36912**	2.10E-05
	-4.68824	1.608924	0.541775	**-3.91799**	**-2.46924**	0.030938
	0*	0.1078	0.588	**0.0001***	**0.0136***	0.9753
MARUTI	**-0.79969**	-0.20779	-0.14531	**-0.41169**	-0.15085	3.96E-05
	-3.0809	-1.05885	-1.27565	**-2.10142**	-1.32667	0.082496
	0.0021*	0.2898	0.2022	**0.0357***	0.1847	0.9343
ONGC	-0.25008	**-0.63382**	-0.31338	-0.01734	-0.00505	1.58E-06
	-0.64674	**-2.12992**	-1.75563	-0.0582	-0.02821	0.00192
	0.5179	**0.0333***	0.0793	0.9536	0.9775	0.9985
RELIANCE	**2.544755**	**-2.6471**	**-1.1586**	**2.046858**	**0.880003**	7.01E-06
	5.162687	**-6.92898**	**-5.06112**	**5.303133**	**3.819922**	0.011613
	0*	**0***	**0***	**0***	**0.0001***	0.9907
SBIN	**-1.62161**	-0.00574	-0.09994	-0.63917	-0.22379	3.61E-05
	-2.11537	-0.0098	-0.29337	-1.09115	-0.65531	0.031846
	0.0345*	0.9922	0.7693	0.2753	0.5123	0.9746
TATAMOTORS	-0.41321	-0.36246	-0.05256	-0.23633	-0.24953	3.28E-05
	-0.9866	-1.1271	-0.27957	-0.7367	-1.33048	0.034357
	0.3239	0.2598	0.7798	0.4614	0.1835	0.9726
TATAPOWER	-0.92318	-0.05562	0.070614	-0.61497	-0.39959	2.45E-05

	-1.78633	-0.13989	0.300413	-1.54579	-1.69803	0.021054
	0.0742	0.8888	0.7639	0.1223	0.0896	0.9832
TATASTEEL	-0.50291	**-0.53312**	-0.21351	-0.10864	-0.11351	4.11E-05
	-1.47815	**-2.03046**	-1.35304	-0.41402	-0.7155	0.062706
	0.1395	**0.0424***	0.1762	0.6789	0.4744	0.95
TCS	-0.7699	-0.27832	-0.30863	-0.35159	-0.00987	-1.21E-05
	-1.72471	-0.82219	-1.57065	-1.03918	-0.05027	-0.01877
	0.0847	0.411	0.1164	0.2988	0.9599	0.985
NIFTY50	**-2.21808**	**0.921352**	**0.616827**	**-1.57277**	**-0.95665**	-2.05E-06
	-5.89006	**3.204017**	**3.747055**	**-5.39175**	**-5.65961**	-0.00563
	0*	**0.0014***	**0.0002***	**0***	**0***	0.9955

Source: Computed Value

It is noted that the results of the error correction co-integrating term C(1) indicate the long-term relationship in the short-term dynamics, and C(2) to C(6) indicates the short-term relationship between the variables. It is reflected that for the majority of stocks, there is a short-term relationship between the variables. In all these cases where the co-integrating term is negative and small, it is shown that the errors go back to the equilibrium and the error is corrected while the positive and significant co-integrating term implies that the errors are bursting.

VI. CONCLUSION

Higher liquidity, lower transaction costs, lower margins, easier leverage positions, rapid execution and greater flexibility for short positions are mainly due to the advantages offered by the subsequent market. These advantages attract larger knowledgeable traders and make the subsequent markets respond first when market-wide or stock-specific information comes in. Subsequent prices therefore lead the prices of the spot market. On the other hand, low-cost contingent strategies and high degree of leverage gains in the subsequent market draw larger speculative traders to a more regulated subsequent market segment from a spot market. It effectively decreases the spot market's knowledge asymmetries by reducing the amount of noise trading and helps in price discovery, enhancing the overall scope of the market, improving market efficiency and increasing market liquidity. When market-wide information or major stock-specific information arrives, this makes the spot market react first. In addition, there is a two-way relationship between subsequent and spot markets through the process of price discovery. This may be due primarily to subsequent markets that attract larger informed traders to enjoy the benefits of higher liquidity, lower transaction costs, lower margins, and greater flexibility for short positions. Therefore, these benefits make subsequent markets lead the spot markets around macroeconomic or major stock-specific releases of information. The spot markets will therefore lead the subsequent market under the circumstances that these subsequent markets draw greater speculative traders from the spot market and reduce spot market knowledge asymmetries by reducing the amount of noise trading and helping to discover prices, improve the overall market size, improve market efficiency and increase market liquidity. It helps the spot market react quickly when market-wide or stock-specific information comes in.

Johansen's technique of co-integration followed by the Vector Error Correction Model (VECM) was used to investigate the long-term relationship between stock subsequent and stock index subsequent. The empirical analysis was carried out from April 2005 to December 2015 for the daily data series. The analysis reveals the spot-to-subsequent demand bidirectional relationship. The research also provides evidence of a long-run equilibrium relationship between the index of spot market prices and their subsequent prices. It means that either of these two historical prices would help predict the other, which is the proof that these two markets disapprove of the theory of market efficiency.

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