

Impact of Financial Derivatives on Volatility and Price Discovery in Stock Markets – Review of Related Studies

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ABSTRACT

Purpose: This paper is an extensive literature review on studies related to impact of derivatives on volatility and price discovery in stock markets.

Design/Methodology/Approach: The literature systematically analyses studies conducted on this subject in the last 25 years.


Findings: There are mix of techniques used by various researchers while analysing volatility and lead-lag relationship between spot market and derivatives market. The studies have been carried out on high frequency data, daily and monthly data as well.

Originality/Value: The research gaps identified in the paper include analysing the relationship over longer time duration, comparison across different markets and evaluation of changes in market dynamics after global financial crisis 2008 and COVID-19 pandemic.

Paper Type: Review of literature.

KEYWORDS Financial | Derivatives | Volatility | Price Discovery | Stock | Markets

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Introduction

The introduction and subsequent growth of derivatives in simple words is the result of the demand created by hedgers, who wanted to guard themselves of the future uncertainties, and the speculators, who wanted to play and earn by way of predicting those uncertainties. In India, derivatives trading was launched in the year 2000 and has seen a tremendous growth ever since its introduction. Today, National Stock Exchange (NSE) and Bombay Stock Exchange (BSE) are not only the leading exchanges in India, but as per the Futures Industry Association (FIA), they are the first largest and the fifteenth largest exchanges respectively in the world, based on the number of contracts traded.

In India, the primary reason for launching of the derivative markets was that after opening up the economy in 1991 and the beginning of the reforms phase in financial markets, it was analysed that the equity market were getting highly volatile, and investors were facing a lot of risk and uncertainty in the market.

Thus, to cope up with the above issues, and to match the performance of Indian financial markets with international markets, the decision of introduction of derivatives on both NSE and BSE was taken. Consequently, NSE and BSE have started trading in equity derivatives in year 2000. India's trust with derivatives thus had three main objectives, a) reduce the volatility of the market, b) help in price discovery, and c) provide products that match risk preference of investors, including hedgers.

The equity derivative market in India has grown tremendously. Key hallmarks of the growth journey include introduction of new products, increasing volumes and better risk management framework. This is evident since NSE and BSE launched Bank Nifty weekly options in 2016 and 2018, respectively. NSE and BSE also launched currency derivatives on US Dollar and Indian Rupee currency pair along with weekly options contracts on NIFTY 50 in 2018. Derivatives in India have also led to increased integration with international markets, reduced cost of transaction, increased liquidity and reduced volatility in the equity segment.

Broadly the following two views exist on the impact of derivatives on the stock market. The first view is based on the theory of destabilizing forces, which assumes that derivatives trading leads to an increased stock market volatility due to the high degree of leverage involved (Newbery, 1987). The second view, based on the theory of market completion, suggests that derivatives help in improving market depth, liquidity, market efficiency price discovery, reduce asymmetric information and thus reduce the volatility of the cash market (Arrow, 1953, Ross, 1976, Mayhew, 2001).

With this background, the present paper attempts to analyse the review of related research studies conducted on

the impact of derivatives on market volatility, and studies on Lead-Lag relationships between derivatives and spot markets. The paper has been organized into two sections i.e. review of studies related to impact of market volatility, and review of studies related to the lead-lag relationship between cash and derivatives market.

Review of Studies relating to Impact of Derivatives on Market Volatility

On the basis of analysis given in Table 1 it can be seen that impact on volatility in the Indian market has been extensively studied during year 2002 to 2020, as there was lot of curiosity of researchers to evaluate the relevance of introduction of derivatives in India. Some of the significant studies include Hussain and Atif (2020), Pal and Chattopadhyay (2019), Singh and Tripathi (2016), Kalenteis and Milonas (2013), Kabir and Ikram (2012), Sahu, D. (2012), Girish, G.P. (2012), Singla, R. (2012), Otswal, Priyanka (2011), Kaur, Gurpreet (2011), Sakhtivel, P. and Kamaiah, B. (2011), Ray, K. and Panda, A.K. (2011), Singh, G. and Kansal, S. (2010), Gahlot, R., Datta, K. and Kapil, S. (2010), Pati, P.C. and Rajib, P. (2010), Manier, M. (2009), Gupta, K. and Singh, B. (2009), Gaurishankar S. Hiremath, (2009), Mallikarjunappa, T. and Afsal, E.M. (2008), Debasish, S.S. (2008), Bhaumik, Karanasos and Kartsaklas (2008), Sarangi, S.P. and Patnaik, U.S. (2006), Sah, A.N. and Omkarnath, G. (2005), Raju, M.T. and Karande, Kiran (2003), Ghosh, G. and Bandivadekar, S. (2003), Shenbagaraman, P. (2003), and Thenmozhi, M. (2002). These studies analysed the impact of futures and options on underlying spot market volatility in India.

Most of the studies carried out on analyse of impact on volatility have been done on Index derivatives. These include Xie S. and Huang J. (2014) worked on the China Securities Index (CSI) 300, CSI 300 index futures, Rajoub and Azzam (2012) and Al-Zoubi and Kh.Al-Zu'bi (2011) on Amman Stock Exchange's (ASE) general weighted price index, Kasman, A. and Kasman, S. (2008), among these studies the indexes used are ISE-30 index of Istanbul Stock Exchange (ISE), Bologna, P. and Cavallo, L. (2002) index futures and DAX index of Italian stock markets, Pilar, C. and Rafeal, S. (2002) Spanish stock market, Butterworth, D. (1998) FTSE Mid 250 futures contracts, Smit, E. and Nienaber, H. (1997) share, Gold and industrial indices of (Johanesberg Stock exchange) JSE, Chan, K. et. al. (1991) S&P 500 stock index and stock index futures, Katsikas (2007) index futures of major European stock markets.

In Indian scenario, various studies have been carried out on CNX Nifty 50 Index because it is a popular benchmark indicator of Indian financial market. These include Hussain and Atif (2020); Kabir and Ikram (2012); Girish, G.P. (2012); Singla, R. (2012); Otswal, P. (2011); Kaur, G. (2011); Ray, K. and Panda, A.K. (2011); Sakhtivel, P. and Kamaiah,

B. (2011); Singh, G. and Kansal, S. (2010); Gahlot, et al. (2010); Pati, P.C. and Rajib, P. (2010); Manier, M. (2009); Karande, Kiran (2003); Thenmozhi, M. (2002). Few authors have studied on other indices as well like Gupta, K. and Singh, B. (2009) on Nifty junior index and Nifty index, Gaurishankar S. Hiremath, (2009) on option index of NSE, Sarangi, S.P. and Patnaik, U.S. (2006) S & P CNX Nifty, Nifty junior and S&P 500 index, Sah, A.N. and Omkarnath, G. (2005) S&P Nifty index indices like Nifty junior, NSE 20, S&P Nifty 500, BSE 100 and BSE 200, Ghosh, G. and Bandivadekar, S. (2003) S&P CNX Nifty and BSE Sensex.

Majority of these studies have taken daily closing prices of spot Index and futures and options. These include Hussain and Atif (2020); Xie S. and Huang J. (2014); Gahlot, et al. (2012); Girish, G.P. (2012); Singla, R. (2012); Kaur, G. (2011); Sakhtivel, P. and Kamaiah, B. (2011); Drimbetas, E. (2007); Raju M.T. and Karande, Kiran (2003) employed on daily closing prices data. Kabir and Ikram (2012) studied on monthly average data, Rajoub and Azzam (2012) analysed daily, weekly and monthly closing prices, Sahu, D. (2012), Al-Zoubi and Kh.Al-Zu'bi (2011), Gaurishankar S. Hiremath, (2009), Shenbagaraman, P. (2003), Gulen, M and Stewart, M (2000) studied on returns, Pati, P.C. and Rajib, P. (2010) studied trading volume, Debasish, S.S. (2008); Rastogi (2019); and Siopis and Lyroudi (2007) analysed weekly closing prices.

Most popular econometric techniques used by various researchers include GARCH family models. The GARCH (1,1) model has been the most popular used in various studies

by Gahlot, et al. (2012); Sahu, D. (2012); Otswal, Priyanka (2011); Sakhtivel, P. and Kamaiah, B. (2011); Girish, G.P. (2012); Gupta, K. and Singh, B. (2009); Gaurishankar S. Hiremath, (2009); Debasish, S.S. (2008); Kasman, A. and Kasman, S. (2008); Ghosh, G. and Bandivadekar, S. (2003); Shenbagaraman, P. (2003); Bologna, P. and Cavallo, L. (2002); Yu, Shang-Wu. (2001); Thenmozhi, M. (2002); Sah, A.N. and Omkarnath, G. (2005); Butterworth, D. (1998); Smit, E. and Nienaber, H. (1997); Chan, K. et. al. (1991); and Saravanan, G. and Malabika, Deo (2010). Other studies have used variations in GARCH family models including Hussain and Atif (2020), used EGARCH (1,1); Pal and Chattopadhyay (2019) used DCC-MV-TARCH; Rastogi (2019) used GMM; Xie S. and Huang J. (2014) employed set of GARCH models; Kalantzis, G.F. and Milonas, N.T. (2013) employed VECM-GARCH; Rajoub and Azzam (2012) applied GARCH-M; Singla, R. (2012) used F- test; Kaur, G. (2011) applied GARCH, ARCH and EGARCH; Pati, P.C. and Rajib, P. (2010) employed ARMA-EGARCH; Manier, M. (2009); and Pilar, C. and Rafeal, S. (2002) applied GARCH, EGARCH and GJR; Rao, Ananth (2008) calculated MGARCH and VAR; Drimbetas, E. (2007) analysed using EGARCH; Siopis and Lyroudi (2007) used GARCH, EGARCH; Katsikas (2007) applied EAR-GARCH; Sarangi, S.P. and Patnaik, U.S. (2006) used GARCH and IGARCH; and Gulen, M and Stewart, M (2000) have used GARCH, GJR-GARCH, EGARCH and NGARCH.

The summary of the various studies conducted on impact of volatility on spot market has been shown in Table 1, below.

Table 1: Studies on Impact of Derivatives on Volatility of Spot Market

Author	Year	Country	Indices	Techniques	Result found
Hussain and Atif	2020	India	Nifty 50	EGARCH (1,1)	Derivatives volume increases the underlying spot market volatility. However, the open interest stabilizes the stock market volatility
Pal and Chattopadhyay	2019	India	NIKKI and S&P 500	DCC-MV-TARCH model	Significant asymmetric volatility spillover between the domestic stock market and the foreign exchange market and also from the domestic stock market to the bullion market and changes in gross volume of FII trade.
Rastogi	2019	India	Nifty 50	Generalized Method of Moments (GMM) on weekly data from 2010-2017	The volatility in the options market is not associated with volatility in the spot and futures market. But the volatility in spot and futures markets are associated with each other.
Singh S. and Tripathi L.K	2016	India	Sensex	Unit Root Test, ARCH LM and GARCH (1, 1)	Introduction of futures led to change in the spot market volatility in reduction of the volatility



Author	Year	Country	Indices	Techniques	Result found
Kalantzis, G.F. and Milonas, N.T.	2013	France and Germany	powernext (French) Spot market, EEX (German) spot market, joint spot market and Powernext futures market, EEX futures market, joint futures market	Bivariate VECM-GARCH	Volatility has reduced after the introduction of futures trading in France.
Sahu, D.	2012	India	Individual Stocks	Jarque-Bera (JB), (ADF) test, Lagrange Multiplier (LM) test, GJR- GARCH (1,1) and GARCH (1,1)	Volatility has reduced after the introduction of futures trading in India.
Gu, S. and Gong, X.	2012	China	CSI 300 index futures	GJR-GARCH and stock-Watson "counterfactual VAR" models	Couldn't find any significant changes in the underlying stock market volatility
Gahlot, Ruchika and Datta, Saroj Kumar	2012	Brazil, Russia, India, China	IBrx-50, RTSI, Nifty, and CSI300	GARCH M model, ACF, and run tests	Volatility reduced after the introduction of futures trading in the Indian stock market.
Rajoub and Azzam	2012	Amman	Amman Stock Exchange's (ASE) general weighted price index	GARCH-M	A negative correlation found between returns and volatility before and after the crisis.
Gahlot, R., Datta, K. and Kapil, S.	2010	India	S&P CNX Nifty index, 5 individual derivatives stocks, and 5 individual Non-derivatives stocks	ADF and GARCH(1,1)	Changes in the structure of volatility but no significant change in the volatility
Pati, P.C. and Rajib, P.	2010	India	NSE S&P CRISIL NSE Index and Nifty index futures	LM test, ARMA-EGARCH	Volatility reduced after the introduction of futures trading
Hiremath, Gaurishankar S.	2009	India	NSE Option Index	GARCH (1,1)	Volatility has increased after introducing options in the Indian financial market.
Manier, M.	2009	India	Nifty 50 index	GARCH, EGARCH, and GJR	No significant change in the volatility
Mallikarjunappa, T. and Afsal, E.M.	2008	India	S&P CNX Nifty Index		Found changes in the volatility patterns after the inception of derivatives, but they couldn't find any significant change in the underlying market in terms of stabilization or destabilization of the market
Gupta, K. and Singh, B.	2008	India	Nifty junior index and Nifty index	ARCH/GARCH (1,1)	Volatility reduced after the introduction of futures trading
Bhaumik, Karanasos and Kartsaklas	2008	India	NSE index	FI-GARCH, bivariate dual long-memory model	Volatility reduced after the introduction of futures trading. Results also concluded that there was decrease in volume of futures after the introduction of options and significant expiration day effect.
Kasman, A. and Kasman, S.	2008	Turkish stock market	ISE-30 index	EGARCH	Volatility reduced after the introduction of futures trading.

Author	Year	Country	Indices	Techniques	Result found
Debasish, S.S.	2008	India	NSE Nifty Spot Market	Six measures of volatility, the linear regression model, and the GARCH models	No significant change in stock market volatility.
Drimbetas, E. et al	2007	Athens stock exchange, Greece	FTSE/ASE 20 index, DAX30, DJIA, and MSCI	EGARCH	Volatility reduced after the introduction of futures trading.
Siopis and Lyroudi	2007	Athens stock exchange, Greece	FTSE/ASE 20 index	GARCH (1,1), EGARCH (1,1) and TGARCH (1,1)	Significant changes in the volatility following the introduction of futures.
Katsikas, E.	2007	European markets	Index futures of major European stock markets	EAR-GARCH	Negative relationship between volatility and autocorrelation
Sarangi, S.P. and Patnaik, U.S.	2006	India	S&P CNX Nifty, Nifty junior, and S&P 500 index	GARCH and IGARCH	No significant change in the volatility. However, change in the structure of the volatility was observed.
Sah, A.N. and Omkarnath, G.	2005	India	S&P Nifty index and many indices like Nifty junior, NSE 200, S&P Nifty 500, BSE 100, and BSE 200	GARCH (1,1), EGARCH	No significant change with the introduction of futures and options
Raju, M.T. and Karande, Kiran	2003	India	S&P CNX Nifty Index futures	Cointegration analysis and GARCH techniques	Volatility has reduced after the introduction of futures trading. Price discovery prevails in the futures and spot market
Ghosh, G. and Bandivadekar, S.	2003	India	S&P CNX Nifty and BSE Sensex, nifty junior and BSE-200	GARCH/ARCH	Fall in volatility, after the introduction of futures trading
Shenbagaraman, P.	2003	India	S&P CNX Nifty	GARCH (1,1)	No significant change in the volatility
Thenmozhi, M.	2002	India	NSE 50 futures and NSE 50 index, S&P CNX Nifty index futures	Standard Deviation	Reduced volatility after the introduction of futures trading.
Pilar, C. and Rafeal, S.	2002	Spain	Spanish stock market	GARCH, EGARCH, and GJR,	Reduction in volatility post introduction of futures trading in Spain.
Yu, Shang-Wu.	2001	USA, France, Japan, Australia, UK and Hong Kong	Different indices of six countries	GARCH (1,1) MA (1),	Increase in volatility in the U.S., France, Japan, Australia. No significant change in the U.K. and Hong Kong.
Gulen, H and Stewart, M.	2000	Twenty-five countries	indices of twenty-five countries	GARCH models	Volatility increased in the U.S. and Japan.
Butterworth, D.	1998	UK	FTSE Mid 250 futures contracts	GARCH	Futures trading has significantly changed the volatility structure.
Smit, E. and Nienaber, H.	1997	South Africa	Share, Gold and industrial indices of (Johannesburg Stock exchange) JSE	ARIMA	Positive relationship between equity volatility and trading volume of spot and futures market.



Based on the results of the above studies particularly including Singh S. and Tripathi L.K (2016), Sahu, D. (2012), Kalantzis, G.F. and Milonas, N.T. (2013), Gahlot, Ruchika and Datta, Saroj Kumar (2012), Rajoub and Azzam (2012), Pati, P.C. and Rajib, P. (2010), Gupta, K. and Singh, B. (2008), Bhaumik, Karanasos and Kartsaklas (2008), and Kasman, A. and Kasman, S. (2008) the view forward is that introduction of derivatives have led to decrease in stock market volatility. However, studies including Hussain and Atif (2020), Hiremath, Gaurishankar S. (2009), Yu, Shang-Wu. (2001), Gulen, H and Stewart, M. (2000), and Smit, E. and Nienaber, H. (1997) concluded that the volatility has actually increased with derivatives. Studies including Debasish, S.S. (2008), Mallikarjunappa, T. and Afsal, E.M. (2008), Gu, S. and Gong, X. (2012), Gahlot, R., Datta, K. and Kapil, S. (2010), Manier, M. (2009), Sarangi, S.P. and Patnaik, U.S. (2006), Sah, A.N. and Omkarnath, G. (2005), and Shenbagaraman, P. (2003) found that with the introduction of derivatives there was no significant change in the volatility.

Review of Studies on Lead-lag Relationship

Another important function of introduction of derivatives is its role in price discovery in the spot market. There have been extensive research to analyse the relationship of price discovery between spot market and futures market. Table 2 gives summary of studies related to researchers lead-lag and price discovery relationship of spot and derivatives market. Some authors have undertaken this study in Indian context and it includes Mall, et. al (2012); Choudhary, K. Bajaj, S (2012); Debasish, S.S. (2009); and Jackline S and Deo, Malbika (2011) who studied lead-lag relationship in India.

Most of the studies related to lead-lag relationship between futures and cash/spot market have been carried out in other countries also which includes IngyuChiouet.

al (2011) studied over four countries like Tokyo, London and New York; Hsu, H. et. al. (2008) and Cheng, C. et. al (1995) studied in USA and Taiwan; Gee C. S and Karim, Mohd (2005) in Malaysia, Sakellariou, I.K. (2010) worked in Germany; Kavussanos, M.G. et. al (2008) and Floros C. Vougas, D.V. (2007) studied in Greece; Fung, JKW, Jiang, Li and Louis T.W. Cheng (2000) studied in Hong Kong; Kurka, John F. (2011) conducted study in California; Pomona, Min, J.H. Najand, Mohd. (1999) analysed Korean market.

Most of such studies have been carried out on indices and option and futures on indices like Debasish, S.S. (2009) analysed NSE Nifty stock market index and futures and options index; Mukharjee and Mishra, R.K. (1999) evaluated spot market index and index futures; Kurka, John F. (2011) analysed S&P 500 futures contract and the S&P 500 spot index; Min, J.H. Najand, Mohd (1999) studied KOSPI 200 index and its nearby futures contracts.

The data frequency used by various authors includes studies based on daily prices, high frequency minute to minute price data, weekly and monthly data. The studies worth mentioning include Gupta, K. and Singh, B. (2006); Brooks, Rew and Stuart (2001); Herbst, McCormack and West (1987); Kawaller et al. (1987); Stoll and Whaley (1990); Cheung and Ng (1990); Chan, K. et. al (1991); Jiang, Li and Louis T.W. Cheng (2000); Kurka, John F. (2011) studied on Minute to Minute data; Debasish, S.S. (2009) studied on hourly returns data. Mukharjee and Mishra, R.K. (1999); Chan, K. (1992); Maniar, H.M. et. al (2007); and Sakellariou, I.K. (2010) studied on intraday data, Kavussanos, M.G. et. al (2008); Mall et al. (2012); and Floros C. Vougas, D.V. (2007) analysed daily returns and volatilities between price movements, Saatcioglu, K. and Starks, L. (1998) used monthly data. A brief summary of the studies on review of lead-lag relationship and price discovery is given in Table 2 as under.

Table 2: Studies on Lead-Lag Relationship between Derivatives and Spot Market

Author	Year	Country	Indices	Techniques	Result found
Frommherz	2019	Germany	DAX	Threshold error correction model	The futures market leads the spot market for price discovery. There is a sensitivity towards the market environment and short-selling weakens price discovery.
Ren	2019	China	Chinese mainland stock market	Thermal optimal path	The index option leads the index during stable time, but lead-lag relation reverses when bearish trend
Ahn et al.	2019	China	SSE 50 Index	VECM	transaction costs do not affect the role of price discovery. derivative market is leading the price discovery process
Damien et al.	2019	U.S.	S&P 500 E-mini futures and the corresponding exchange-traded fund (SPY ETF)	VECM	E-mini futures lead initially and after 2007, both contribute similar portions to the price discovery process.

Author	Year	Country	Indices	Techniques	Result found
Zavadska et al.	2018	All countries	Review of Literature	Review	lead-lag relationship is a dynamic during uncertain periods
Fassas and Siriopoulos	2018	Athens stock exchange	Cah and futures market Index	VECM	strong bi-directional dependence in the intraday volatility of both markets
Qin and Heo	2017	Korea	#VKOSPI futures # VKOSPI index # KOSPI index	VECM GARCH	bi-directional lead-lag relationship between the VKOSPI futures and the VKOSPI index there is no lead-lag relationship from VKOSPI futures or VKOSPI index to KOSPI index
Maio	2017	China	Chinese CSI 300	VAR GARCH	significant return and volatility shock spill-over from stock market to futures market
Yen-Hsien and Wan-Shin	2016	Taiwan	spot volatility index (VIX) and futures	VECM and GARCH models	Both VIX spot and VIX futures contribute to price discovery.
Ersoy, E. and Bayraktaroglu, A.	2013	Istanbul	# Daily closing prices # Istanbul Stock Exchange 30 (ISE 30) Index # Turkish Derivatives Exchange (TurkDEX)-ISE 30 index futures contracts	# Johansen Co-integration Test, # Vector Error Correction Model # Granger Causality Tests	Found that spot and futures markets are co-integrated and two-way causality between spot and futures markets. No lead-lag relationship between spot and futures markets.
Mall M, Bal R. K. and Mishra P. K.	2012	India	# Daily observations # Nifty index and Nifty based index futures (FUTIDX) prices at the National Stock Exchange Ltd (NSE) of India, NSE database	# Augmented Dicky fuller, # Unit root test, # Co-integration, Vector Error Correction	Proved that the index futures market leads to the spot market in the long-run only, but not in the short-run.
Dmytro Kovalchak	2012	Russian	# 5-minute data # futures and index prices and on 50 Russian stocks of RTS index of Russian market to find that relationship.	# Three-stage-least-squares regression	Exhibited bi-directional relation between spot and futures markets
Choudhary, K. Bajaj, S.	2012	India	Individual Stocks	# Johansen's cointegration # Engle and Granger's residual based approach, # Granger causality test # VECM (Vector Error Correction Model)	Found that there is a bi-directional relationship between the spot and futures markets in case of 30 securities information flow and one security, i.e., Wipro is showing a unilateral relationship from spot to futures. Also, depicted that the futures market is leading the spot market in the case of 12 securities, whereas the spot market is leading 19 securities.



Author	Year	Country	Indices	Techniques	Result found
IngyuChiou et al.	2011	Tokyo, London and New York	10 years data	# Regression model	Found that Tokyo leads London and New York; London leads New York and Tokyo, and New York leads Tokyo and London. He observed the strongest relationship between London and New York is the strongest.
Jackline S and Deo, Malbika	2011	MCX (Multi Commodity Exchange), India	# The spot and futures prices # Lean hogs and pork bellies were obtained	# Augmented Dickey Fuller tests # Phillips-Perron tests, # Granger causality test, # Unit root tests # Pairwise Granger Causality tests	Proved bi-causality relationships among markets, found that short term future price series leads (Granger cause) the cash market and vice versa for both the selected markets.
Sakellariou, I. K.	2010	German	# Intraday data # DAX index, German market	# Multivariate Threshold Regression Model (TRM) of Tsay (1998)	Main findings of this study is that there exist short run effects between the two markets across time.
Debasish, S.S.	2009	India	# Hourly returns # NSE Nifty stock market index and futures & options index	# autoregressive moving average (ARMA) models	This study shows that Nifty derivatives market lead the underlying stock index. The futures & options market also leads the cash market overall.
Srinivasan	2009	India	# Daily data series # June 12, 2000 to September 12, 2008 data of Nifty spot index and index futures market in India	# Johansen's Co-integration # Vector Error Correction Model (VECM)	The empirical results reveal that there exists a long-run relationship between Nifty spot and Nifty futures prices. Further, the results confirm the and also found a bidirectional relationship between the Nifty spot and Nifty futures market prices in India.
Kavussanos, M.G. et. al	2008	Greece	# Cash and futures prices daily returns and volatilities between price movements # FTSE/ATHEX-20 and FTSE/ATHEX Mid-40 stock index futures and the underlying cash indices in the futures market of Greece.	# Granger causality, # VECM-GARCH, # GJR analysis.	Found a bi-directional relationship
Gee C. S and Karim, Mohd	2005	Malaysia	# spot and futures markets of the Malaysian Kuala Lumpur Composite Index (KLCI)	# Co-integration # Error-correction model (ECM)	# suggested that cash market and futures market are co-integrated # futures price lead spot price and the change in futures price is relatively more efficient as compared to spot price # The results also indicate that spot price do lead futures price but the lead-lag relationship is relatively weak as compared to the impact of futures price on spot price.

Author	Year	Country	Indices	Techniques	Result found
Kenourgios	2004	Athens	# Daily data # The period from August 1999 until June 2002 from FTSE/ASE-20 stock index and the three-month FTSE/ASE-20 index futures contract are from the Athens Stock Exchange (ASE) and the Athens Derivatives Exchange (ADEX) respectively	# Co-integration test # error correction model	The presence of a bi-directional causality between stock index spot and futures markets were found in the study.
Maniar, H.M., Maniyar, D.M. and Bhatt, R.	2007	India	# Intraday data has been collected # weighted average of 50 stocks	# Granger-Sims causality regression model	The authors concluded that future returns lead both cash and options index returns by 10 minutes.
Thenmozhi, M.	2002	India	NSE 50 futures and NSE 50 index, S&P CNX Nifty index futures		This study shows that futures index lead the spot index returns by one day.
Min, J.H. Najand, Mohd	1999	Korea	# 10-minute intraday data # KOSPI 200 index and its nearby futures contracts studied in Korea, utilized intraday data.	# Jarque-Bera normality test # SEM Simultaneous Equation Model # VAR	# A bidirectional causality exists in between cash and futures markets # Futures market leads the cash market by as long as 30 minutes
Saatcioglu, K. and Starks, L.	1998	Latin America	# Monthly data of six markets of Latin America	# Granger causality test	Found no relationship between weekly prices and volume and a positive relationship between monthly prices and volume.
Cheng, C., Cheng, I, Huang, H	1995	US and Taiwan	# TAIEX	# GJR-GARCH (1,1) model	TAIEX led the spot and futures prices of the U.S. market, and on the other hand the spot and futures prices in the USA led the spot index in Taiwan.

Majorly the scholars have studied lead lag relationship, using Granger Causality test, cointegration test and VECM (Vector Error Correction Model) technique and various techniques. Some of the prominent techniques used are Ingyu Chiou et al. (2011) used regression, Saatcioglu, K. and Starks, L. (1998); Kavussanos, M.G. et al. (2008); Choudhary, K. Bajaj, S. (2012) applied Granger causality test, Chan, K. (1992) applied GARCH, Hsu, H. et al. (2008) conducted VAR, Granger causality test and generalized impulse response function (GIRF) analysis. Gupta, K. and Singh, B. (2006) used VAR (Vector Auto regression) and VECM; Chan, K. et al. (1991); and Floros C. Vougas, D.V. (2007) applied bivariate GARCH. Bivariate GARCH. Mall et al. (2012); Jackline et al. (2005); Min, J.H. Najand, Mohd (1999) applied cointegration, Vector Error Correction, Granger causality, VECM-GARCH, GIR analysis.

Analysis of the results highlight different observations about price discovery function of derivatives market. Frommherz (2019); Ahn et al. (2019); Gupta et al. (2018); Yen-Hsien and Wan-Shin (2016); Debasish, S.S. (2009); Srinivasan (2009); Thenmozhi, M. (2002); Stoll and Whaley (1990); Cheung and Ng (1990); Chan, K. et al. (1991); Min, J.H. Najand, Mohd (1999); Mall M, Bal R. K. and Mishra P. K. (2012); and Maniar, et al. (2007) propounded that derivatives lead the cash market. Cheng, C. et al. (1995) TAIEX led the spot and futures prices of the US market, Gupta, K. and Singh, B. (2006) no relationship found in eight individual stocks with their related futures contracts. However, Zavadzka et al. (2018), Qin and Heo (2017), Maio (2017), Ersoy, E. And Bayraktarolu, A. (2013), Saatcioglu, K. and Starks, L. (1998) concluded otherwise. Mall M, Bal R. K. and Mishra P. K. (2012) Dmytro Kovalchak (2012), Choudhary, K. Bajaj,



S. (2012), Jackline S and Deo, Malbika (2011), Kavussanos, M.G. et. al (2008), and Min, J.H. Najand, Mohd (1999), showed mixed results.

Concluding Remarks

The results of analysis of review of related studies have brought out some major findings and areas of research gap for both functions of role of derivatives in underlying spot market. Derivatives trading has low transaction costs than the cash market. Thus, it helps in enhancing the availability of information flow. Frequent arrival and rapid processing of information might lead to increased volatility in the spot market. But since derivatives market provides low cost transactions and helps in price discovery, it can also lead to reduction in volatility in the spot market. The results of various studies on impact of the introduction of derivatives on market volatility gives mixed results. In different time periods spot markets have shown reduction in volatility and many times volatility has increased, even in some cases there was no impact on the volatility in the spot market due to available derivatives products. This can be so because of the time period involved in the study such as short run, medium term and long term studies. Most of the studies have been carried out on daily prices of Indices and have used GARCH family of models. The analysis also brings out various research gaps related to identifying the time period for study. There should be study which is carried out on long time duration, which includes various structural breaks to be analysed. This long period should also be divided into short periods of high and low volatility for better and clear understanding of results. There should be studies which focus on global financial crisis time period also and how Indian stock market volatility have changed during the crisis and after the crisis. It can also be analysed that whether the market dynamics related to volatility and price discovery changed in the long run after the global financial crisis. There can be comparative studies on changes in volatility patterns across different countries.

Based on review of related studied on price discovery function of derivatives market and whether spot market leads the derivatives market or vice versa, it can be concluded that the studies have shown mixed results. There are studies which confirm that derivatives market helps in price discovery when studied in different countries and markets. The sample frequency where high frequency data has been taken makes an impact on the results. The results are different because of time duration of the studies which varies from short period to long period. Majorly long period analysis have been carried out on daily data and short period analysis have used high frequency data. The research gap identified here includes that very few studies have been conducted in Indian scenario and there is no study which has been carried out on global financial crisis period and studying the changes in market dynamics during and after financial crisis. Apart from that, analysis can be carried out on other structural breaks like

demonetisation, introduction of GST and even the COVID-19 time periods can be studied.

To conclude, the study on impact of derivatives on volatility and price discovery has ample scope of research in the current scenario as market dynamics are changing very fast. In Indian scenario, a study on analysing the success of derivative market is important as derivatives markets have seen tremendous growth in last few years and are moving towards maturity as it has completed twenty years of trading period.

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The Editorial Board had used the Turnitin tool to check the originality and further affixed the similarity index which is {3%} in this case (See below Annexure-I). Thus, the reviewers and editors are of view to find it suitable to publish in this Volume-12, Issue-3, July-September 2020.

Annexure 1

Submission Date	Submission Id	Word Count	Character Count
13-May-2020	1319321556 (Turnitin)	7867	52008

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Reviewers Comment

Reviewer's Comment 1: The paper is rich in literature and studied literature in the last 25 years. Author has analysed the review of related research studies conducted on the impact of derivatives on market volatility, and studies on Lead-Lag relationships between derivatives and spot markets. And organized into two sections i.e. review of studies related to impact of market volatility, and review of studies related to the lead-lag relationship between cash and derivatives market.

Reviewer's Comment 2: The paper is well structured and organised. The usage of tables has made it more presentable and lucid to understand. Also the author has provided a quite large number of references.

Reviewer's Comment 3: The research is quite significant. In Indian scenario, a study on analysing the success of the derivative market is important as derivatives markets have seen tremendous growth in the last few years and are moving towards maturity as it has completed twenty years of trading period.



Narender and Rumki Bandhopadyay
 "Impact of Financial Derivatives on Volatility and Price Discovery in Stock Markets – Review of Related Studies"
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Conflict of Interest: Author of a Paper had no conflict neither financially nor academically.

Editorial Excerpt

The article has 3% of plagiarism which is the accepted percentage as per the norms and standards of the journal for the publication. As per the editorial board's observations and blind reviewers' remarks the paper had some minor revisions which were communicated on a timely basis to the authors (Narender & Rumki) and accordingly all the corrections had been incorporated as and when directed and required to do so. The comments related to this manuscript are noticeably related to the theme **“Impact of Financial Derivatives on Volatility and Price Discovery in Stock Markets”** both subject-wise and research-wise. The paper examines the literature related to the impact of derivatives on volatility and price discovery in stock markets. The literature systematically analyses studies conducted on this subject in the last 25 years. The research found that there are a mix of techniques used by various researchers while analyzing volatility and lead-lag relationship between spot market and derivatives market. The studies have been carried out on high frequency data, daily and monthly data as well. Overall, the paper promises to provide a strong base for the further studies in the area. After comprehensive reviews and editorial board's remarks the manuscript has been categorised and decided to publish under **“Review of Literature”** category.

Acknowledgement

The acknowledgment section is an essential part of all academic research papers. It provides appropriate recognition to all contributors for their hard work and effort taken while writing a paper. The data presented and analyzed in this paper by authors were collected first handily and wherever it has been taken the proper acknowledgment and endorsement depicts. The author is highly indebted to others who had facilitated in accomplishing the research. Last but not least endorse all reviewers and editors of GJEIS in publishing in a present issue.

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