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IS PRICE-VOLUME RELATIONSHIP ASYMMETRY? INTRADAY EVIDENCE FROM INDIAN STOCK MARKET

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Abstract

This paper examines the asymmetry in the price-volume relationship for 50 Indian stocks using high frequency 5-minute data set for the period July 2, 2012 to December 31, 2012. A dummy variable regression model is employed to check the asymmetric relationship. In sum, consistent with Moosa *et al.* (2003) we established an unusual asymmetry pattern in the return-volume relationship where this relationship is stronger when market goes up than when market goes down. Our findings do not support the proposition that "volume is relatively heavy in bull markets and light in bear markets". A reason for this may be the Indian market is more sensitive to unfavorable news than favorable news.

Keywords: Asymmetric relationship, price-volume relationship, bull and bear markets, intraday, India

1. INTRODUCTION

The question is: do falling stock markets affect trading volume in a significantly different way in contrast to rising stock markets? A general view is that any given quantum of price change causes a higher level of trading volume in a rising stock market compared to the same quantum of absolute price change in a declining stock market. Market myths allege that the price-volume relationship depends on whether the market has a bull or a bear run. The bulls are more optimistic about the assets value and they respond only to positive information. On the other hand, the bears are more pessimistic about the assets value and respond only to negative information. Jennings *et al.* (1981) state that usually the trading volume is more when the investor is an optimist than pessimist. Since the prices increase with an optimistic buyer and they decrease with a pessimistic seller, it follows that the trading volume is high when price goes up and low when price goes down.

Brailsford (1996) opines that the presence of short selling component leads to asymmetric volume-price relationship. Short selling can only be initiated on a zero or up ticks (i.e. on non-negative price changes) whereby the sell price is at least equal to the last transaction price of the stock. Hence, there is a possibility of less number of traders in the market on down ticks (i.e. on negative price changes) than on zero or up ticks (i.e. on non-negative price changes) because of the restriction on short selling. Therefore, we may expect higher average volume on non-negative returns than negative returns.

There are several studies that have attempted to trace the asymmetric behaviour in stock market. However, only a small number of studies confirmed this. Ying (1966) found the earliest evidence in New York Stock Exchange (NYSE). Brailsford (1996) provided evidence that price-volume relationship associated with a positive return is higher than associated with a negative return in the Australian stock market. Mohamad and Nassir (1995) investigated the cases of the Malaysian stock

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market, and found the evidence that trading volume associated with a rising price is, on average, higher than the trading volume associated with a falling price. AI-Deehani (2007) found that higher trading volume is associated more with price going up rather than with price going down for eight different stock markets: US, UK, France, Spain, Japan, Hong Kong, South Korea and Canada. Kamath (2007) detected strong asymmetric return-volume relationship in Turkish market. Kamath (2008) found return-volume asymmetry in Chilean stock market eventhough the relationship is statistically insignificant. Al-Saad (2004), and Al-Saad and Moosa (2008) provided evidence in the emerging market of Kuwait that volume tends to be higher in a rising market than in a falling market. He and Xie (2014) also found similar findings in China that price-volume relationship stronger in case of up markets than down markets.

Similarly in the case of Indian stock market, Kumar and Singh (2009) found mixed result on the asymmetric return-volume relationship using daily data for 50 stocks of S&P CNX Nifty index. Nearly 64% of the cases their study detected asymetric behaviour, whereby volume-return relation is stronger when market moves up than when market moves down and for remaining 36% cases no asymetric relationship was traced.

Contrary to above studies, Moosa et al. (2003) detected the presence of temporal asymmetry in the price-volume relationship in the crude oil futures market where this relationship is stronger for negative change in the price than positive change in the price. Assogbavi et al. (2007) reported absence of such price-volume asymmetry in the emerging market like Russia.

The focus of the past studies more on developed markets with low frequency data set (i.e. daily, weekly). The present study indeed to bridge this research gap by examining the assymetric price-volume behaviour in the developing market in India for a set of 50 stocks of S&P CNX Nifty index with special focus on intaday data set.

The paper is organised as follows: Section 2 describes the data. Section 3 presents the methodology of the study. The empirical results are analysed in section 4. Section 5 summarizes the paper.

2. DATA

Our primary data set consists of transaction price and trading volume for each 5-minute intervals from 2 July 2012 to 31 December 2012 for all the stocks of S&P CNX Nifty index between trading timing 09:15 am to 15:30 pm IST. S&P CNX Nifty index is a well diversified 50 stock index accounting for 25 sectors of the Indian economy. Table 1 provides the list of companies and their industry type. All the data are obtained electronically from Bloomberg terminal.

Table 1: List of constituents of S&P CNX NIFTY Index

S. No.	Symbol	Company name	Industry
1	ACC	ACC Ltd.	Cement
2	ACEM	Ambuja Cements Ltd.	Cement
3	APNT	Asian Paints Ltd.	Chemicals
4	AXSB	Axis Bank Ltd.	Banks
5	BHARATI	Bharti Airtel Ltd.	Telecommunication services
6	BHEL	Bharat Heavy Electricals Ltd.	Electrical equipment
7	BJAUT	Bajaj Auto Ltd.	Automobile
8	BOB	Bank of Baroda Ltd.	Banks
9	BPCL	Bharat Petroleum Corporation Ltd.	Oil and Gas
10	CAIR	Carirn India Ltd.	Oil and Gas
11	CIPLA	Cipla Ltd.	Pharmaceuticals
12	COAL	Coal India Ltd.	Metals and Mining
13	DLFU	DLF Ltd.	Real Estate
14	DRRD	Dr. Reddy's Laboratories Ltd.	Pharmaceuticals
15	GAIL	GAIL (India) Ltd.	Energy, Petrochemicals

16	GRASIM	Grasim Industries Ltd.	Building materials
17	HCLT	HCL Technologies Ltd.	IT service; IT consulting
18	HDFC	Housing Development Finance Corporation Ltd.	Financial services
19	HDFCB	HDFC Bank Ltd.	Banks
20	HMCL	Hero Moto Corp Ltd.	Automobile
21	HNDL	Hindalco Industries Ltd.	Metals
22	HUVR	Hindustan Unilever Ltd.	Consumer goods
23	ICICIBC	ICICI Bank Ltd.	Banks
24	IDFC	IDFC Ltd.	Financial services
25	INFO	Infosys Ltd.	IT services, IT consulting
26	ITC	ITC Ltd.	FMCG
27	JPA	Jaiprakash Associates Ltd.	Infrastructure
28	JSP	Jindal Steel & Power Ltd.	Steel, Energy
29	KMB	Kotak Mahindra Bank Ltd.	Banks
30	LPC	Lupin Ltd.	Pharmaceuticals
31	LT	Larsen & Toubro Ltd.	Engineering and construction
32	MM	Mahindra & Mahindra Ltd.	Automotive
33	MSIL	Maruti Suzuki India Ltd.	Automotive
34	NTPC	NTPC Limited	Electric utility
35	ONGC	Oil & Natural Gas Corporation Ltd.	Oil and Gas
36	PNB	Punjab National Bank	Banks
37	PWGR	PowerGrid Corporation of India Ltd.	Electric utility
38	RBXY	Ranbaxy Laboratories Ltd.	Pharmaceuticals
39	RELI	Reliance Infrastructure Ltd	Energy
40	RIL	Reliance Industries Ltd.	Multi-industry
41	SBIN	State Bank of India Ltd.	Banks
42	SESA	Sesa Sterlite Limited	Mining
43	SIEM	Siemens Ltd.	Multi-industry
44	SUNP	Sun Pharmaceutical Industries Ltd.	Pharmaceuticals
45	TATA	Tata Steel Ltd.	Steel
46	TCS	Tata Consultancy Services Ltd.	IT services, IT consulting
47	TPWR	Tata Power Co. Ltd.	Electric utility
48	TTMT	Tata Motors Ltd.	Automotive
49	UTCEM	UltraTech Cement Ltd.	Cement
50	WPRO	Wipro Ltd.	IT services, IT consulting

Stock returns and trading volume are relevant for this study. The percentage return of the stock is defined as $R_t = \log(P_t/P_{t-1}) * 100$, where R_t is the logarithmic percentage return at time t and P_t represents current 5 minutes interval trading price and P_{t-1} is the trading price for immediately preceding five minutes interval.

Next, the trading volume is the total number of shares traded at each five minute interval. Following Tian and Guo (2007) and AI-Jafari and TIiti (2013), the study uses logarithmic value of volume instead of raw volume to improve the normality properties of the series.

It is necessary to check the stationary properties of a series before an econometric application. The stationarity of the series are carried out by ADF and PP unit root test and the test statistics are reported in Table 2 and 3 respectively for trading volume and stock returns. The results show the null hypothesis that both trading volume and stock returns are non-stationary (i.e. has a unit root) are rejected at 1% level of significance. Hence, both the series are stationary and useful for further econometric analysis.

Table 2: Unit root test for trading volume

Stock	Intercept		Intercept with Trend	
	ADF	PP	ADF	PP
ACC	-20.05*	-65.84*	-20.16*	-65.58*
ACEM	-18.59*	-66.17*	-18.64*	-66.21*
APNT	-20.08*	-68.73*	-20.25*	-68.46*
AXSB	-20.51*	-56.95*	-20.92*	-56.82*
BHARATI	-18.37*	-60.69*	-18.37*	-60.69*
BHEL	-17.60*	-51.81*	-17.60*	-51.82*
BJAUT	-19.31*	-73.14*	-19.72*	-73.39*
BOB	-19.00*	-64.17*	-19.13*	-64.27*
BPCL	-20.44*	-68.48*	-20.61*	-68.45*
CAIR	-18.28*	-51.50*	-18.28*	-51.49*
CIPLA	-18.50*	-64.87*	-18.60*	-64.97*
COAL	-18.97*	-66.11*	-18.97*	-66.11*
DLFU	-20.79*	-62.41*	-21.16*	-62.27*
DRRD	-19.44*	-69.81*	-19.45*	-69.81*
GAIL	-21.22*	-68.53*	-21.23*	-68.51*
GRASIM	-22.47*	-81.19*	-22.47*	-81.19*
HCLT	-18.37*	-67.32*	-18.37*	-67.32*
HDFC	-18.79*	-56.32*	-18.87*	-56.37*
HDFCB	-21.82*	-58.12*	-21.83*	-58.11*
HMCL	-20.42*	-59.06*	-20.47*	-58.90*
HNDL	-20.18*	-54.71*	-20.20*	-54.71*
HUVR	-18.84*	-60.72*	-18.87*	-60.72*
ICICIBC	-20.28*	-57.39*	-21.10*	-56.96*
IDFC	-20.80*	-63.31*	-20.90*	-63.05*
INFO	-18.39*	-51.60*	-18.39*	-51.60*
ITC	-18.75*	-53.48*	-18.79*	-53.48*
JPA	-21.54*	-59.63*	-21.72*	-59.34*
JSP	-18.58*	-55.19*	-18.61*	-55.22*
KMB	-30.78*	-112.68*	-31.79*	-107.70*
LPC	-18.26*	-74.51*	-18.32*	-74.57*
LT	-22.17*	-56.81*	-22.32*	-56.53*
MM	-18.61*	-58.26*	-18.67*	-58.29*
MSIL	-17.82*	-61.35*	-18.36*	-62.08*
NTPC	-19.74*	-71.78*	-19.90*	-71.75*
ONGC	-19.98*	-58.84*	-20.03*	-58.84*
PNB	-18.53*	-55.22*	-18.53*	-55.22*
PWGR	-20.12*	-66.81*	-20.20*	-66.82*
RBXY	-20.51*	-59.67*	-20.66*	-59.71*
RELI	-24.15*	-57.50*	-24.43*	-57.01*
RIL	-20.23*	-50.63*	-20.23*	-50.63*
SBIN	-22.96*	-57.20*	-23.29*	-56.65*
SESA	-20.25*	-56.91*	-20.92*	-56.43*
SIEM	-20.98*	-74.90*	-20.99*	-74.89*
SUNP	-20.14*	-64.92*	-20.14*	-64.91*
TATA	-21.59*	-51.98*	-21.64*	-51.94*
TCS	-17.75*	-49.84*	-17.88*	-50.02*
TPWR	-17.84*	-58.12*	-17.87*	-58.12*
TTMT	-20.20*	-51.40*	-20.23*	-51.40*
UTCEM	-19.81*	-74.65*	-21.05*	-74.10*
WPRO	-19.18*	-66.96*	-19.26*	-66.92*

Note: *Significant at 1% level

Table 3: Unit root test for stock returns

Stock	Intercept		Intercept with Trend	
	ADF	PP	ADF	PP
ACC	-43.78*	-98.32*	-43.77*	-98.32*
ACEM	-43.84*	-95.56*	-43.84*	-95.56*
APNT	-43.22*	-99.27*	-43.26*	-99.27*
AXSB	-44.56*	-105.72*	-44.56*	-105.72*
BHARATI	-44.43*	-102.11*	-44.43*	-102.11*
BHEL	-44.52*	-103.34*	-44.52*	-103.34*
BJAUT	-42.63*	-100.20*	-42.62*	-100.19*
BOB	-43.62*	-101.18*	-43.62*	-101.18*
BPCL	-44.74*	-100.21*	-44.75*	-100.22*
CAIR	-43.83*	-102.88*	-43.83*	-102.88*
CIPLA	-42.55*	-98.32*	-42.58*	-98.34*
COAL	-44.40*	-104.13*	-44.41*	-104.15*
DLFU	-44.75*	-100.25*	-44.76*	-100.26*
DRRD	-43.45*	-96.98*	-43.47*	-96.98*
GAIL	-43.93*	-99.42*	-43.92*	-99.42*
GRASIM	-46.84*	-136.47*	-46.86*	-136.58*
HCLT	-47.92*	-139.93*	-47.94*	-140.12*
HDFC	-44.99*	-104.05*	-45.00*	-104.06*
HDFCB	-44.50*	-102.85*	-44.50*	-102.84*
HMCL	-43.23*	-96.76*	-43.27*	-96.79*
HNDL	-45.12*	-104.01*	-45.12*	-104.00*
HUVR	-44.24*	-105.87*	-44.26*	-105.89*
ICICIBC	-44.18*	-107.62*	-44.19*	-107.61*
IDFC	-44.62*	-107.39*	-44.64*	-107.41*
INFO	-42.81*	-98.59*	-42.85*	-98.60*
ITC	-34.45*	-83.11*	-34.48*	-82.98*
JPA	-34.68*	-84.47*	-34.79*	-84.11*
JSP	-32.25*	-83.89*	-32.40*	-83.29*
KMB	-37.24*	-67.51*	-37.35*	-67.32*
LPC	-35.21*	-76.89*	-35.21*	-76.88*
LT	-34.36*	-92.32*	-34.36*	-92.31*
MM	-32.50*	-86.04*	-32.60*	-85.64*
MSIL	-34.09*	-89.97*	-34.09*	-89.96*
NTPC	-34.36*	-86.85*	-34.48*	-86.44*
ONGC	-33.01*	-90.81*	-33.36*	-89.39*
PNB	-36.34*	-65.68*	-36.36*	-65.56*
PWGR	-32.07*	-83.66*	-32.18*	-83.22*
RBXY	-36.05*	-90.23*	-36.05*	-90.22*
RELI	-32.95*	-90.52*	-32.95*	-90.51*
RIL	-33.93*	-80.90*	-34.03*	-80.51*
SBIN	-35.01*	-66.91*	-35.03*	-66.88*
SESA	-36.06*	-69.44*	-36.13*	-69.29*
SIEM	-33.50*	-90.60*	-33.75*	-89.56*
SUNP	-33.31*	-89.34*	-33.39*	-89.04*
TATA	-34.81*	-82.40*	-34.82*	-82.36*
TCS	-36.01*	-90.64*	-36.02*	-90.62*
TPWR	-36.61*	-51.01*	-36.61*	-51.01*
TTMT	-37.30*	-86.17*	-37.31*	-86.15*
UTCEM	-36.10*	-91.18*	-36.14*	-91.01*
WPRO	-35.76*	-91.86*	-35.78*	-91.79*

Note: *Significant at 1% level

3. METHODOLOGY

The asymmetric pattern in the return-volume relationship is investigated through the following dummy variable regression model suggested by Brailsford (1996).

$$V_t = \alpha_1 + \beta_1 D_t |R_t| + u_t \qquad \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots (1)$$

Where, V_t and R_t stands for trading volume and stock returns resepectively at time t. Here D_t represents a dummy variable. This is 1 for negative value of return and 0 otherwise. The estimated parameter β_1 represents the asymmetry in the relationship. A statistically significant negative value of β_1 in equation (1) would indicate that price-volume relationship is higher when market goes up than when market goes down and in opposite a statistically significant positive value of β_1 would indicate that the price-volume relationship is higher when market goes down than when market goes up. An insignificant β_1 indicates no asymmetry in the relationship whether market is up or down.

4. EMPIRICAL RESULTS

Whether price-volume relation is higher in a positive market than in a negative market? To check this asymmetric relationship the study estimated a dummy variable regression model using equation (1) and the results are reported in Table 4. The asymmetric in the relationship between volume and returns is indicated by coefficient β_1. For all the stocks β_1 is highly significant at 1% level, suggesting that return-volume relationship is stronger when market goes up than when market goes down. Our finding is in contrary to the proposition that "volume is relatively heavy in bull markets and light in bear markets" and consistent with Moosa *et al.* (2003) who detected stronger price-volume relationship for negative price changes than positive price changes.

Table 4: Asymmetric relationship between return and volume

Stock	α_1	t-statistics	β_1	t-statistics	R-squared
		$V_t = \alpha_1 + \beta_1 D_t |R_t| + u_t$			
ACC	3.30	652.77	1.80*	17.48	0.032
ACEM	4.23	828.90	1.41*	14.85	0.024
APNT	2.64	460.62	2.63*	20.88	0.045
AXSB	4.27	1087.43	0.79*	16.39	0.028
BHARATI	4.61	994.60	1.33*	20.83	0.045
BHEL	4.50	1010.87	1.70*	24.21	0.060
BJAUT	3.50	734.34	1.61*	16.34	0.028
BOB	3.70	753.39	1.43*	17.46	0.032
BPCL	3.81	723.01	1.59*	17.00	0.031
CAIR	4.39	980.46	2.04*	21.09	0.046
CIPLA	4.09	810.37	1.00*	13.65	0.020
COAL	4.12	838.87	1.74*	17.03	0.031
DLFU	4.70	1081.65	1.53*	24.82	0.063
DRRD	3.37	650.03	1.76*	15.75	0.026
GAIL	3.77	718.35	1.75*	18.26	0.035
GRASIM	2.64	433.07	1.49*	14.02	0.021
HCLT	3.90	815.08	1.01*	14.00	0.021
HDFC	4.37	1027.04	1.82*	19.95	0.042
HDFCB	4.31	984.25	1.37*	12.43	0.017
HMCL	3.42	734.66	1.98*	22.01	0.050
HNDL	4.71	1050.54	1.45*	20.68	0.045
HUVR	4.25	1057.03	1.10*	16.85	0.030
ICICIBC	4.45	1115.47	1.38*	18.07	0.034
IDFC	4.71	1136.56	1.11*	17.69	0.033
INFO	3.96	962.92	1.28*	20.83	0.045

ITC	4.64	1041.80	1.92*	19.66	0.040
JPA	5.16	1291.78	0.99*	21.21	0.047
JSP	4.22	778.85	1.55*	22.39	0.052
KMB	3.65	659.21	1.45*	13.90	0.021
LPC	3.77	756.94	1.72*	18.79	0.037
LT	4.09	1078.70	1.42*	19.51	0.040
MM	3.98	871.78	1.28*	13.37	0.019
MSIL	3.78	796.58	1.42*	18.58	0.036
NTPC	4.20	774.92	1.81*	15.36	0.025
ONGC	4.34	953.48	1.63*	17.98	0.034
PNB	3.70	721.81	1.76*	21.33	0.047
PWGR	4.31	823.99	1.76*	15.09	0.024
RBXY	3.74	724.54	2.24*	23.57	0.057
RELI	4.21	1003.86	1.36*	23.03	0.055
RIL	4.41	1070.46	1.76*	19.02	0.038
SBIN	4.33	1160.16	0.75*	17.61	0.033
SESA	4.21	968.19	0.55*	14.06	0.021
SIEM	3.04	464.10	2.05*	16.66	0.029
SUNP	3.79	785.72	1.51*	15.64	0.026
TATA	4.53	1139.98	1.68*	23.68	0.058
TCS	3.94	881.32	1.93*	20.72	0.045
TPWR	4.34	885.42	1.43*	19.13	0.038
TTMT	4.94	1301.26	0.98*	19.97	0.042
UTCEM	2.91	445.30	1.61*	12.48	0.017
WPRO	4.02	847.60	1.66*	18.54	0.036

Note: *Significant at 1% level

5. SUMMARY AND CONCLUSION

This paper examines the asymmetry in the price-volume relationship for 50 Indian stocks using high frequency 5-minute data set for the period July 2, 2012 to December 31, 2012. In sum, consistent with Moosa *et al.* (2003) we established a different asymmetry pattern in the return-volume relationship where this relationship is stronger when market goes up than when market goes down. Our findings do not support the proposition that "volume is relatively heavy in bull markets and light in bear markets". A reason for this may be the Indian market is more sensitive to unfavorable news than favorable news.

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