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EXAMINING THE IMPACT OF STRUCTURAL BREAKS ON PRICE DISCOVERY EFFICIENCY: EVIDENCE FROM THE INDIAN EQUITY FUTURES MARKET

Keywords: structural breaks, global financial crisis, change in government, demonetization, COVID-19 and price discovery.

J E L Classification: C1, C5, G13, G14, G17.

Abstract: The current study aims to examine the impact of structural breaks on price discovery efficiency of Indian equity futures market. Global financial crisis, change of Government, demonetization and COVID-19 are identified as significant events. Data is divided into sub-samples of pre and post event period to study the impact of these events on price discovery efficiency of the Indian equity futures market. Unit root test is used to check stationarity of data. Granger causality test, Johansen's cointegration test and Vector error correction methodology (VECM) are used for analysis. During full

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sample period, it is observed that there is a significant bi-directional causality between cash and futures markets and cash market leads futures market in price discovery. In addition, global financial crisis triggered volatility in Indian equity futures market, which reduced its price discovery efficiency, whereas, after change in Government, bi-directional transmission of information restored between cash market and futures market. Furthermore, futures market played a leading role in absorbing volatility triggered by demonetization. COVID-19 did not significantly affect price discovery efficiency of Indian equity futures market.

■■■ INTRODUCTION

Literature¹ suggests that derivatives market is expected to lead price discovery to cash market due to leverage benefits, short selling restriction and funding constraints. However, in the Indian stock market, which is one of the most liquid derivatives market in the world in terms of contracts traded, Karmakar and Inani (2019) show that cash market leads in price discovery. Nevertheless, Aggarwal and Thomas (2019), by using high frequency data, stated that futures market dominates cash market in India during periods of high information and information share of futures market increases further if news is negative. Present study, therefore, is an attempt to examine the impact of events like global financial crisis, change of Government, demonetization and COVID-19 on price discovery in National Stock Exchange of India (NSE) because these events can be seen as high information periods. Leblang and Mukherjee (2005) and Pástor and Veronesi (2012) also suggests that such events trigger volatility in stock market.

Market efficiency concept was first tested by Bachelier (1900) in his PhD thesis. He stated that prices of commodity fluctuate randomly. Later this phenomenon was also observed in US stock prices in the studies of Working (1934) and Cowles and Jones (1937). However, these studies were overlooked until late 1950s. Kendall (1953) and Osborne (1959) observed that stock price data behaved like wandering series. In addition, Fama (1970) stated that efficient market is the one in which prices fully reflect available information. He considered three information subsets. First is weak form of market efficiency, which states that only historical prices form part of information set. Secondly, in semi-strong form of market efficiency, information set contains publically available infor-

¹ Please see, Chatrath and Song (1998); Bohl, Salm and Schuppli (2011); Demir, Martell and Wang (2019).

mation. Thirdly, in strong form of market efficiency, it is checked whether privately available information given to investors can also reflect in stock prices.

Hasbrouck (1995), using information share method, observed that securities traded in multiple markets are technically bound as they are subject to same information sets, which do not allow price of security to diverge too much and law of one price should prevail. However, Brailsford and Hodgson (1997) observed that there may be market frictions due to which information may not reflect in both markets simultaneously. One market may react faster to new information while others may follow, resulting in a lead-lag relationship between both markets. Therefore, if informed traders trade in derivative market in place of cash market, price discovery in derivatives shall be rapid and definite in contrast to underlying market (Booth, So & Tse, 1999), which may offer arbitrage opportunities to investors (Roy & Chakraborty, 2020).

Furthermore, Floros and Vougas (2008) and Demir, Martell and Wang (2019) suggested that there is a significant relationship between cash and futures markets and both markets have predictive power for each other, making the relationship bi-directional (Kawaller, Koch & Koch, 1987). Bosch and Pradkhan (2017) suggested that trading activity of non-commercial traders increases rate of convergence in both markets. Korn, Krischak and Theissen (2019) stated that illiquidity in futures market increases with increase in illiquidity in cash market. In addition, Roy and Chakraborty (2020) stated that if there is any disequilibrium in both markets in the long run, cash market plays a leading role to correct such disequilibrium.

Bose (2007) observed that index futures respond to new information more quickly than cash market and both markets contribute to price discovery process. Information share of futures market is highest if new information is perceived negatively (Aggarwal & Thomas, 2019). Moreover, Adämmer, Bohl and Gross (2016) stated that reliable price discovery still occurs in futures market even if there are some dozen of transactions.

On the contrary, Karmakar and Inani (2019) posit that cash market is dominant in price discovery because there are some indirect costs associated with futures market due to which informed trading occurs in cash market. However, Kumar and Tse (2009) stated that this scenario does not hold throughout the year and information share of both markets become equal at times. Furthermore, Beaulieu, Ebrahim and Morgan (2003) suggested that improvement in contract specifications can increase price discovery role of futures market.

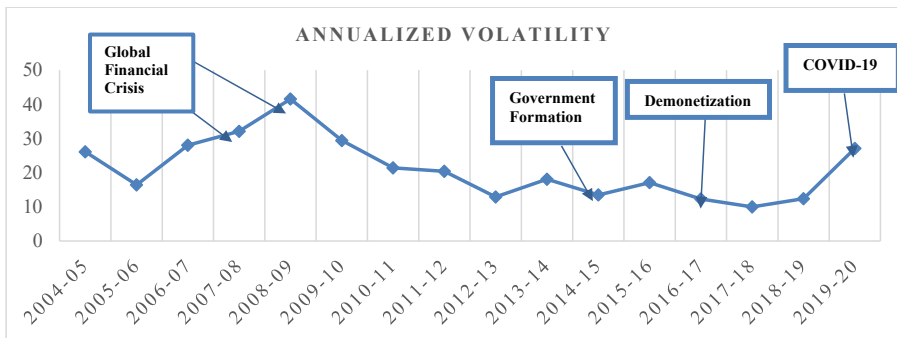
Furthermore, Gerlach, Wilson and Zurbruegg (2006) found that 1997 Asian financial crisis has significantly affected integration of Asia-Pacific real estate market. These markets were not integrated before the crisis but became significantly integrated afterwards. In addition, Pettenuzzo and Timmermann (2011) stated that investors tend to allocate 40% assets to short horizon and 60% to long horizon but after considering structural breaks, allocation to short horizon rises to almost 100% and long horizon declines to almost 10%. Moreover, Pástor and Stambaugh (2012) stated that long horizon variance is reduced due to mean reversion but is offset by other uncertainties faced by investor.

Therefore, the effect of structural breaks on price discovery efficiency is evident in many studies around the world, however, it is yet to be examined in the Indian equity futures market. This study attempts to plug this research gap by studying the impact of global financial crisis, change in Government, demonetization and COVID-19 on price discovery in Indian equity futures and cash markets.

NEED OF THE STUDY

In financial year 2007–08 and 2008–09, Nifty experienced higher volatility than previous years, which was induced by global financial crisis (Gupta & Kaur, 2015). Annualized volatility rose to 32.1% in 2007–08 and 41.54% in 2008–09 as compared to 28% in previous financial year (figure 1). Indian markets became the seventh most volatile market in the world. Derivative turnover also decreased by 17.3% at NSE during financial year 2008–09.

Figure 1. Annualized Volatility of Nifty 50 Index for Full Sample Period



Source : annualized volatility figures extracted from annual reports of SEBI from year 2004-05 to 2019-20 (www1).

In addition, Leblang and Mukherjee (2005) suggested that stock markets of Britain and United States have been sensitive to elections as monetary and fiscal policies adopted by elected party affect economic outcomes and in turn affect price movement in stock market. Similarly, Pástor and Veronesi (2012) and Nageri (2019) also observed that uncertain policy change by government induces volatility in stock market.

Furthermore, key structural reform like demonetization also affected stock market significantly as Sensex and NIFTY fall by 2.5% and 2.7% respectively on next trading day after demonetization was announced. Moreover, COVID-19 abruptly affected stock markets worldwide and India's two benchmark indices, i.e. Sensex and Nifty fall by 26% and 23.8% respectively during financial year 2019-20.

Therefore, this study aims to examine whether structural breaks have significant impact on price discovery efficiency of Indian equity futures market.

THE RESEARCH METHODOLOGY AND THE COURSE OF THE RESEARCH PROCESS

Research Questions

To achieve above stated objectives, following hypothesis have been framed:

H₁: There is no significant lead-lag relationship between Indian equity futures and cash market.

H₂: Global financial crisis does not significantly affect co-movement and lead-lag relationship between Indian equity futures and cash market.

H₃: Change of Government does not significantly affect co-movement and lead-lag relationship between Indian equity futures and cash market.

H₄: Demonetization does not significantly affect co-movement and lead-lag relationship between Indian equity futures and cash market.

H₅: COVID-19 does not significantly affect co-movement and lead-lag relationship between Indian equity futures and cash market.

Data Description and Research Methodology

To examine above stated hypothesis, daily closing prices of near month Nifty Futures contracts and Nifty have been downloaded from the website of NSE for period Jan 1, 2004 to Jan 31, 2021. Index Futures were introduced in June, 2000.

Sample period is taken from year 2004 because trading in derivatives gained momentum from this year. Initial period is left out to allow market to settle down after introduction.

Table 1. Descriptive Statistics

Event	Sample Period	Variables	Observations	Mean	Standard Deviation	Skewness	Kurtosis	Jarque-Bera Test
Full Sample Period	Jan 2004 to Jan 2021	NFR	4243	0.0004	0.015	-0.61	16.13	30781.61*
		NR	4243	0.0004	0.014	-0.49	15.62	28315.19*
Pre Global Financial Crisis	Jan 2004 to Dec 2007	NFR	1004	0.0012	0.017	-1.16	13.86	5157.74*
		NR	1004	0.0012	0.015	-0.97	10.61	2574.64*
Post Global Financial Crisis	Jan 2008 to Dec 2009	NFR	489	-0.0003	0.026	0.08	7.27	371.88*
		NR	489	-0.0003	0.025	0.18	7.99	511.14*
Before formation of NDA Government	Jan 2010 to Apr 2014	NFR	1081	0.0002	0.011	-0.02	3.85	32.26*
		NR	1081	0.0002	0.011	-0.02	3.82	30.73*
After formation of NDA Government	May 2014 to Jan 2021	NFR	1669	0.0004	0.011	-1.52	26.93	40469.34*
		NR	1669	0.0004	0.011	-1.62	26.49	39109.07*
Pre Demonetization	May 2014 to Oct 2016	NFR	615	0.0004	0.009	-0.61	6.15	292.36*
		NR	615	0.0004	0.009	-0.55	6.11	278.91*
Post Demonetization	Nov 2016 to Dec 2019	NFR	782	0.0004	0.007	0.31	6.48	405.71*
		NR	782	0.0004	0.008	0.27	6.32	369.43*
During COVID-19	Jan 2020 to Jan 2021	NFR	272	0.0004	0.019	-1.62	16.11	2066.54*
		NR	272	0.0004	0.019	-1.75	16.01	2054.41*

*Significant at 1% level of significance.

Note:

- NFR denotes Nifty Futures Returns,
- NR denotes Nifty Returns.

S o u r c e : based on author's calculations.

The US based sub-prime lending crisis spread across the world causing global financial crisis. Impact of this crisis was witnessed in Indian securities markets at close of financial year 2007–08, which continued during early 2008–

09 (Sakthivel, Veera Kumar, Raghuram, Govindarajan & Vijay Anand, 2014). Therefore, sub-sample period is divided into two parts; before and after Global financial crisis.

Moreover, election of 2014 is being considered as significant event in Indian political system. The National Democratic Alliance (NDA) formed Government in May 2014 (Wagay, 2018). Hence, to check impact of change in Government, period is divided into two parts, i.e. before and after formation of NDA government.

Furthermore, to eradicate fake currency and black money, demonetization was announced of high denomination currency notes of Rs. 500 and Rs. 1000 in India on Nov 8, 2016 (Chauhan & Kaushik, 2017). Hence, pre-demonetization period is taken as May 1, 2014 to Oct 31, 2016 and post period is taken as Nov 1, 2016 to Dec 31, 2019.

COVID-19 was first detected in China on Nov 17, 2019 and it quickly spread across the world during year 2020–21 (Khanthavit, 2020). Therefore, COVID-19 sample period is taken for annual year 2020–21.

To check for presence of unit root in closing prices of near month Nifty futures contracts and Nifty 50, Augmented Dickey Fuller (ADF) and Philips Perron (PP) tests have been used. It is found that first difference of prices, i.e. log return is stationary. In order to save the space, the results are not reported, however, these may be provided on demand.

Moreover, to examine co-movement among these two markets, Johansen's Co-integration test has been applied. In addition, Granger Causality test is applied to check for direction of causality across these two markets. Furthermore, to examine whether both markets absorb new information simultaneously or observe lead-lag relationship, Vector Error Correction Model has been applied.

RESULTS AND INTERPRETATION

Daily mean returns in both cash and futures markets (as shown in table 1) are approx. zero for almost all periods, which suggests that market returns are showing mean reverting behavior. In addition, for all sample periods mean returns are positive, which exhibits continuous bull-run in the Indian stock market with few years exception (www1). However, for period after Global financial crisis, i.e. 2008–09, mean returns are negative which may be due to higher volatility observed in stock market during this period (www1). Furthermore,

co-efficients of skewness and kurtosis are statistically significant for all sample periods. However, after global financial crisis period, these values are slightly reduced but still significant, which implies that returns of markets are leptokurtic and not normally distributed. It is further tested through Jaque-Bera test, showing similar results. Skewness co-efficient in futures market is relatively higher than cash market (with few exceptions), which suggests that futures market takes away noise from cash market (Gupta & Singh, 2006) and informed trading happens in futures market (Antoniou, Holmes & Priestley, 1998; and Bohl, Salm & Schuppli, 2011).

Furthermore, results of Granger causality test (as shown in table 2) suggest that there is significant transmission of information across both markets during Full sample period, which outlines that both markets are important and new information is discounted in both markets (Roy & Chakraborty, 2020). Bi-directional causality is also observed during pre-global financial crisis period but this relationship deviates in period of post global financial crisis and continues during pre-Government formation period, which depicts no causality between two markets. It may be due to fact that volatility increased in stock market during this period, which in turn made an adverse impact on performance of NSE (Ali & Afzal, 2012; and Sakthivel et al., 2014). Bi-directional transmission of information restored in period after formation of Government, which manifests that policies adopted by Government affects stock market (Leblang & Mukherjee, 2005). During pre-demonetization period, bi-directional causality is observed while post-demonetization, uni-directional causality is observed from futures to cash market, which implies that futures market absorbed volatility triggered by demonetization (Aggarwal & Thomas, 2019). In addition, it is also observed that during full sample period, causality from cash to futures market is more significant than futures to cash market implying more informed trading happens in spot market (Karmakar & Inani, 2019). In addition, during COVID-19 pandemic, bi-directional transmission of information is observed, which is almost equal from both markets towards each other.

Table 2. Granger Causality Test

Event	Period	Null Hypothesis	F Statistics
Full Sample Period	Jan 2004 to Jan 2021	NFR Cause NR	2.04*
		NR Cause NFR	3.38*
Pre Global Financial Crisis	Jan 2004 to Dec 2007	NFR Cause NR	2.19*
		NR Cause NFR	3.07*
Post Global Financial Crisis	Jan 2008 to Dec 2009	NFR Cause NR	1.11
		NR Cause NFR	0.61
Before formation of NDA Government	Jan 2010 to Apr 2014	NFR Cause NR	0.82
		NR Cause NFR	1.02
After formation of NDA Government	May 2014 to Jan 2021	NFR Cause NR	1.77**
		NR Cause NFR	1.61**
Pre Demonetization	May 2014 to Oct 2016	NFR Cause NR	1.54***
		NR Cause NFR	1.79**
Post Demonetization	Nov 2016 to Dec 2019	NFR Cause NR	0.90
		NR Cause NFR	1.45***
During COVID-19	Jan 2020 to Jan 2021	NFR Cause NR	2.73*
		NR Cause NFR	2.22**

*Significant at 1% level of significance.

**Significant at 5% level of significance.

***Significant at 10% level of significance.

Note:

- NFR denotes Nifty Futures Returns,
- NR denotes Nifty Returns.

Source: based on author’s calculations.

In addition, results of Cointegration test (table 3a) reveal that both markets are integrated and test statistics of λ max and λ trace are significant at rank zero and insignificant at rank 1. However, for periods before demonetization and after demonetization test statistics at zero are insignificant, which implies no cointegration during these periods. This may be due to fact that significantly high turnover was observed in futures market as compared to cash market in these sub-periods.

Moreover, result of VECM (table 3b) suggests that cash market leads in price discovery to futures market. During full sample period, cash market leads futures market by 4 days (Kumar & Tse, 2009; and Karmakar & Inani, 2019). Similar results are obtained for all sub periods except pre-global financial crisis period, pre-demonetization, post-demonetization and post-Government formation period where futures market leads cash market in price discovery as these periods are characterized as high information and high volatility periods and futures were introduced with a purpose to reduce effect of informational asymmetries. Therefore, futures market has played significant role in absorbing volatility (Aggarwal & Thomas, 2019). However, during COVID-19 pandemic, both markets are equally efficient and contribute equally to price discovery process. This is in line with Topcu and Gulal (2020) which states that the effect of COVID-19 became relatively insignificant due to timely announcement of large stimulus packages by Government.

Table 3. Johansen's Cointegration Test and Vector Error Correction Methodology

Event	Full Sample Period	Pre Global Financial Crisis	Post Global Financial Crisis	Before Formation of NDA Government	After Formation of NDA Government	Pre Demonetization	Post Demonetization	During COVID-19
Period	Jan 2004 to Jan 2021	Jan 2004 to Dec 2007	Jan 2008 to Dec 2009	Jan 2010 to Apr 2014	May 2014 to Jan 2021	May 2014 to Oct 2016	Nov 2016 to Dec 2019	Jan 2020 to Jan 2021
Table 3a. Johansen's Cointegration Test								
Hypothesized No. of CE(s)	None	At most 1	None	At most 1	None	At most 1	None	At most 1
Eigen Value	0.014	0.002	0.017	0.007	0.047	0.021	0.022	0.034
Maximum Eigen Value Test (Test Statistics)	59.05*	8.83	16.8	6.37	23.07**	10.09	23.48**	9.02
Trace Test Critical Values (Test Statistics)	67.88*	8.83	23.17***	6.37	25.87*	12.52	28.81*	9.01
Table 3b. Vector Error Correction Methodology								
	NF	N	NF	N	NF	N	NF	N
Err Corr.	-2.57*	0.03	-0.16	1.40	-1.47	-0.45	-1.83***	0.27
Constant	0.02	0.01	0.17	0.19	-0.02	-0.01	0.12	-0.23
NF(-1)	1.69***	-0.04	-0.58	-1.64**	1.35	0.99	1.38	0.04
NF(-2)	1.56	-0.04	-0.66	-1.67**	1.19	0.93	1.45	0.54

Table 3. Johansen's...

Event	Full Sample Period	Pre Global Financial Crisis	Post Global Financial Crisis	Before Formation of NDA Government	After Formation of NDA Government	Pre Demonetization	Post Demonetization	During COVID-19								
Period	Jan 2004 to Jan 2021	Jan 2004 to Dec 2007	Jan 2008 to Dec 2009	Jan 2010 to Apr 2014	May 2014 to Jan 2021	May 2014 to Oct 2016	Nov 2016 to Dec 2019	Jan 2020 to Jan 2021								
NF(-3)	1.47	-0.03	-0.78	-1.73**	1.44	1.28	1.52	0.34	-0.49	-1.88***	1.77***	0.67	0.22	-0.89	1.44	1.22
NF(-4)	1.19	-0.20	-1.04	-1.93**	1.94	1.90***	1.50	0.38	-0.68	-2.02**	1.69***	0.63	0.01	-1.08	1.28	1.12
NF(-5)	0.93	-0.38	-1.15	-1.99*	NA	NA	1.47	0.41	-0.77	-2.08**	1.66***	0.61	-0.15	-1.19	1.19	1.03
NF(-6)	0.92	-0.33	-1.16	-1.97*	NA	NA	1.48	0.43	-0.76	-2.02**	1.58	0.56	-0.23	-1.25	1.68***	1.58
NF(-7)	0.71	-0.46	-1.18	-1.91**	NA	NA	1.33	0.29	-0.92	-2.14**	1.20	0.22	-0.36	-1.33	2.08**	2.04
NF(-8)	0.65	-0.45	-1.06	-1.75**	NA	NA	0.99	-0.03	-0.99	-2.15**	1.22	0.28	-0.45	-1.37	2.24**	2.21
NF(-9)	0.71	-0.32	-0.97	-1.63	NA	NA	0.76	-0.21	-0.97	-2.08**	1.16	0.27	-0.45	-1.34	NA	NA
NF(-10)	0.85	-0.10	-0.77	-1.39	NA	NA	0.60	-0.28	-0.73	-1.81***	1.03	0.17	-0.58	-1.43	NA	NA
NF(-11)	0.96	0.10	-0.59	-1.16	NA	NA	0.70	-0.14	-0.79	-1.81***	0.74	-0.09	-0.58	-1.39	NA	NA
NF(-12)	1.08	0.33	-0.60	-1.10	NA	NA	0.48	-0.33	-0.49	-1.43	0.75	-0.02	-0.64	-1.44	NA	NA
NF(-13)	1.23	0.58	-0.21	-0.62	NA	NA	0.56	-0.16	-0.39	-1.29	0.57	-0.15	-0.58	-1.31	NA	NA
NF(-14)	0.92	0.41	-0.61	-0.93	NA	NA	0.73	0.08	-0.23	-1.06	0.66	0.05	-0.60	-1.26	NA	NA
NF(-15)	0.87	0.51	-0.76	-1.00	NA	NA	0.79	0.26	0.02	-0.67	0.47	-0.07	-0.85	-1.37	NA	NA
NF(-16)	0.32	0.05	-0.89	-1.13	NA	NA	0.61	0.22	-0.79	-1.32	-0.29	-0.68	-1.19	-1.52	NA	NA
NF(-17)	-0.11	-0.24	-0.80	-1.00	NA	NA	0.68	0.47	-1.65	-1.94	-0.24	-0.48	-2.67*	-2.79*	NA	NA

Table 3. Johansen's...

Event	Full Sample Period	Pre Global Financial Crisis	Post Global Financial Crisis	Before Formation of NDA Government	After Formation of NDA Government	Pre Democratization	Post Democratization	During COVID-19						
Period	Jan 2004 to Jan 2021	Jan 2004 to Dec 2007	Jan 2008 to Dec 2009	Jan 2010 to Apr 2014	May 2014 to Jan 2021	May 2014 to Oct 2016	Nov 2016 to Dec 2019	Jan 2020 to Jan 2021						
N(-18)	-0.74	-0.63	-0.83	-0.83	NA	NA	-1.24	-1.24	-1.06	-0.98	-2.76*	NA	NA	
N(-19)	-0.91	-0.69	-1.37	-1.20	NA	NA	NA	NA	NA	NA	NA	NA	NA	
N(-20)	1.68***	1.78***	-0.23	-0.22	NA	NA	NA	NA	NA	NA	NA	NA	NA	
N(-1)	-2.28*	-0.56	0.25	1.29	-1.78***	-1.42	-1.74***	-0.43	0.18	1.69***	-2.18**	-0.99	0.42	-0.65
N(-2)	-2.16**	-0.57	0.28	1.28	-1.57	-1.32	-1.80***	-0.57	0.22	1.66***	-2.08**	-0.95	0.59	-1.07
N(-3)	2.05**	-0.57	0.42	1.36	-1.81***	-1.65***	-1.89***	-0.71	0.17	1.56	-1.98**	-0.88	0.60	-1.65***
N(-4)	-1.77***	-0.39	0.71	1.59	-2.29*	-2.25*	-1.87***	-0.74	0.36	1.69***	-1.92***	-0.86	0.79	-1.47
N(-5)	-1.51	-0.21	0.81	1.63	NA	NA	-1.83***	-0.76	0.48	1.79***	-1.91***	-0.85	0.89	-1.34
N(-6)	-1.56	-0.31	0.80	1.59	NA	NA	-1.83***	-0.76	0.41	1.68***	-1.83***	-0.81	0.89	-1.97**
N(-7)	-1.29	-0.15	0.79	1.52	NA	NA	-1.66***	-0.62	0.64	1.85***	-1.44	-0.46	0.03	-2.21**
N(-8)	-1.22	-0.14	0.67	1.34	NA	NA	-1.34	-0.32	0.69	1.86***	-1.48	-0.54	0.09	-2.19**
N(-9)	-1.27	-0.26	0.59	1.24	NA	NA	-1.08	-0.12	0.67	1.79***	-1.38	-0.49	0.11	1.00
N(-10)	-1.36	-0.43	0.44	1.05	NA	NA	-0.92	-0.03	0.49	1.57	-1.26	-0.41	0.29	1.14
N(-11)	-1.51	-0.67	0.24	0.79	NA	NA	-1.07	0.23	0.54	1.55	-0.97	-0.14	0.31	1.12
N(-12)	-1.61	-0.88	0.27	0.74	NA	NA	-0.82	-0.01	0.25	1.19	-0.96	-0.21	0.35	1.16

Table 3. Johansen's...

Event	Full Sample Period	Pre Global Financial Crisis	Post Global Financial Crisis	Before Formation of NDA Government	After Formation of NDA Government	Pre Demonetization	Post Demonetization	During COVID-19
Period	Jan 2004 to Jan 2021	Jan 2004 to Dec 2007	Jan 2008 to Dec 2009	Jan 2010 to Apr 2014	May 2014 to Jan 2021	May 2014 to Oct 2016	Nov 2016 to Dec 2019	Jan 2020 to Jan 2021
N(-13)	-1.71	-1.09	0.29	-0.91	0.16	-0.83	0.31	NA
N(-14)	-1.32	-0.84	0.43	-1.06	-0.02	-0.86	0.30	NA
N(-15)	-1.25	-0.92	0.57	-1.09	-0.22	-0.68	0.47	NA
N(-16)	-0.68	-0.45	0.70	-0.98	0.57	0.05	0.91	NA
N(-17)	-0.15	-0.05	0.61	-0.97	1.39	-0.09	2.35**	NA
N(-18)	0.44	0.29	0.61	NA	0.85	0.79	2.47**	NA
N(-19)	0.68	0.44	1.24	NA	NA	NA	NA	NA
N(-20)	-2.09	-2.21	-0.17	NA	NA	NA	NA	NA

*Significant at 1% level of significance

**Significant at 5% level of significance

***Significant at 10% level of significance

Source: based on author's calculations.

■■■ CONCLUSION

This study aims to examine impact of structural breaks on price discovery efficiency of Indian equity futures market. Daily closing prices of near month Nifty Futures contracts and Nifty have been downloaded from the website of NSE for period Jan 1, 2004 to Jan 31, 2021 to conduct this study. Sample period is divided into pre and post into sub-periods to include important structural breaks like global financial crisis, change of Government, demonetization and COVID-19.

It is stated that for full sample period, cash market leads futures market in price discovery (Karmakar & Inani, 2019). However, during pre-global financial crisis period, pre-demonetization, post-demonetization and post-Government formation period, futures market leads cash market in price discovery, which implies that futures market reduced informational asymmetries during high information periods (Aggarwal and Thomas, 2019). Furthermore, policies adopted by government also affect stock market significantly (Leblang & Mukherjee, 2005; and Pástor & Veronesi, 2012). Moreover, it is observed that there was uni-directional flow of information from cash to futures market before demonetization, however, no causality is observed afterwards.

Disintegration is also observed in both markets during pre-global financial crisis, pre-demonetization and post-demonetization period, which can be attributed to high turnover volume in futures market than cash market during these sub-periods. However, during full sample period, both markets are found to be cointegrated.

In addition, COVID-19 does not seem to be significantly affecting stock market. Khanthavit (2020) observed negative stock market reactions to COVID-19, which were attributed to extensive media coverage rather than disease itself. In addition, Topcu and Gulal (2020) also stated that the effect of COVID-19 became relatively insignificant due to timely announcement of large stimulus packages by Government.

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