Price Discovery Process in Spot and Futures Markets in India: Evidence from Nifty and Bank Nifty Index

OPEN ACCESS

Manuscript ID: MGT-2025-13019256

Volume: 13

Issue: 1

Month: July

Year: 2025

P-ISSN: 2321-4643

E-ISSN: 2581-9402

Received: 21.06.2025

Accepted: 29.06.2025

Published Online: 01.07.2025

Citation:
Srinivasan, S., and MS Ramaratnam. "Price Discovery Process in Spot and Futures Markets in India: Evidence from Nifty and Bank Nifty Index." *Shanlax International Journal of Management*, vol. 13, no. 1, 2025, pp. 33–45.

DOI:
https://doi.org/10.34293/management.v13i1.9256

S. Srinivasan
Assistant Professor, Department of Business Administration
Sri Sankara Arts and Science College, Kanchipuram &
Research Scholar, Faculty of Management
Sri Chandrasekharendra Saraswathi Viswa Mahavidyalaya, Kanchipuram, Tamil Nadu, India
https://orcid.org/0000-0002-3721-7786

M. S. Ramaratnam
Professor, Faculty of Management
Sri Chandrasekharendra Saraswathi Viswa Mahavidyalaya, Kanchipuram, Tamil Nadu, India
https://orcid.org/0000-0002-3721-7786

Abstract
Purpose: *This study examines dynamic nature of relationship among spot (cash) market and its respective futures markets of Nifty & Bank Nifty indices on the Indian stock exchange, with a focus on identifying long-term equilibrium and the direction of price discovery.*
Methodology: *Using daily data from 1stJanuary 2017, to 31stDecember, 2021, the analysis is structured in three stages. First, stationarity of the data is evaluated using Augmented Dickey-Fuller, and further confirmed using Phillips–Perron methods. Second, cointegration analysis is conducted using both Engle and Granger residual-based approach and Johansen-Juselius approach to assess short-run and long-term co-movements between stock prices in spot market and futures prices. Ultimately, temporal relationships and adjustment rates for price imbalances are examined through Vector Error Correction Approach(VECM) methodology.*
Results: *The findings validate extensive long-run cointegration between spot and futures market for both indices, reflecting strong integration of the markets. The VECM estimates also confirm that futures market has leading role in pricing process since it reacts faster than the spot market. This suggests futures segment drives the cash market in absorption of information, hence improving overall market efficiency.*
Conclusions: *The research reaffirms the pivotal role of futures market towards guiding direction of price movements in the spot market prices and justifies the efficient market hypothesis in the Indian context. It underscores the maturity and responsiveness to information of India's derivatives market, particularly with regard to the Nifty and Bank Nifty indices.*
Implications: *For traders and hedgers, the futures market serves as a key signal for timing positions. Institutional investors can use these findings to refine hedging and arbitrage strategies. Regulators should focus on ensuring market liquidity and transparency to support continued efficiency.*
Future Directions: *Future research could incorporate high-frequency intraday data and modern techniques such as GARCH models, regime-switching frameworks, or machine learning to better capture short-term volatility and evolving price dynamics in Indian financial markets.*
Keywords: Price Discovery, NSE Nifty, Financial Markets, Lead-lag Relationship, Unit Root Test, VECM, Cointegration, Causality Test.

Introduction

Understanding the price discovery process within various asset classes has consistently intrigued academicians, market regulators, and investment professionals. Price discovery is defined as process by which market prices are determined, influenced by the interactions between buyers and sellers and moulded by the dissemination of information within financial markets. The introduction of futures contracts plays a critical role in enhancing market efficiency and transparency, as it influences spot market transactions.

Futures markets are often regarded as primary venues for price discovery due to their ability to incorporate investor expectations about future movements. Due to attributes like high leverage and lower trading expenses, these markets tend to absorb new information faster than their spot counterparts.

National Stock Exchange of India (NSE), established in 1992, has evolved significantly over the decades. By 2021, it emerged as the top global derivatives exchange by contract volume and secured the fourth position in global rankings in the spot market regarding trading volume. Average daily turnover in NSE's (F&O) segment peaked at Rs.110.42 lakh crore as of August 19, 2022.

The Nifty 50 represents a basket of the fifty most significant firms listed on the National Stock Exchange—was launched on April 22, 1996, by India Index Services and Products Limited (IISL). Trading in Nifty futures commenced on June 12, 2000. Similarly, the Nifty Bank index, introduced in 2000, includes 12 highly liquid and large-cap banking stocks, with futures trading on this index beginning on June 13, 2005.

Further developments in the derivatives market included the introduction of index options on Nifty 50 from June 4, 2001. Futures on single stocks were introduced on November 9, 2001, and later options on individual equities were also launched. As of December 31, 2023, options trading is available on 195 stocks as specified by SEBI.

The growth trajectory of NSE's derivatives segment has been exceptional. In the financial year 2000–2001, the average daily turnover stood at Rs.11 crore, with approximately 90,580 contracts traded. By comparison, the average turnover skyrocketed to Rs. 11,04,21,070 crore, with a total of 12,34,56,61,638 contracts traded (refer Table 1). This remarkable expansion underscores the growing relevance of analyzing price discovery among spot & futures markets.

Although the derivatives segment has gained significance in India, the effectiveness of futures in identifying prices relative to the spot market—especially for major indices like Nifty and Bank Nifty—remains debatable. The lack of a comprehensive and updated empirical analysis that shows dynamics of short and long run co-movement hinders a full understanding of market efficiency and the flow of information across these segments. This gap limits the ability of traders, policymakers, and institutional investors to make informed decisions based on the actual behaviour of these interlinked markets. This research aims to address this important gap by offering a thorough, data-informed examination of the evolving connection between spot & futures in India. This approach seeks to establish if the futures market is at forefront role in pricing and how rapidly equilibrium is reestablished following short-term fluctuations. The insights gained will be valuable not only for traders and institutional investors in making informed decisions but also for regulators in enhancing the functioning of India's capital markets.

Literature Review

A very extensive literature has tested how markets respond to new information release, with the of new information release, with the broad areas of investigation being informational efficiency, liquidity, transaction costs, and inter-market integration (Sakthivel et al.). The literature has shown that process of pricing mechanism between stock price and futures markets is related closely for both long and short horizons (Hasbrouck; Stoll and Whaley). Market-moving events—in the form of policy changes, politics, economic announcements, or earnings reports—can impact either the spot or futures markets, creating a movement in other markets too.

Several empirical investigations (Abhyankar,; Baur and Dimpfl; Brooks et al.; Chan; Choudhary and Bajaj; Entrop et al.; Fedderke and Joao; Iyer and Pillai; Karmakar; Kawaller et al.; Kim and Lim; Min and Najand; Pati and Rajib; Raju and Shirodkar; Sehgal et al.; Tse et al.; Yadav) point out that derivatives markets incorporate fresh data more quickly than corresponding cash markets. This suggests that futures often take the lead in uncovering prices, with spot markets trailing behind.

Derivatives markets are sometimes viewed as efficient vehicles for information transmission among related securities, thus assisting in price formation (Hasbrouck). Several scholars have also explored the lead-lag relationship between similar financial instruments across different markets. For instance, (Brooks et al.) found that FTSE 100 futures prices often lead their spot index, lending support to the notion that broad-based market information is first absorbed in the derivatives market.

While the dominant narrative supports futures leadership, some studies reveal the opposite. (Palamalai and Ibrahim) reported that the spot market led in gold contracts, and (Cabrera et al.) found similar results in the foreign exchange market. Likewise, (Choudhary and Bajaj), in an analysis of 20 individual stocks, observed instances where spot prices led the futures market. Their findings showed that price discovery dynamics may exhibit unidirectional or bidirectional causality, depending on the asset or market conditions.

Sharma discovered a bidirectional causal relationship in exchange rate movements between spot and futures. Likewise, intraday volatility patterns show strong bidirectional interaction between stock price and futures markets (Fassas et al.; Fassas and Siriopoulos; Min and Najand). Granger causality tests performed by Inani on short-run data also confirmed bidirectional causality. Depending on the specific currency pairs, (Kumar et al.) observed unidirectional as well as bidirectional causality within India's forex market.

In high-frequency or intraday studies, (Stoll and Whaley) witnessed one-way relations at particular moments. (Pati and Rajib), in research on CNX Nifty, detected the presence of one-way price transmission along the long-run equilibrium line. Madasu investigated information flow between spot and futures in commodities using Granger causality methods.

Numerous studies have applied methods including cointegration assessment and error-correction systems to investigate pricing connections across different time horizons. Choudhary and Bajaj used both Johansen's and residual-based cointegration techniques to test for long-run equilibrium. Similarly, Raju and Shirodkar Utilized VECM techniques to evaluate how derivative securities influence price formation relative to their cash market counterparts. Inani studied crude oil markets in India, identifying cointegration among series of order I(1), and applied VECM to assess price efficiency in forecasting spot prices. Nath et al. used similar methods for the gold futures market.

Table 1 Total F&O Turnover in Index and Equities Segment in NSE

Year	Contracts traded	Turnover (Rs.. Cr)	Average Daily Turnover (Rs.. Cr)
2022-23	12345661638	1060042346	11042107.77
2021-22	18660140821	1695233134	6835617.48
2020-21	8534860876	643618108.3	2584811.68
2019-20	5137228372	345391355.5	1398345.57
2018-19	3167183212	237590973.7	958028.12
2017-18	1913878548	164984859.1	670670.16
2016-17	1399746129	94370301.61	380525.41
2015-16	2098610395	64825834.3	262452.77
2014-15	1837041131	55606453.39	228833.14
2013-14	1284424321	38211408.05	152236.69
2012-13	1131467418	31533003.96	126638.57
2011-12	1205045464	31349731.74	125902.54
2010-11	1034212062	29248221.09	115150.48
2009-10	679293922	17663664.57	72392.07
2008-09	657390497	11010482.2	45310.63
2007-08	425013200	13090477.75	52153.3
2006-07	216883573	7356242	29543
2005-06	157619271	4824174	19220
2004-05	77017185	2546982	10107
2003-04	56886776	2130610	8388
2002-03	16768909	439862	1752
2001-02	4196873	101926	410
2000-01	90580	2365	11

Source: NSE website.

Mallikarjunappa and Afsal incorporated VECM with the EGARCH model to analyze the way short-run departures from equilibrium, the system corrects itself and returns to a state of equilibrium over extended periods. Johansen's approach to cointegration was combined with the VECM for the analysis also employed by researchers such as Fassas and Siriopoulos; Karmakar; Kumar; Sehgal et al. to analyze dynamic spot & futures price linkages. Pradhan et al. used the ARDL bounds testing method combined with error correction modelling to study price interrelationships.

Additional research by Kim et al. involved the use of Vector Autoregression (VAR), variance decomposition, and impulse response functions to determine leadership roles in price formation between futures and cash indices. Kim and Lim employed VECM and GARCH to confirm that futures prices led spot prices in Chinese steel market. Zhong et al.applied EGARCH-cointegration model for investigating volatility spillover and price discovery in Mexican futures market. Kumar et al. applied GARCH techniques and Granger causality to analyze volatility in India's forex market.

Methods

The research concentrates on examining temporal connections, both immediate and prolonged, among benchmark indices and their derivative instruments. For this purpose, analytical tools including Engle and Granger methodology, equilibrium adjustment systems, and causal inference approaches were implemented to study sequential relationships.

The empirical work uses daily data spanning from January 1, 2017, through December 31, 2021. The research obtained cash and derivatives market figures directly from NSE's authorized website. In an effort to reduce contract expiry distortion, the research replaces next-month futures contracts at expiry weeks. Both price series are standardized using natural logs to achieve stabilized variance and satisfy model requirements.

The two-step Engle and Granger cointegration approach (Engle and Granger) and the ECM are utilized in this study to test long-term equilibrium and short-run behaviour. The research also employed the cointegration methodology developed by Johansen and Juselius, integrating it with VECM was applied to study interactions between several time-dependent variables. Subsequently, the directional flow of price signals between cash and derivatives markets was analyzed using Granger's causality methodology.

Prior to performing cointegration analysis, establishing the non-stationarity degree for individual time-based variables remains fundamental. For that purpose, ADF Test and another stationary test Phillips–Perron (PP) tests are utilized in order to determine stationarity and order of integration. The investigation then adopts the Engle and Granger sequential method to evaluate co-movement patterns. The primary task involves checking the integration rank of all temporal data. The second step involves estimating a cointegration equation with ordinary least squares (OLS), where residuals are taken and tested for stationarity to verify the existence of a cointegrating among time series.

If cointegration is detected, a general error correction model (ECM) is formulated by incorporating the lagged residual (error correction term) into the differenced equations. This framework allows for capturing short-run deviations while maintaining the long-run equilibrium relationship.

Johansen Multivariate Maximum likelihood Estimation Cointegration test

$$\Delta X_t = \sum_{i=1}^{p-1} \Gamma_i X_{t-i} + \Pi X_{t-i} + \varepsilon_t \; ; \; \varepsilon_t = \begin{pmatrix} \varepsilon_{s,t} \\ \varepsilon_{F,t} \end{pmatrix} \approx \mathrm{N}(0, \Sigma) \quad (1)$$

Cointegrating Vector

$$\lambda_{Trace}(r) = -T \sum_{i=r+1}^{n} \ln(1-\hat{\lambda}_i) \quad (2)$$

$$\lambda_{Max}(r, r+1) = -T \ln(1-\hat{\lambda}_{r+1}) \quad (3)$$

As highlighted by Lai and Lai, traditional econometric methods become unreliable when dealing with non-stationary time series, as they fail to provide valid inferences regarding market efficiency. Therefore, the use of advanced techniques such as the cointegration method developed by Johansen; Johansen and Juselius is vital for testing hypotheses like "simple efficiency" or "speculative efficiency" in financial markets where prices tend to follow non-stationary behaviour.

Vector Error Correction model

$$\Delta Spot_t = \alpha_{S,0} + \sum_{k=1}^{j-1} \alpha_{S,k} \Delta Spot_{t-k} + \sum_{k=1}^{j-1} \beta_{S,k} \Delta Futures_{t-k} + \alpha_S Z_{t-1} + e_{S,t} \quad (4)$$

$$\Delta Futures_t = \alpha_{F,0} + \sum_{k=1}^{j-1} \alpha_{F,k} \Delta Spot_{t-k} + \sum_{k=1}^{j-1} \beta_{F,k} \Delta Futures_{t-1} + \alpha_F Z_{t-1} + e_{F,t} \quad (5)$$

Results

Table 2 presents summary statistics for selected variables, including the skewness, kurtosis, mean, standard deviation & Jarque-Bera test values of Nifty spot& futures, Bank Nifty spot & Bank Nifty futures series. The skewness values across all four series are found to be positive, indicating a distribution with a longer right tail. Furthermore, the kurtosis for each series is below the benchmark value of 3, suggesting that the returns are less peaked and have lighter tails compared to a normal distribution.

Table 2 Descriptive Statistics

	Nifty Futures	Nifty Spot	Bank Nifty Futures	Bank Nifty Spot
Mean	11809.51	11792.71	27731.51	27683
Median	11090.3	11069.65	26962.95	26935.95
Maximum	18495.4	18477.05	41360.45	41238.3
Minimum	7581.55	7610.25	16881.05	16917.65
Std. Dev	2404.069	2400.238	5124.188	5093.422
Skewness	1.117653	1.122125	0.337999	0.338042
Kurtosis	3.407548	3.417611	2.442992	2.442095
Jarque Bera	266.524	269.0208	39.60831	39.66597
P-value	0.0000	0.0000	0.0000	0.0000

Source: Authors' calculations.

The Jarque-Bera test rejected the assumption of normal distribution for the dataset. This outcome indicates that all series deviate from a normal distribution pattern.

Table 3 Unit Root Test Results

Variables	ADF based unit root test at Level	ADF based unit root test at First Difference	PP test for unit root at Level	PP for unit root at First difference
Nifty Futures	-1.9260	-12.0969*	-1.7193	-38.1440*
Nifty Spot	-1.9400	-12.0163*	-1.7205	-37.0045*
Bank Nifty Futures	-2.2262	-34.2909*	-2.2527	-34.2913*
Bank Nifty Spot	-2.2278	-34.0270*	-2.2620	-34.0270*

Source: Authors' calculations.

Note: * indicate a 1% level of significance.

Over the study period, Nifty spot index recorded a maximum of 18,477.05 & a minimum of 7,610.25, while its futures counterpart ranged from a peak of 18,495.45 to a low of 7,581.55. The Bank Nifty spot index varied between 41,238.30 and 16,917.65, whereas the Bank Nifty futures ranged from 41,360.45 to 16,881.05.

To proceed with econometric analysis such as the unit root and ECM, all series were converted to their logarithmic forms. The stationarity properties of the log-transformed data were subsequently assessed utilizing Augmented Dickey-Fuller & confirmed by performing another unit root test like Phillips–Perron tests. According to results, presented in Table 3, it was demonstrated that the original variables exhibited non-stationarity, however, this non-stationarity was mitigated through first differencing, indicating that all series are integrated of order one (I(1)), suggesting that cointegration techniques can be appropriately applied to test for potential long-run relationships between the stock price and its derivative prices

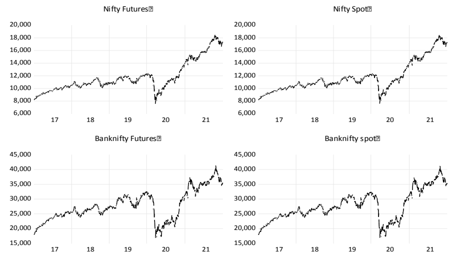

Figure 1 Line Chart Representing Nifty and Bank Nifty from 1st Jan 2017 to 31st Dec 2021 for Both Spot and Futures

Findings confirm persistent balance between cash and derivative valuations for both major market indicators. Statistical co-movement implies synchronized price behavior between underlying assets and their derivatives across extended periods. In the presence of short-term discrepancies, the spot or futures market realign with the long-run equilibrium, thereby reinforcing market efficiency.

To assess this long-run association, the (Engle and Granger) two-step cointegration method was employed. The outcomes, summarized in Table 4, suggest potential cointegration between both indices. Regressions exhibit high R^2 values and super-consistent coefficients, indicating strong linear relationships. Regression equations of the form ($S_t=\beta_0+\beta_1F_t+e_t$,$F_t=\beta_0+\beta_1S_t+e_t$) for both Nifty and Bank Nifty were estimated, and the residuals from these regressions were found to be stationary at the 1% significance level, further affirming cointegration Trace and Maximum Eigenvalue statistics were used in Johansen Cointegration test to ascertain the number of cointegrating vectors. According to Table 5 findings, there is only one cointegrating relationship for each index, confirming a stable long-run linkage between the prices of Nifty and Bank Nifty in both markets.

Table 4 Engle and Granger Co-integration Test Results

Cointegration Regression between Spot and Futures of Nifty index ($S_t=\beta_0+\beta_1F_t+e_t$)				
Variable	Coefficient	S.E	t-Statistics	Probability value
Constant	0.004309	0.002515	1.713751	0.0868
β_1	0.999389	0.000269	3719.853	0.0000
Dependent variable: log nifty spot				
R^2 = 0.999911			Durbin-Watson statistic: 0.667014	
Residual test based on Engle and Granger Approach ($\Delta \hat{u}$ = " $\beta \hat{u}_{(t-1)} + v_t$)				
		Critical value		
Variable	ADF Statistic	1%	5%	10%
$\hat{u}$	-10.27372	4	3.37	3.02
Cointegration Regression between Future and Spot of Nifty index ($F_t=\beta_0+\beta1\ S_t+e_t$)				
Variable	Coefficient	S.E	t-Statistics	Probability value
Constant	-0.003475	0.002517	-1.380643	0.1676
β_1	1.000522	0.000269	3719.853	0.0000
Dependent variable: log nifty futures				
R^2 = 0.999911			Durbin-Watson statistic: 0.667152	
Residual test based on Engle and Granger Approach ($\Delta \hat{u}$ = " $\beta \hat{u}_{(t-1)} + v_t$)				
		Critical value		
Variable	ADF Statistic	1%	5%	10%
$\hat{u}$	-10.27261	4	3.37	3.02
Cointegration Regression between Spot and Futures of Bank Nifty index ($S_t=\beta_0+\beta_1\ F_t+e_t$)				
Variable	Coefficient	S.E	t-Statistics	Probability value
Constant	0.044338	0.003153	14.06176	0.0000

β_1	0.995502	0.000309	3225.062	0.0000
Dependent variable: log Banknifty spot				
$R^2 = 0.999881$			Durbin-Watson statistic: 0.784916	
Residual test based on Engle and Granger Approach ($\Delta u\hat{}" = " \beta u\hat{}_{(t-1)} + v_t$)				
		Critical value		
Variable	ADF Statistic	1%	5%	10%
$u\hat{}$	-10.83304	4	3.37	3.02
Cointegration Regression between Futures and spot of Bank Nifty index ($F_t=\beta_0+\beta_1 S_t+e_t$)				
Variable	Coefficient	S.E	t-Statistics	Probability value
Constant	-0.043319	0.003181	-13.61889	0.0000
β_1	1.004399	0.000311	3225.062	0.0000
Dependent variable: log Banknifty futures				
$R^2 = 0.999881$			Durbin-Watson statistic: 0.785022	
Residual test based on Engle and Granger Approach ($\Delta u\hat{}" = " \beta u\hat{}_{(t-1)} + v_t$)				
		Critical value		
Variable	ADF Statistic	1%	5%	10%
$u\hat{}$	-10.82881	4	3.37	3.02

Source: Authors' calculations.

Subsequently, VECM were estimated todetermine short-run co-movements and speed of adjustment. The model with Nifty spot as the dependent variable is specified as:

$$\Delta S_t = \alpha_s Z_{t-1} + \alpha_{f0}\Delta F_t + \alpha_1 \Delta F_{t-1} + \alpha_2 \Delta F_{t-2} + \alpha_3 \Delta F_{t-3} + \beta_1 \Delta S_{t-1} + \beta_2 \Delta S_{t-2} + \beta_3 \Delta S_{t-3} + C \quad (6)$$

Conversely, the model with Nifty futures as the dependent variable is given by:

$$\Delta F_t = \alpha_f Z_{t-1} + \alpha s_0 \Delta S_t + \alpha_1 \Delta F_{t-1} + \alpha_2 \Delta F_{t-2} + \alpha_3 \Delta F_{t-3} + \beta_1 \Delta S_{t-1} + \beta_2 \Delta S_{t-2} + \beta_3 \Delta S_{t-3} + C \quad (7)$$

Schwarz Information Criterion was used to identify number of lags, and Z_{t-1} stands for error correction term in both models. Error correction coefficients terms α_s and α_f in the Nifty VECM were found to be -0.2263 and -0.2294, respectively, and statistically significant. This implies a symmetric response from both markets to deviations, showing that each plays an equal role in price formation. Diagnostic checks confirmed the absence of serial correlation, although signs of ARCH effects were present.

For Bank Nifty, the VECM with spot as the dependent variable is structured as:

$$\Delta S_t = \alpha_s Z_{t-1} + \alpha_{f0}\Delta_{Ft} + \alpha_1 \Delta F_{t-1} + \alpha_2 \Delta F_{t-2} + \beta_1 \Delta S_{t-1} + \beta_2 \Delta S_{t-2} + C \quad (8)$$

And the model with futures as the dependent variable is:

$$\Delta F_t = \alpha_f Z_{t-1} + \alpha_{s0}\Delta S_t + \alpha_1 \Delta F_{t-1} + \alpha_2 \Delta F_{t-2} + \beta_1 \Delta S_{t-1} + \beta_2 \Delta S_{t-2} + C \quad (9)$$

As with Nifty, the lag structure was determined using the Schwarz criterion. Table 7 reports the results of the Bank Nifty VECM, where the error correction coefficients α_s and α_f are -0.2845 and -0.2874, respectively, and both are statistically significant. This again implies mutual adjustment of spot & futures in pricing process in response to new information.

Table 5 Johansen's Cointegration Test Results

Pairs	Hypothesized No. of Cointegration Equation(s)	Trace Stat	Critical Value @ 5% (probability-value)	Max-Eigen Statistic	Critical Value @ 5% (p-value)
Nifty Spot and Nifty Futures	None *	84.747	15.494(0.000)	84.124	14.264(0.000)
	At most 1	0.623	3.841(0.4298)	0.623	3.841(0.4298)
Bank Nifty Spot and Bank Nifty Futures	None *	95.806	15.494(0.000)	91.712	14.264(0.000)
	At most 1*	4.093	3.841(0.043)	4.093	3.841(0.043)

Source: Authors' calculations.

The bidirectional significance of the error correction terms for both indices and their futures contracts indicates strong co-movement and adjustment mechanisms.

Diagnostic testing on the Bank Nifty model revealed no serial correlation, although evidence of ARCH effects was observed, consistent with volatility clustering often present in financial time series.

Table 8 presents the outcomes from the causality analysis, revealing one-directional causal patterns for both benchmark instruments. The findings show that Nifty derivative values exhibit predictive power over their underlying spot prices, implying futures markets lead in information incorporation. However, an inverse relationship emerges for Bank Nifty, where cash market prices demonstrate forecasting ability over their corresponding derivatives. This contrasting evidence points to differential price formation mechanisms across the examined indices.

Table 6 Results of Error Correction Model for Nifty

	ΔS_t			ΔF_t	
	Coefficients	t-Statistics		Coefficients	t-Statistics
Z_{t-1}	-0.2263**	-9.4152	Z_{t-1}	-0.2294**	-9.3774
ΔF_t	0.9768**	324.2843	ΔS_t	1.0119**	324.2901
ΔF_{t-1}	0.2015**	6.4385	ΔF_{t-1}	-0.2051**	-6.4383
ΔF_{t-2}	0.1297**	4.3201	ΔF_{t-2}	-0.1261**	-4.1221
ΔF_{t-3}	0.0526*	1.9337	ΔF_{t-3}	-0.0477*	-1.7219
ΔS_{t-1}	-0.1809**	-5.7288	ΔS_{t-1}	0.1833**	5.7036
ΔS_{t-2}	-0.1303**	-4.3203	ΔS_{t-2}	0.1270**	4.1349
ΔS_{t-3}	-0.0687**	-2.5065	ΔS_{t-3}	0.0645**	2.3090
Intercept	0.0000	0.2954	Intercept	0.0000	-0.1000
DW statistics	2.009093		DW statistics	2.010835	
Jarque Bera	1183.234**		Jarque Bera	1291.477**	
Serial correlation	F-statistic : 1.604		Serial correlation	F-statistic : 1.342	
	Obs R-Square: 3.229			Obs R-Square: 2.701	
ARCH	F-statistic : 10.952**		ARCH	F-statistic : 10.800**	
	Obs R-Square: 10.873**			Obs R-Square: 10.724**	

Source: Authors' calculations.

Note: ** represents 5% statistical significance, while * denotes a 10% significance level.

Table 7 Results of Error Correction Model for Bank Nifty

	ΔS_t			ΔF_t	
	Coefficients	t-Statistics		Coefficients	t-Statistics
Z_{t-1}	-0.2845**	-10.8493	Z_{t-1}	-0.2874**	-10.9056
ΔF_t	0.9855**	361.9541	ΔS_t	1.0053**	361.9320
ΔF_{t-1}	0.2197**	7.1721	ΔF_{t-1}	-0.2220**	-7.1759
ΔF_{t-2}	0.1438**	5.1560	ΔF_{t-2}	-0.1488**	-5.2866
ΔS_{t-1}	-0.2152**	-6.9557	ΔS_{t-1}	0.2178**	6.9697
ΔS_{t-2}	-0.1385**	-4.9237	ΔS_{t-2}	0.1433**	5.0453
Intercept	0.0000	0.0736	Intercept	0.0000	0.0420
DW statistics	1.984310		DW statistics	1.985645	
Jarque Bera	783.394**		Jarque Bera	818.314**	
Serial correlation	F-statistic : 1.400		Serial correlation	F-statistic : 1.152	
	Obs R-Square: 2.814			Obs R-Square: 2.316	
ARCH	F-statistic : 37.513**		ARCH	F-statistic : 43.294**	
	Obs R-Square: 36.464**			Obs R-Square: 41.893**	

Source: Authors' calculations.

Note: ** represents 5% statistical significance

Discussion

This study analyzed the dynamics of price discovery between spot and futures contracts of Nifty and Bank Nifty, both of which are actively traded on the National Stock Exchange of India. The dataset comprised daily closing prices from January 1, 2017, to December 31, 2021. The research aimed to uncover both long-term and short-term linkages between these markets using a combination of econometric tools: the Engle and Granger approach, ECM, and Granger Causality test.

Table 8 Pairwise Granger Causality

Hypothesis	F-Value	P-Value
The Granger causality analysis reveals no predictive linkage from Nifty spot prices to its corresponding futures	1.23316	0.2949
The Granger causality analysis reveals no predictive linkage from Nifty futures prices to its corresponding spot	2.52575**	0.0393
The Granger causality analysis reveals no predictive linkage from Bank Nifty spot prices to its corresponding futures	2.33740*	0.0535
The Granger causality analysis reveals no predictive linkage from Bank Nifty futures prices to its corresponding spot	1.43121	0.2214

Source: Authors' calculations.

Note: ** indicates a 5% level of significance and * indicate a 10% level of significance

The empirical outcomes show that futures and spot markets for both indices maintain a stable long-term linkage. ECM results also provide evidence that both markets respond symmetrically to short-run disequilibria, further confirming the co-movement and mutual influence argument. Granger Causality test provides evidence of directional information flow—futures prices cause spot prices for Nifty, whereas spot prices cause futures prices in the case of Bank Nifty.

These results indicate an effective price discovery process, but one with some heterogeneity between indices. The capacity of futures to be a leader in one market but not another suggests that price discovery depends on the context and may be affected by liquidity, market structure, and the conduct of market participants.

Conclusion

This research endeavored to explore the dynamic interaction between spot & futures for Nifty and Bank Nifty indices of India, particularly with Regarding long-term balance, both markets contribute distinctly to the price discovery mechanism. Employing a thorough three-stage approach—stationarity testing, cointegration analysis, and the use of a VECM—the study verifies the existence of robust long-term and also short-run equilibrium between two markets. Interestingly, the VECM findings illustrate that a little more than 22% of disequilibrium in Nifty and 28% in Bank Nifty is adjusted within a single trading day, which demonstrates a very high degree of error correction and implies both markets are highly integrated.

The conclusions reinforce the dominant role of futures in uncovering prices, particularly during periods of volatility and informational shifts. As such, Nifty and Bank Nifty futures serve as effective instruments for arbitrage, hedging, and informed trading. This directly addresses the study's objective of determining whether futures absorb information first and help markets return to equilibrium is examined after short-term deviations. By filling the existing empirical gap on how data travels between futures and spot in India, this work enhances understanding of efficiency in developing markets.

However, since only partial correction occurs within one day, pricing inefficiencies may persist in the short run—offering strategic opportunities for traders, such as through pairs trading or other arbitrage techniques. This contributes to the broader understanding of market efficiency in emerging economies like India.

It is important to acknowledge that the study focused exclusively on index futures, specifically Nifty and Bank Nifty, which are among the most liquid instruments in the Indian derivatives market. The results, therefore, may not be directly generalizable to less liquid instruments such as individual stock futures or other derivative products. The selected time frame captures significant disruptions, including the COVID-19 outbreak and global financial turmoil and supply chain disruptions—which could have influenced volatility patterns and the stability of equilibrium relationships.

Future research can build on these findings by incorporating high-frequency data, accounting for structural breaks, and employing advanced econometric models like GARCH or regime-switching frameworks in conjunction with cointegration techniques. Expanding the scope to include individual stock futures, sectoral indices, or cross-market comparisons may offer a more nuanced. It offers an in-depth view of pricing mechanisms and market linkage within India's changing financial framework.

Suggestions

Given that the futures market, particularly for Nifty and Bank Nifty, plays paramount role in the pricing mechanism and only a portion of market disequilibrium is corrected within a single trading day, investors and traders should consider using short-term arbitrage strategies like spread or pair trading are used to exploit short-lived discrepancies between futures and spot prices. Futures are deployed not just for speculative purposes but also to hedge against financial risk, especially during periods of heightened volatility.

In order to implement these strategies, market participants are urged to upgrade their technological infrastructure and analytical powers. Fast-moving algorithmic trading systems can be especially useful in exploiting price inefficiencies. Institutional investors need to adopt regime-specific volatility models that have been back-tested to monitor variations between futures and spot prices. In the meantime, portfolio managers can incorporate Nifty and Bank Nifty futures into active asset allocation strategies, specifically in the event of macroeconomic events or earnings cycles, employing them as directional or hedging instruments to conserve capital while retaining market exposure.

Even retail investors, working at a smaller level, can gain from educational programs that tame the mechanics of futures trading and arbitrage. Active monitoring of open interest,volume patterns, and basis activity can also assist all investors in better evaluating liquidity conditions and sentiment in markets.

By coordinating trading and hedging activities with empirical evidence on markets dynamics, returns can be enhanced and risk exposure lowered. These recommendations, complemented by facilitative policy initiatives like enhanced transparency, enhanced infrastructure, and wider derivative offerings, can enhance market efficiency and enable investors to make more effective choices in India's emerging financial markets.

Policy Recommendations:

Policymakers and regulators should recognize how the futures markets plays pivotal role in the price discovery mechanism and make efforts to ensure that such markets have high levels of liquidity and transparency. Encouraging effective information dissemination and reducing market frictions would assist in maintaining fair prices and market stability. Additional regulatory support for the development of derivative instruments and enhancement of market infrastructure would further consolidate the overall financial ecosystem, especially in emerging economies such as India.

References

Abhyankar, Abhay H. "Return and Volatility Dynamics in the FT-SE 100 Stock Index and Stock Index Futures Markets." *Journal of Futures Markets*, vol. 15, no. 4, 1995, pp. 457-88.

Baur, Dirik. G., and Thomas Dimpfl. "Price Discovery in Bitcoin Spot or Futures?". *Journal of Futures Markets*, vol. 39, no. 7, 2019, pp. 803-17.

Brooks, Chris., et al. "A Trading Strategy Based on the Lead–lag Relationship between the Spot Index and Futures Contract for the FTSE 100." *International Journal of Forecasting*, vol. 17, no. 1, 2001, pp. 31-44.

Cabrera, Juan., et al. "Do Futures Lead Price Discovery in Electronic Foreign Exchange Markets?." *Journal of Futures Markets*, vol. 29, no. 2, 2009, pp. 137-156.

Chan, Kalok. "A Further Analysis of the Lead–lag Relationship between the Cash Market and Stock Index Futures Market." *The Review of Financial Studies*, vol. 5, no. 1, 1992, pp. 123-52.

Choudhary, Kapil., and Sushil Bajaj. "Price Discovery Process in Nifty Spot and Futures Markets. *Global Business Review*, vol. 14, no. 1, 2013, pp. 55-88.

Engle, Robert F., and C. W. J. Granger. "Co-integration and Error Correction: Representation, Estimation, and Testing." *Econometrica: Journal of the Econometric Society*, vol. 55, no. 2, 1987, pp. 251-76.

Entrop, Oliver., et al. "The Determinants of Price Discovery on Bitcoin Markets." *Journal of Futures Markets*, vol. 40, no. 5, 2020, pp. 816-37.

Fassas, Athanasios P., et al. "Price Discovery in Bitcoin Futures." *Research in International Business and Finance*, vol. 52, 2020.

Fassas, Athanasios P., and Costas Siriopoulos. "Intraday Price Discovery and Volatility Spillovers in an Emerging Market." *International Review of Economics & Finance*, vol. 59, 2019, pp. 333-46.

Fedderke, J., and M. Joao. "Price Discovery in South African Financial Markets: Investigating the Relationship between South Africa's Stock Index Futures Market and the Underlying Market." *Studies in Economics and Econometrics*, vol. 25, no. 2, 2001, pp. 1-23.

Hasbrouck, Joel. "One Security, Many Markets: Determining the Contributions to Price Discovery." *The Journal of Finance*, vol. 50, no. 4, 1995, pp. 1175-99.

Inani, Sarveshwar Kumar. "The Relative Efficiency of the Crude Oil Futures Market: Evidence from India." *International Journal of Banking, Accounting and Finance*, vol. 9, no. 2, 2018, pp. 225-43.

Iyer, Vishwananthan., and Archana Pillai. "Price Discovery and Convergence in the Indian Commodities Market." *Indian Growth and Development Review*, vol. 3, no. 1, 2010, pp. 53-61.

Johansen, Soren. "Statistical Analysis of Cointegration Vectors." *Journal of Economic Dynamics and Control*, vol. 12, no. 2, 1988, pp. 231-54.

Johansen, Soren., and Katarina Juselius. "Maximum Likelihood Estimation and Inference on Cointegration—with Appucations to the Demand for Money." *Oxford Bulletin of Economics and Statistics*, vol. 52, no. 2, 1990, pp. 169-10.

Karmakar, Madhusudan. "Price Discoveries and Volatility Spillovers in S&P CNX Nifty Future and its Underlying Index CNX Nifty." *Vikalpa*, vol. 34, no. 2, 2009, pp. 41-56.

Kawaller, IRA G., et al. "The Temporal Price Relationship between S&P 500 Futures and the S&P 500 Index." *The Journal of Finance*, vol. 42, no. 5, 1987, pp. 1309-1329.

Kim, Kyoungsu., and Seok Lim. "Price Discovery and Volatility Spillover in Spot and Futures Markets: Evidences from Steel-related Commodities in China." *Applied Economics Letters*, vol. 26, no. 5, 2019, pp. 351-357.

Kim, Minho., et al. "Trading Costs and Price Discovery Across Stock Index Futures and Cash Markets." *Journal of Futures Markets*, vol. 19, no. 4, 1999, pp. 475-98.

Kumar, Satish. "Price Discovery in Emerging Currency Markets." *Research in International Business and Finance*, vol. 46, 2018, pp. 528-36.

Kumar, T. K. Dhaneesh., et al. "Effectiveness of Currency Futures Market in India: An Empirical Investigation." *IIM Kozhikode Society & Management Review*, vol. 6, no. 2, 2017, pp. 196-03.

Lai, Kon S., and Michael Lai. "A Cointegration Test for Market Efficiency." *The Journal of Futures Markets*, vol. 11, no. 5, 1991, pp. 567-75.

Madasu, Pardhasaradhi. "Econometric Analysis of Spot and Futures Indices of MCX." *Sumedha Journal of Management*, vol. 4, no. 1, 2015, pp. 17-30.

Mallikarjunappa, Thathaiah., and E. M. Afsal. "Price Discovery Process and Volatility Spillover in Spot and Futures Markets: Evidences of Individual Stocks." *Vikalpa the Journal for Decision Makers*, vol. 35, no. 2, 2010, pp. 49-62.

Min, Jae H., and Mohammad Najand. "A Further Investigation of the Lead–lag Relationship between the Spot Market and Stock Index Futures: Early Evidence from Korea." *Journal of Futures Markets*, vol. 19, no. 2, 1999, pp. 217-32.

Nath, Golak., et al. "An Empirical Analysis of Efficiency in the Indian Gold Futures Market." *Macroeconomics and Finance in Emerging Market Economies*, vol. 12, no. 3, 2019, pp. 240-69.

Palamalai, Srinivasan., and P. Ibrahim. "Price Discovery and Asymmetric Volatility Spillovers in Indian Spot-futures Gold Markets." *International Journal of Economic Sciences and Applied Research*, vol. 5, no. 3, 2012, pp. 65-80.

Pati, Pratap Chandra., and Prabina Rajib. "Intraday Return Dynamics and Volatility Spillovers between NSE S&P CNX Nifty Stock Index and Stock Index Futures." *Applied Economics Letters*, vol. 18, no. 6, 2011, pp. 567-74.

Pradhan, Rudra. P., et al. "The Lead–lag Relationship between Spot and Futures Prices: Empirical Evidence from the Indian Commodity Market." *Resources Policy*, vol. 70, 2021.

Raju, Guntur Anjana., and Sanjeeta Shirodkar. "The Lead Lag Relationship between Spot and Futures Markets in the Energy Sector: Empirical Evidence from Indian Markets." *International Journal of Energy Economics and Policy*, vol. 10, no. 5, 2020, pp. 409-14.

Sakthivel, P., et al. "Price Discovery and Volatility Transmission in Currency Spot and Futures Markets in India: An Empirical Analysis." *Global Business Review*, vol. 20, no. 4, 2017, pp. 931-45.

Sehgal, Sanjay., et al. "An Investigation of Price Discovery and Volatility Spillovers in India's Foreign Exchange Market." *Journal of Economic Studies*, vol. 42, no. 2, 2015, pp. 261-84.

Sharma, S. "An Empirical Analysis of the Relationship between Currency Futures and Exchange Rates Volatility in India." *Reserve Bank of India Working Paper Series 01*, 2011.

Stoll, Hans R., and Robert E. Whaley. "The Dynamics of Stock Index and Stock Index Futures Returns." *Journal of Financial and*

Quantitative Analysis, vol. 25, no. 4, 1990, pp. 441-68.

Tse, Yiuman., et al. "Price Discovery in the Foreign Exchange Futures Market." *Journal of Futures Market*, vol. 26, no. 11, 2006, pp. 1131-43.

Yadav, Anjali. "Price Discovery Vehicle in Foreign Exchange Spot & Future Market-The Evidence from National Stock Exchange." Available at SSRN 3808752, 2021.

Zhong, Maosen, et al. "Price Discovery and Volatility Spillovers in Index Futures Markets: Some Evidence from Mexico." *Journal of Banking & Finance*, vol. 28, no. 12, 2004, pp. 3037-54.

Author Details

S. Srinivasan, *Assistant Professor, Department of Business Administration, Sri Sankara Arts and Science College, Kanchipuram & Research Scholar, Faculty of Management, Sri Chandrasekharendra Saraswathi Viswa Mahavidyalaya, Kanchipuram, Tamil Nadu, India,* ***Email ID****: srinivasan.kpm@gmail.com*

M. S. Ramaratnam, *Professor, Faculty of Management, Sri Chandrasekharendra Saraswathi Viswa Mahavidyalaya, Kanchipuram, Tamil Nadu, India*