

## **Derivatives Trading and Stock Market Volatility: A Systematic Review**

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### **ABSTRACT**

Derivative products like futures and options on Indian stock markets have become important instruments of price discovery, portfolio diversification and risk hedging in recent times. Two contractory views exist relating to the impact of derivatives on spot market volatility. 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. The second view is based on the theory of market completion which suggests that derivatives help in improving market depth, liquidity, market efficiency price discovery, reduce asymmetric information and reduces the volatility of the cash market. The present paper aims at presenting a comprehensive review of literature related to the introduction of derivatives and their impact on spot market volatility.

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The reforms in the financial sector that took place in the Indian economy during the nineties, resulted in the formation of a vibrant secondary market for stocks. Among other things the reforms created institutional structure to facilitate fair trading to each market participant at a low cost. However, despite the reforms the levels of concentration in trading as well as the level of speculative trades were too high. It was in this backdrop that the L.C. Gupta committee recommended the introduction of derivative instruments so that some of the speculative transactions, which currently take place in the spot market, can be attracted towards the derivatives market. Moreover, introduction of derivative instruments would also enable investors to choose the level of portfolio risk that they are comfortable with. Any risk in excess of this level can be hedged away.

In order to have an efficient derivatives market, it is important to have an efficient spot market. An efficient spot market will be characterized by asset prices that reflect information that is available to the different investors. In fact, both these markets complement each other in terms of their respective efficiencies. On commencement of derivatives trading there arrives a set of active information seekers who, in general, improve market efficiency. These information seekers can be of three types (i) hedgers (ii) arbitrageurs or (ii) manipulators. While hedgers and arbitrageurs facilitate the linking of spot market prices with the futures market price, the manipulators may not facilitate this process. In other words, a derivative market without manipulators, introduces a set of information seekers who improve the efficiency of the spot market by incorporating the information, privy to the derivative market participant, in the spot market asset prices. However, in the presence of manipulators, these information seekers play an ambiguous role. And one can not rule out the possibility of manipulators because of the high level of leverage offered by the derivative instrument. Therefore, it can be said that the effect of additional information, generated by derivatives trading, on

the spot market asset prices, depends on the purpose for which the derivative instrument is used. In India most derivative traders describe themselves as hedgers and Indian laws generally require derivatives to be used for hedging purpose only (Sarkar, 2006). However, in practice it is very difficult to differentiate a hedger from a speculator.

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 tryst 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). The present paper aims at presenting a comprehensive review of literature related to the introduction of derivatives and their impact on spot market volatility.

The systematic review of studies reveal that impact on volatility in the Indian market has been extensively studied. 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.

The studies which carried out on analysis of impact on volatility 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 (Johannesburg 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.

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.

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 Ingyu Chiouet. 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.

These studies used Granger Causality test, cointegration test and VECM (Vector Error Correction Model) technique and various techniques. Some of the prominent techniques used are Ingyu Chiouet. 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. 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 resultshighlight 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, Zavadska et al. (2018), Qin and Heo (2017), Maio (2017), Ersoy, E. And Bayrakdaroglu, A. (2013), Saatcioglu, K. and Starks, L. (1998) concluded otherwise. Mall M, Bal R. K. and Mishra P. K. (2012) DmytroKovalchak (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.

### **Conclusion**

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.

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