Price Disparity of Dual - Listed Companies (DLCs) in the Equity Market : Evidence from Indian Bourses with Special Reference to the Pharma Sector

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Abstract

The equity market in India has shown high level of reporting price differences of dual - listing companies (DLCs) in the leading stock exchanges of India (i.e. Bombay Stock Exchange and National Stock Exchange) and depicted high price disparity. The present study intended to measure the price disparity that existed between the dual listed securities in the equity market with special reference to the pharma sector. The present study included the top four pharmaceutical companies which are traded on the BSE & NSE, such as : Sun Pharmaceutical's Ltd., Lupin, Dr. Reddy's Laboratories, and Cipla. The daily open - high - low - close (OHLC) price data were extracted from end of the day (EOD) series published by the respective exchanges through their official websites. After the basic data cleaning process, the descriptive statistics were used to find the price disparity. In addition to this, histogram was used to measure the price variance. The results of the study revealed that among the four pharma companies, Dr. Reddy's Laboratories had the highest price disparity during the study period. It also showed that the reporting price disparity was huge in case of Dr. Reddy's Laboratories as compared to the remaining companies after currency demonetization.

Keywords **: price disparity, dual listed securities, currency demonetization**

JEL Classification: D53, D43, G10

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India's premier bourses - the National Stock Exchange (NSE) and the Bombay Stock Exchange (BSE) - use different methods to arrive at the component of the traded open-high-low-close (OHLC) price data in the end of the day (EOD) series. In general, the open price of the securities is captured by the automated trading system, when the respective trading day session begins. Likewise, the high and low price of the securities on the trading day is captured by the automated trading system during the trading session of a particular day. The closing price of the respective securities is determined by the leading stock exchanges using different techniques. They adopt a different methodology to arrive at the closing price of the securities during the respective trading day.

On the BSE, the closing price is determined immediately after the normal trading ends, and is calculated on the basis of the following criteria :

Criteria	Closing Price Calculated Based on Weighted Average Price of …
If more than 20 market lots were traded in the final 15 minutes	last 20 market lots traded in the final 15 minutes

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If less than 20 market lots were traded, but at least 10 trades were executed in the final 15 minutes	last 10 trades in the final 15 minutes
If at least10 trades in the last 15 minutes	last 10 trades in the final 30 minutes
If less than 10 trades were executed in the final 30 minutes	all trades in the last 30 minutes
If there are no trades in the last 30 minutes	last traded price becomes the closing price

At the NSE, the official closing price comes out of a separate session held from 3:35 pm to 3:50 pm (normal trading ends at 3:30 pm). During regular trading, orders are executed immediately, based on a price-time priority. However, in the closing session, the orders are keyed in, and the trading system continuously calculates an equilibrium price. The equilibrium price for a stock at any point of time is the level at which the prevailing demand-supply position in that stock is optimized. Orders are matched only at the end of this session, and all the trades are executed at the equilibrium price. However, if no orders are placed for a stock in the closing session or an equilibrium price cannot be arrived at due to non-optimization of demand and supply, no trade is executed. The price at which the last trade is executed in normal trading becomes the closing price.

Review of Literature

Throughout the last decade, price difference became an important phenomenon due to dual listing in the stock exchanges as it led to arbitrage opportunity among the stock exchanges. This section contributes to the emerging empirical literature available relating to price disparity as well as the arbitrage opportunity arising out of such price disparity of the dual listed companies' stock prices.

Aziz and Yetty (2016) conducted a study on the stock price behavior in dual listing stocks on the Indonesia Stock Exchange and New York Stock Exchange. The study concluded that there existed arbitrage opportunity for both stocks, although it was very small. The potential arbitrage occurred because of the price difference in the two markets and a long-term equilibrium relationship.

Sakr and Halaby (2015) conducted a study on market efficiency and arbitrage opportunities in the case of Egyptian global depository receipts. The study concluded that there existed a difference between the corresponding closing prices in both markets. The closing prices of the GDRs in London and their underlying stocks in Egypt were not identical, and this appeared because of the difference in the trading hours between London and Egypt. The two hours lag between the two markets resulted in a difference in the closing prices of both securities.

Liu and Bogomolov's (2012) study revealed that arbitrage profits were still available with monthly returns ranging from 0.5% to 3.8% after considering transaction costs and non-overlap trading time issues.

Hussain's (2009) study exposed that the high level of spreads imposed by foreign exchange brokers made the quest for triangular arbitrage unsuccessful. Not only did the results indicate that the arbitrage opportunities were very rare, but also pointed to the fact that they were also not very profitable.

Jong, Rosenthal, and Dijk (2008) in their paper evaluated investment strategies that exploited the deviations from theoretical price parity in a sample of 12 dual-listed companies (DLC's) in the period from 1980 - 2002. DLC's arbitrage involved considerable uncertainty as there was no identifiable date at which the twin prices would converge. It was shown that arbitrage strategies exhibited a large amount of idiosyncratic risk and a distribution with a fat left-tail. The idiosyncratic volatility of arbitrage return lay in the range of 30-35% for all strategies, which was close to 50% higher than the total volatility of the S&P 500. It was concluded that arbitrage was not successful in eliminating this mispricing.

Li's (2009) study found that the option trading volume in the Canadian market was lower than that in the U.S. market and during dramatic market price drops, the option trading volume remained at a low level. The

hypothesis was done to find out that there was no significant difference between the arbitrage opportunities contained in cross-listed stocks and those of purely domestically listed U.S. stocks. In terms of cross-listed securities, arbitrage proportions reported in Canadian markets were not significantly different from those existing in U.S. markets.

Akram, Rime, and Sarnoa (2005) in their paper investigated the presence and characteristics of arbitrage opportunities in the foreign exchange market using a unique data set for three major capital and foreign exchange markets. The analysis unveiled the existence of numerous short-lived arbitrage opportunities, whose size was economically significant across exchange rates and comparable across different maturities of the instruments involved in arbitrage. The duration of arbitrage opportunities was, on an average, high enough to allow agents to exploit deviations from the law of one price, but low enough to explain why such opportunities had gone undetected in much previous research using data at lower frequency.

Majumdar (2007) tried to look into the intersectoral and intertemporal characteristics in prices of such stocks of Indian origin that were being dually traded on the American and Indian stock exchanges. The study found that 50% of the dually listed companies in the sample showed an increase in domestic share prices immediately after their foreign listing.

Based on the above literature survey, it is observed that majority of the studies have been done on dual listing and the arbitrage opportunity that arose in various segments of the financial markets such as the cross-border listing (i.e. listing made in two or more countries), futures market, forex market, regional listing, and the Indian companies listed abroad. None of the studies addressed dual-listing in the same country, therefore, this paper tries to address this research gap.

Research Objective

The objective of the study is to measure the absolute spot price divergence of dual listed companies in the equity market with special reference to the pharma sector. In addition, the study also aims to measure the spot price divergence of dual listed large market capitalized pharma securities in the Indian equity market before and after the currency demonetisation.

Research Method

The closing price of a stock is neither the last traded price nor indicative of the price at which investors could have bought or sold the stock. Traders often manipulate closing prices, though this was far more common in the earlier outcry system, when the market lacked depth. However, even today, the closing price of an illiquid stock can present an inaccurate picture of its value. Therefore, we were keenly interested to know the spot price divergence of the dual listing securities in the Indian equity market.

(1) Research Data Description, Source, and Period : This study involves daily series of traded open-high-low-close (OHLC) data through the end of the day (EOD) of the respective stock exchanges from April 1, 2016 to March 31, 2017 from the respective official websites for the top four market capitalized pharma companies, namely (a) Sun Pharmaceuticals [₹ 2,17,636 crs.], (b) Lupin [₹ 84,193 crs.], (c) Dr. Reddy's Laboratories [₹ 63,779 crs.], (d) Cipla [₹ 52,081 crs.]. The data were further used to observe the price difference in the dual listing of securities in the equity market traded on NSE from www.nseindia.com and the same top four market capitalized pharma companies traded on BSE from www.bseindia.com.

(2) Tools for Analysis : To compute the spread between the individual securities prices on the basis of open, high, low, close prices of leading (i.e. NSE & BSE) stock exchanges in India, we calculated the descriptive statistics to

measure the central tendency and measures of variability or dispersion on the basis of individual securities. In addition to this, a histogram is used which plots the frequency of spread occurrences in a data set that has been divided into the various classes called bins. The bin results are reported in the Analysis and Results section in the following bin ranges :

Actual Range of Price Difference in (₹)								
< -10 to – 5	-5 to – 2.5	-2.5 to – 1	-1 to 0	0	0 to 1	1 to 2.5	2.5 to 5	5 to 10 & <

Analysis and Results

The data analysis part begins with the computation of spread of the open, high, low, and close price of the pharmaceutical companies that are listed on both National Stock Exchange (NSE) and Bombay Stock Exchange (BSE). It aims to measure the variation that exists in the spot price of the companies (i.e. the difference in the open, high, low, and closing price between the two stock exchanges).

(1) Descriptive Statistics - Spot Price Divergence of Pharma DLCs : The Table 1 describes the descriptive characteristics, that is, central tendency and measures of variability or dispersion of the spot price divergence from BSE to NSE of dual listing companies under pharma sector for the period from April 1, 2016 to March 31, 2017.

(2) Range of Divergence - Spot Price Dissimilarity of Pharma DLCs : The Table 2 exhibits the range of divergence

Table 1. Descriptive Statistics of Spot Price Divergence of Pharma Sector from 01 / 04 / 2016 to 31 / 03 / 2017

Descriptive Statistics of Spot Price Divergence		Descriptive Value of Price Difference		
		Min.	Mean ± *SD*	Max.
Cipla	Open	-7.00	0.33 ± 2.28	9.65
	High	-5.55	-0.19 ± 0.83	4.00
	Low	-10.25	0.14 ± 1.05	2.70
	Close	-2.90	-0.30± 0.81	1.80
Dr Reddy's Laboratories	Open	-45.00	1.82±13.12	70.00
	High	-11.80	0.32±6.51	70.00
	Low	-26.50	0.35±15.13	15.95
	Close	-11.50	-0.10±3.51	8.90
Lupin	Open	-15.95	1.04 ± 6.43	20.05
	High	-10.05	-0.01 ± 2.51	15.60
	Low	-7.95	0.68 ± 1.74	6.75
	Close	-5.70	-0.31 ± 1.87	5.40
Sun Pharmaceutical Industries Ltd.	Open	-5.30	0.47 ± 2.18	7.00
	High	-2.00	0.2 ± 1.14	8.70
	Low	-3.90	0.27 ± 0.66	2.20
	Close	-2.00	0.06 ± 0.67	2.35

Note. Calculation available on request from the authors.

Table 2. Range of Divergence : Spot Price Dissimilarity of Pharma Sector from 01 / 04 / 2016 to 31 / 03 / 2017

Range of Divergence: Spot Price Dissimilarity Total # observation (*n* = 248)		Actual Range of Price Difference in (₹) Bombay Stock Exchange (BSE) to National Stock Exchange (NSE)								
		<& - 10 to - 5	- 5 to - 2.5	- 2.5 to - 1	-1 to 0	0	0 to 1	1 to 2.5	2.5 to 5	5 to 10 &<
Cipla	Open		4	14	34	64	55	49	21	7
	High		1	1	29	138	69	8	2	
	Low	1	1		17	68	144	16	1	
	Close			1	49	119	63	16		
Dr Reddy's	Open	38	29	19	11	13	14	13	20	91
Laboratories	High	3	16	30	60	41	35	22	17	24
	Low	4	13	10	24	22	39	39	74	23
	Close	3	21	27	31	42	41	32	34	17
Lupin	Open	13	25	36	19	23	16	17	37	62
	High	1	0	17	65	78	44	18	13	12
	Low		3	7	20	52	73	65	26	2
	Close		3	23	51	70	59	25	15	2
Sun	Open		2	21	41	45	54	50	28	7
Pharmaceutical	High				13	123	85	17	7	3
Industries Ltd.	Low			1	7	64	155	21		
	Close				17	106	105	20		

Note. Calculation available on request from the authors.

of spot price dissimilarity of dual listing companies under the pharma sector for the period from April 1, 2016 to March 31, 2017.

(3) Price Divergence of Pharma DLCs - Before and After Currency Demonetisation : The Figure 1 exhibits the reporting price disparity of CIPLA in the leading stock exchanges from April 2016 to March 2017. The graph shows the reporting price disparity before and after currency demonetisation. It is observed from the graph that the reporting price disparity is moving downwards before currency demonetisation by providing an advantage to the Bombay Stock Exchange, but soon after currency demonetisation, the price disparity moves upward, which means that it is providing an advantage to the National Stock Exchange. Therefore, there is less chance of reporting price disparity in the case of dual listed Cipla pharma company.

The Figure 2 exhibits the reporting price disparity of Dr. Reddy's Laboratories in the leading stock exchanges from April 2016 to March 2017. The graph shows the reporting price disparity before and after currency demonetisation. The reporting price disparity is huge as compared to what it is for the remaining companies after currency demonetisation. This shows that there was a greater advantage soon after demonetisation for trade in the BSE trading platform as the price moved downwards during that period.

The Figure 3 exhibits the reporting price disparity of Lupin in the leading stock exchanges from April 2016 to March 2017. The graph shows the reporting price disparity before and after demonetisation. The reporting prices do not have a huge disparity due to process of currency demonetisation as the reporting price movement is following a certain trend.

The Figure 4 exhibits the reporting price disparity of Sun Pharmaceutical in the leading stock exchanges from April 2016 to March 2017. The graph shows the reporting price disparity before and after currency demonetisation. The reporting prices do not have a huge disparity due to process of currency demonetisation as the reporting price movement is following a certain trend.

The Figures 1- 4 depict the reporting price disparity among the Indian stock exchanges, the price disparity before and after currency demonetization on November 8, 2016. The left-hand side in the Figures 1 – 4 shows two price distribution diagrams; wherein the first one explains the before-currency demonetisation price disparity and the second one explains the after-currency demonetisation price disparity. The right-hand side line graphs explain the price movement on time basis.

Figure 1. CIPLA : Reporting Price Disparity Before & After Currency Demonetisation

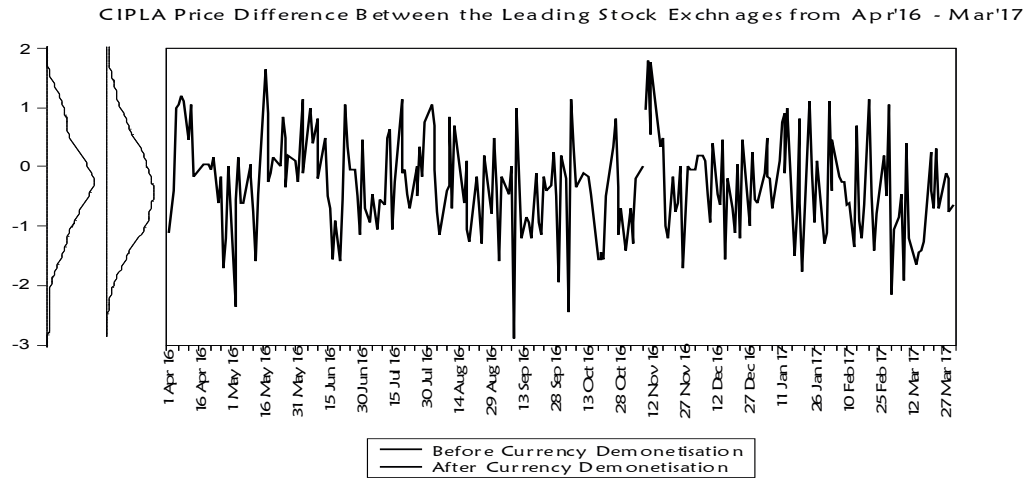


Figure 2. Dr. Reddy's Laboratories : Reporting Price Disparity Before & After Currency Demonetisation

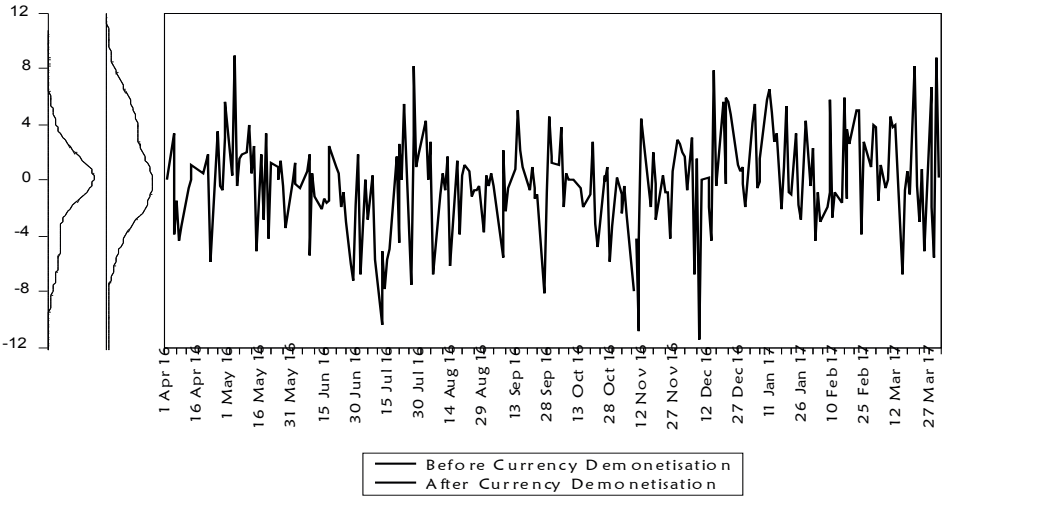


Figure 3. Lupin : Reporting Price Disparity Before & After Currency Demonetisation

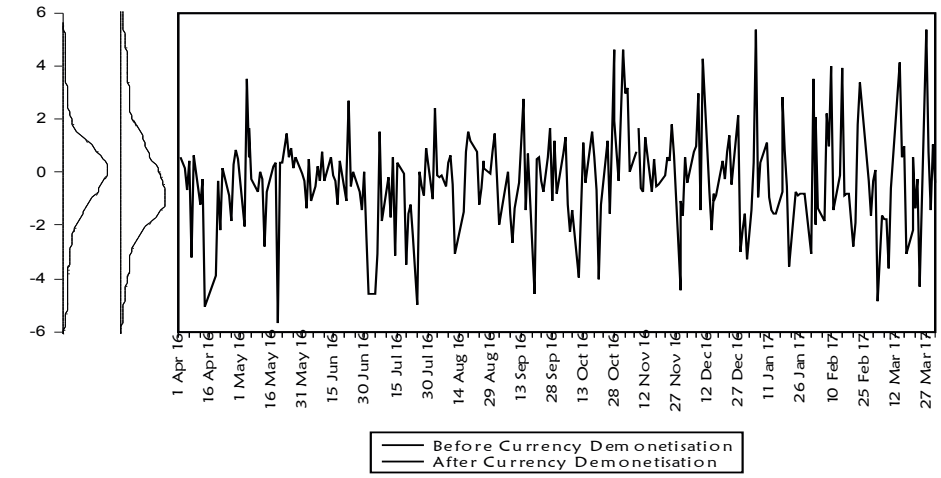
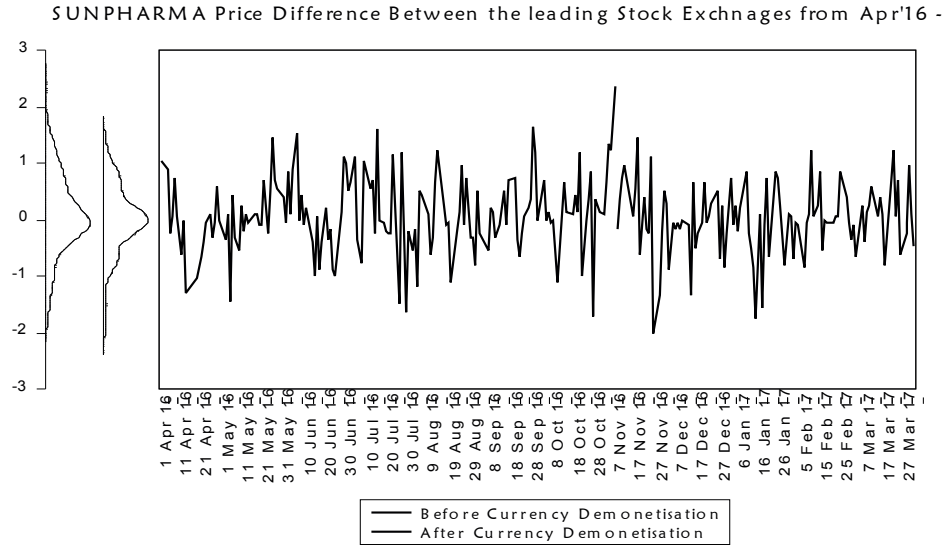


Figure 4. Sun Pharmaceutical Industries Ltd : Reporting Price Disparity Before & After Currency Demonetisation



Research Implications

During the whole study period, there is a high degree of reporting price disparity in case of Dr. Reddy's Laboratories reporting price convergence range of ₹ – 45.00 (Open) and ₹ 70.00 (Open & High) reporting price of BSE equating to NSE. Lupin shows the second - highest degree of reporting price disparity in the range of ₹ –15.95 (Low) and ₹ 20.05 (Open). The third highest degree of reporting price disparity occurs in Cipla reporting price convergence range of ₹ – 10.25 (Low) and ₹ 9.65 (Open). Finally, Sun Pharmaceutical shows low degree of reporting price disparity among the pharma companies, with reporting price convergence of ₹ – 5.30 (Open) and ₹ 8.70 (High).

Finally, the study reveals that among the four pharma companies, Dr. Reddy's Laboratories has the highest price disparity in the study period. It also shows that the reporting price disparity is huge in case of Dr. Reddy's Laboratories as compared to the other companies after currency demonetisation. None of the studies have addressed dual-listing in the same country and have not examined the impact it has on investors. In a country like India, the majority are small investors ; hence, the impact in terms of losses incurred by them due to differential pricing of the stocks is huge.

Limitations of the Study and Scope for Future Research

In this study, a whole - hearted effort has been put to collect, organize, analyze, and interpret the related data and finally to attain the optimum outcome of the research. In spite of these efforts, there exist some limitations that act as a barrier to conduct the research. Due to non-availability of individual security data in MSEI: SX-40 to the public, we were unable to incorporate data from this exchange. High frequency data (i.e. triggered as seconds / minutes) is useful to capture the price convergence in a better way, but the high frequency data are highly priced, therefore, we were unable to afford it. Therefore, end of the date (EOD) data were used to observe the price disparity among dual listed securities. Future researchers can carry out the research by using high-frequency data for greater accuracy. Research can also be carried out using the MSEI stock exchange, the newest stock exchange of India.

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