RELATIONSHIP BETWEEN SPOT AND FUTURES PRICES OF INDIAN STOCKS

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ABSTRACT

This study aims to analyse the relationship between the spot and futures prices of the stocks traded at the national stock exchange of India. The daily closing prices from 2011 to 2016 of the spot and futures of the sample stocks are tested for stationarity, cointegration and, vector error correction model is used for inspecting the dynamics of the two prices. The cointegration results show an existence of long run relationship among the futures and spot prices of the sample stocks. The price discovery results vary for the sample companies. Results show that, Coal futures prices are leading spot prices, but Cipla spot prices are leading the futures prices. The results show a presence of one-way causality running from futures to spot prices.

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Introduction

Derivative market has been a perseverance instrument for investors and stakeholders for risk management and hedging against their investment. The information propagation, gathering and clarification of news, among the participants affects the prices of the markets. Derivatives instruments vary across the globe, perhaps the futures and options are the preferred instrument from the derivatives segment. The market offers efficacy of price discovery process where adjustments of the prices from an old equilibrium to the new equilibrium happen in the market and thus the spot and futures markets share a lead lag relationship (Booth, So, and Tse, 1999; Theissen, 2011). There are studies conducted to analyse the efficiency in the market in India. Butdue to the recent development and dynamic environment of today's world which offers the new swift flow of information in the markets, the market efficiency needs to be tested empirically (Gupta and Yang, 2011).

Large number of studies has been conducted for examining this lead lag relationship in developed markets focusing on equity and commodity derivatives. In emerging economies, the studies are relatively less, as the development of derivatives markets is comparatively a recent case for them.The effectiveness of the market which is essential for price discovery mechanism to work adequately is shown by the linkage between spot and futures prices. The derivatives market has started in India for more than a one and a half decade, index derivatives are almost two decade old, and various regulatory reforms have taken place over the years. For bringing the transparency in the derivatives market the price discovery mechanism should function effectively. The financial markets eventually make contribution towards the economic growth of a country (Alomari, Marashdeh, and Bashayreh, 2019).

Economic growth of the nation is contributed by various sectors of industries which is also applicable in India's context (Kniivilä, 2007). Considering the Indian scenario where the energy and medical sector are very important for making nation self-reliant, Indian energy and medical sectors are among the biggest markets in the world (Chakrabarti and Arora, 2016; Lakshminarayanan,2011; Itumalla, and Acharyulu, 2012; Ganesan and Veena, 2018).Coal is India's top energy source for fulfilling the energy requirement (Sachdev, 1997). Indian energy sector depends largely on coal and is fourth largest consumer of coal for energy usage (Tiewsoh, Sivek and Jirásek 2017). Dhungel (2014) study revealed that the electricity consumption may be driven by economic growth if mobilisation of foreign aid in the productive sectors is harnessed. The Pharmaceuticals companies in India have a significant contribution in the medical sector and are on growing trajectory and pharmaceuticals companies plays important role in medical industry ("potential of the Indian pharmaceutical industry," 2019).Consequently, theinvestors invest more in

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the company's stocks especially in developing countries which have a prospect for better return (Sarwar et al., 2019). Therefore, market efficiency tested by analyzing the stocks of companies involved in coal and pharmaceutical sectors may be productive in developing markets such as India which contributes to its economic growth. This study tries to explore the causal relationship between the spot and futures prices of stocks of the two promising Indian companies contributing to the energy and medical sector.

Review of Literature

Dhungel (2014) studied the electricity consumption and foreign aid in Nepal by using error correction model, for inspecting the long and short run equilibrium between them. He observed that a 100% change in foreign aid shall change the electricity consumption by 46% which was statistically significant, and VECM results indicated that there is both short and long run equilibrium in the system. Ezzati (2013) in his discussion paper ushered on the global financial integration co-movements of volatilities spillovers from one market to another, the study was carried out for observing the financial volatility movement among six countries. The analysis was done on the standard research methodology using GARCH-M model two stage procedures. The sample of equity markets ranged from 1997 to 2011, of foreign exchange markets ranged from 1997 to 2013 and of money markets from 2004 to 2012, data was modelled out by means of monthly financial returns and was derived through equity, money and foreign exchange markets of the countries selected. The outcomes indicated that significant volatility interdependencies existed of among Iranian financial markets in Middle East and with the rest of the world. Another interesting conclusion was that the financial markets can be integrated in terms of variances, even though they may not be integrated at levels.

Chamalwa and Bakari (2016) studied the relationship between GDP growth and, money supply and credit to private sector in Nigeria by using Johnsen cointegration test, Granger causality and VECM for the period 1981 to 2012. Bidirectional causality was found among the three variables, and money supply and credit to private sector has effect on GDP in the short run. They concluded that improved financial system risk management, corporate governance, and macroeconomic stability should be sustained, with recommendation to reduce interest rate. Mehta (2011) studied relationship between capital formation and economic growth in long and short run considering the data from Economic Survey of Ministry of Finance, Government of India for the period 1950 to 2010. Capital formation was taken in terms of Gross Domestic Capital Formation (GDCF) and economic growth in terms of Gross Domestic Product (GDP). They applied Engle-Granger and VECM, and found that lagged values of economic growth do not impact the capital formation. Srinivasan (2011) found in sample of twelve pharmaceuticals companies' stocks in India that the pharmaceutical stocks futures introduction declined the volatility of spot market. The findings of most of the pharmaceutical companies indicated unequal positive response to new information on the volatility of spot market.

Karmakar (2009) in his study of Indian Nifty index of national stock exchange found spot and futures market to be cointegrated and, nifty futures lead the spot index. Rosenberg and Traub (2009) in their study of currency markets found futures market to lead the spot markets. Srinivasan (2010) found the spot and futures markets to be cointegrated and a bidirectional causality in futures and spot market was present, and found spot market relatively leading futures market in the stocks of IT companies. Kumar et al. (2017) found causality from spot to futures market only in USDINR and EUROINR currency and bidirectional causality in GBPINR currency exchange rates. Gupta and Bhatia (2019a) found one-way causality from Nifty spot to Nifty futures and no causality in Nifty Bank and Nifty IT indices in their study. Gupta and Bhatia (2019b) found bidirectional causality from futures to spot as well as from spot to futures market in all of their sample currencies investigated.

Methodology

This study examines the long-term and short relationship between spot and futures prices of two stocks by employing standard econometrics tools. The sample companies comprise of the Cipla Limited (Cipla) from pharmaceutical sector and Coal India Limited (Coal).The sample period for study is from 1 April 2011 to 31 March 2016.However due to unavailability of the futures data of Coal India Limited from 1 April 2011 to 5 August 2016, the period is excluded from the study for Coal India. The stock's spot and futures prices are collected from the database of National Stock Exchange of India (NSE). The Variables for the study are the closing prices of the spot and futures prices of Cipla and Coal India during the sample period.

The standard econometric tools are applied for evaluating the long and short run relationship between the prices of spot and future markets. The time series data of the companies is tested with basic statistical tests. Stationary of the time series is verified by augmented dickey–fuller (ADF) test (Dickey and Fuller, 1979) and KPSS (Kwiatkowski et al., 1992).ADF has a null hypothesis of data having a unit root,

whereas KPSS has a null hypothesis of data not having a unit root. Thereafter VAR (vector auto regressive) model isused for estimating the optimum lag length. For testing the co-integration among the spot and futures prices, Johnson's cointegration test is applied. And the short run relationship was inspected by Vector Error Correction Model (VECM). The causality was detected by granger causality test.

Results

The results of descriptive statistics are shown in Table 1. The mean value of Coal futures prices is 336.1777and spot is 335.7967. The skewness and kurtosis of Coal futures prices is -0.381 and 2.617 respectively, and skewness and kurtosis of the spot prices is -0.052 and 20661 respectively. The Jarque-Bera value suggests that the series do not follow normal distribution. The mean value of Cipla futures prices is 453.1095and spot is 451.5264. The skewness and kurtosis of Cipla futures prices is 0.6571and 1.9502respectively, and skewness and kurtosis of the spot prices is 0.6581and 1.9478 respectively. The Jarque-Bera value suggests that the series do not follow normal distribution.

Table1: Descriptive Statistics

Variables	Coal India Ltd.		Cipla Ltd.	
	Futures	Spot	Futures	Spot
Mean	336.1777	335.7967	453.1095	451.5264
Maximum	444.4500	443.4000	743.2000	739.6000
Minimum	243.7500	244.0000	275.6000	274.5000
Std. Dev.	39.4193	39.1570	135.3850	135.0218
Skewness	-0.0363	-0.0521	0.6572	0.6581
Kurtosis	2.6174	2.6614	1.9502	1.9478
Jarque-Bera	7.2806	6.0126	146.0763	146.6011
Probability	0.0262	0.0495	0.0000	0.0000
Observations	1152	1152	1239	1239

Source: Computed value

The truncated unit root test results are shown in Table 2. The data is tested for stationarity by applying ADF and KPSS test at level and first difference with intercept, trend and constant, and no trend and intercept. However, the significance was same, so only results with trend and intercept are shown. The results show that the spot prices and futures prices become stationary at the first difference as no unit root is present in the spot and futures prices of Coal and Cipla.

Table 2: Unit Root Test Results of

Variables	ADF Test		KPSS Test	
At Level with Trend & Intercept	t-Statistic	significance	t-Statistic	significance
Coal futures	-2.6728	unit root	0.364	unit root
Cipla futures	-1.8715	unit root	0.274	unit root
Coal Spot	-2.900	unit root	0.374	unit root
Cipla Spot	-1.890	unit root	0.277	unit root
At First Difference Trend & Intercept				
Coal futures	-33.736	stationary	0.072	stationary
Ciplal futures	-36.158	stationary	0.106	stationary
Coal Spot	-33.290	stationary	0.090	stationary
Cipla Spot	-35.929	stationary	0.105	stationary

Source: Computed value

The optimum lag length of 1is selected for Coal India and 2 for Cipla by the SC of VAR criteria. The Johansen's Cointegration test results are shown in Table 3 of Coal and Cipla. The trace statistics, eigen values and their respective p values rejects the hypothesis of no cointegrating equation which can be hypothesized in spot and futures prices of both Coal India and Cipla. The result suggests that there exist one cointegrating equation between the spot and the futures prices of both Coal India and Cipla.

Table 3: Johansen's Cointegration Test Results

Hypothesized No. of CE(s)	Eigen value	Trace Statistic	Critical Value 1%	Probability
Unrestricted Cointegration Rank Test (Trace)				
Coal None *	0.084	108.420	31.154	0.000
Coal 1	0.007	8.118	16.554	0.242
Cipla None *	0.113	149.584	19.937	0.000
Cipla 1	0.001	1.305	6.635	0.253
Unrestricted Cointegration Rank Test (Maximum Eigen value)				
Coal None *	0.084	100.302	23.975	0.000
Coal 1	0.007	8.118	16.554	0.242
Cipla None *	0.113	148.278	18.520	0.000
Cipla 1	0.001	1.305	6.635	0.253

Source: Computed value,* denotes rejection of the hypothesis

Table 4 shows the Vector Error Correction Model Results. The speed of adjustment of in short run for Coal futures is 4.44%, and of Coal spot is 12.81% significant at 5% level of significance for acquiring long run equilibrium. The speed of adjustment of Cipla futures is 27.95%, and of Cipla spot is 6.15% for acquiring long run equilibrium. The results show coal futures prices leading the coal spot prices, and Cipla spot prices leading the Cipla futures prices in the price discovery process. CUSUM test is used to test model for stability and result show it is stable.

Table 4: Vector Error Correction Model Results

Variables	Coal Futures	Coal Spot	CiplaFutures	Cipla Spot
Coefficient	-0.0444	0.1281	-0.2795	0.0615
Std. Error	0.0554	0.0573	0.1870	0.1872
t-Statistic	-0.8026	2.2367	-1.4947	0.3286
Prob.	0.4224	0.0255	0.1353	0.7425

Source: Computed value

The results of granger causality test are shown in Table 5. The number of observations of both the companies is different; however the causality results are consistent for both. The results show one-way causality running from Coal futures prices to spot prices and in Cipla also there is one-way causality running from futures prices to spot prices.

Table 5: Granger Causality Test Results

Null Hypothesis:	Observations	F-Statistic	Probability
Coal spot does not Granger Cause Coal futures	1147	0.369	0.544
Coal futures does not Granger Cause Coal spot		4.439	0.035
Cipla spot does not Granger Cause Cipla futures	1237	1.293	0.275
Cipla futures does not Granger Cause Cipla spot		5.213	0.006

Source: Computed value

Conclusion

This paper examines the relationship between the spot and the futures prices of two stocks traded at NSE. The time series data of the twostocks was tested for the basic statistics, stationarity, co-integration among the spot and futures prices. The results show that the spot and futures prices of both companies have a long run relationship. VECM results shows that the Coal India futures prices are leading the spot prices, and Cipla spot prices are leading the futures prices in price discovery process. For analysing the causality between the spot and futures values Granger Causality test was applied. The analysis describes that in both Cipla and Coal, there is a unidirectional causality, which is running from futures prices to spot prices. The implications of the study are relevant to participants of market and regulators due to intricate finding of Coal India futures prices leading the spot prices in short run, whereas Cipla spot prices leading the futures prices, however, the causality is running from spot prices to futures prices of both the companies. It seems that the market can benefit from the information contained in the spot prices more efficiently. The future scope of the study is to check various sectoral prices and for a longer period.

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