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Indian Stock Market's Volatility and Derivatives: An Analytical Study

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Abstract

In recent years, Indian stock markets' derivative products, such as futures and options, have developed into crucial tools for price discovery, portfolio diversification, and risk hedging. Using the ARCH/GARCH technique, this study investigates how the introduction of index futures has affected spot market volatility for both the S&P CNX Nifty and the BSE Sensex. The empirical research suggests that the introduction of index futures led to a decrease in spot market volatility because fresh news had a greater impact and uncertainty resulting from older news had a less impact. Yet, further research also demonstrates that over the time under review, market-wide volatility has decreased. To determine if the introduction of index futures in general has had a positive or negative impact on the market, substitute indexes such the BSE 200 and Nifty Junior are developed. lowering the volatility on the spot market or falling in line with a general decline in volatility across the market. The results obtained using these surrogate indices demonstrate that, while the "futures effect" clearly contributes to the reduction of volatility in the case of the S&P CNX Nifty, its contribution to the reduction of volatility in the case of the BSE Sensex, where derivative turnover is significantly low, appears to be ambiguous.

Key words: Index futures, volatility, stock markets, derivatives, and ARCH-GARCH

Introduction

A financial instrument is considered a derivative if its value is "derived" from another underlying security or a group of securities. These incredibly adaptable instruments allow traders to take on highly leveraged bets at

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cheap transaction costs. Index futures, stock futures, index options, and stock options are a few examples of derivative products that have become In recent years, there have been significant price discovery, portfolio diversification, and risk hedging tools on stock markets all around the world. Investors now have access to a larger selection of instruments as a result of the introduction of all the aforementioned derivative products in the Indian markets. Yet, the introduction of derivative products has not always been viewed favourably globally. In reality, it is viewed as a market for speculators, and there has long been fear that this could negatively affect the spot market's volatility. Yet, recent research supports the claim that the introduction of these products not only broadened the markets but also played a key role in lowering volatility in the spot markets. In June 2000, index futures were introduced to the Indian stock exchanges. Afterwards, index options, stock futures and options, and interest rate futures were also established. Particularly in the case of the National Stock Exchange (NSE), the volumes in derivative markets have significantly increased, and at this time, the turnover in derivative markets is significantly bigger than the turnover in spot markets.
This article attempts to investigate if there has been any discernible change in the volatility of the Indian spot markets after the introduction of index futures in June 2000. Additionally, it makes an effort to determine whether the volatility change is the result of unrelated macroeconomic factors or if it may be related to the derivative products that were recently launched to the Indian stock markets. The structure of this article is as follows: The literature review is presented in Section I, the methods and outcomes of the empirical exercise are evaluated in Section II, and the study's findings are presented in Section III.

Section I

Literature Survey

According to one school of thinking, the introduction of futures trading causes the spot market to become more volatile and thus destabilises the market (Cox 1976; Figlewski 1981; Stein, 1987). Others contend that the addition of futures actually lessens the volatility of the spot market and stabilises the market (Powers,

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1970; Schwarz and Laatsch, 1991 etc.). This section goes into great length about the thinking behind and outcomes of these two alternative schools.

The first school's supporters see the derivatives market as a speculative market. The derivatives market, which is known for high risk, is accessible to traders with little to no capital or stock. Hence, it is claimed that speculative traders' involvement in systems that permit high levels of leverage degrades market information quality. These uneducated traders could contribute to market instability in cash markets (Chatrath, Ramchander and Song, 1995). Another point of view, however, suggests that speculation can also be seen as a process that balances out price swings.

The argument over traders and how futures affect spot price volatility shows that more volatility is not desired. Nevertheless, this is deceptive since it ignores the connection between the knowledge and the volatility (Antoniou and Holmes, 1995). The information that is currently available on the market affects prices. Due to two factors, futures trading may change the information that is available. First, futures trading draws more traders to the market; second, because futures market transaction costs are lower than those in the equity market, futures trading.

On the other side, there are equally compelling claims that the futures and options markets have developed into significant venues for price discovery in the cash markets. Numerous authors have suggested that trading in these items increases market liquidity, decreases informational asymmetries, improves market efficiency, and reduces volatility in the cash market (Kumar, Sarin and Shastri, 1995; Antoniou, Holmes and Priestley, 1998).

Section II Empirical Analysis

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We used daily data for the BSE Sensex and S&P CNX Nifty from January 1997 to March 2003. We also take into account the volatility on the broad-based BSE-200 and Nifty Junior, on which derivative products have not yet been offered, in addition to these two series on which derivative products are currently available. Despite the fact that BSE and NSE prices are closely correlated through arbitrage, these markets' derivative turnover is very different (with the NSE recording a maximum turnover in the derivative market). A hint for differentiating the swings caused by the introduction of future items and those caused by other market factors may come from comparing the volatility fluctuations between the BSE-200/Nifty Junior and the Sensex/Nifty. Several widely used indices are available, including BSE-100, BSE-200, BSE-500, and Nifty.

The empirical test looks at whether the introduction of index futures had any notable effects on the volatility of spot stock returns. To assess the effect of these policy changes on the volatility of stock returns, it looks at daily returns on the BSE Sensex, daily returns on the S&P CNX Nifty, and daily returns on the BSE-100, BSE-200, and BSE-500. The Generalized Autoregressive Conditional Heteroscedasticity (GARCH) framework is used in this paper to model return volatility, following Bologna and Cavallo (2002).

Bollerslev (1986) created the GARCH model as a generalised version of Engle's Autoregressive Conditional Heteroscedasticity from 1982. (ARCH). The conditional variance at time 't' in the GARCH model is dependent on the squared error term past values and the conditional variance past values.

Bollerslev's (1986) GARCH (p, q) model is illustrated as follows:

Bollerslev's (1986) GARCH (p, q) model is illustrated as follows:

Yt = aX+?t?t?/?t-1N (O, ht)

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ht = ß o

+ Sß I

? t-i

+ Sß j

ht-j

with I = 1, 2, p and j = 1, 2...

Where Xis a group of independent variables and Yt is the dependent variable (s). ? The GARCH error term t has a mean of zero and a variance of ht.

In order to simulate stock return volatility, the GARCH (1,1) framework has been widely shown to be the most frugal representation of conditional variance that best matches a variety of financial time series (Bollerslev, 1986; Bologna and Cavallo, 2002). Here is the model specification:

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Rt=ao+a1Rt-1 +? t? t /? t-1 N (O, ht)

ht = ß o

+ ß 1

? t-1

+ß 2

ht-1

+ l Df

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where Rt is the BSE Sensex daily return and Rt-1 is the lag return. Following Bologna and Cavallo (2002), the conditional variance has been supplemented by the dummy variable Df, which has a value of zero for the pre-index-futures era and a value of one for the post-index-futures period. To determine if the introduction of index futures could be connected to any change in the volatility of the spot market, the direction and magnitude of the dummy variable coefficients are employed. In order to gain a greater understanding of the change in the coefficient values and how it affects the volatility of stock returns, this exercise also calculates the GARCH model's coefficients independently for the pre-index future and post-index future periods. The

a_0	a_1	b_0	b_1	b_2	l
Estimates for the Whole Period					
0.05	0.11	0.55	0.18	0.69	-0.28
(0.19)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Before the Introduction of Index Future					
0.10	0.09	0.44	0.12	0.76	
(0.12)	(0.02)	(0.01)	(0.00)	(0.00)	
After the Introduction of Index Future					
0.03	0.13	0. 32	0.26	0.61	
(0.53)	(0.00)	(0.00)	(0.00)	(0.00)	

The first two rows of the Table 1 present the result for the whole period under consideration for BSE Sensex. It shows the coefficient of the index-futures dummy variable ($l = -0.28$) is significant at one per cent level, which is indicative of the fact that the introduction of index futures might have made a difference in the volatility of BSE Sensex returns. The negative sign of the dummy variable coefficient is suggestive of the reduction in the volatility. This preliminary result supports the hypothesis that the introduction of index future has reduced the volatility in the BSE spot market, even though derivative turnover is quite low in BSE as compared with NSE.

The results reported in Table 1 presents estimate of the GARCH model coefficient for the pre-future trading and post-future trading periods. The

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coefficients reported in Table 1 support the findings of the Antoniou and Holmes (1995) and Bologna and Cavallo (2002). It shows that in the GARCH variance equation the b_1 components have gone up and b_2 components have actually gone down in the post Index-future period and these estimates are significant at one per cent level. The b_1 component is the coefficient of square of the error term and the b_2 represents the

Coefficient of the lagged variance term in the GARCH variance equation. Both Antoniou and Holmes' (1995) and Bologna and Cavallo's (2002) papers have referred b_1 as the effect of 'recent news' and b_2 capturing the effect of 'old news'. Thus, in line with the findings in the UK and Italy, the result reported here supports the hypothesis that introduction of index futures have actually increased the impact of recent news and at the same time reduced the effect of uncertainty originating from the old news.

The Index futures were introduced only in the BSE Sensex and not in the other (*e.g.*, BSE-100, BSE-200 and BSE-500) indices available on the BSE. Moreover, futures trading was introduced in most of the scrips included in the BSE Sensex. Thus, if index and stock futures were the only factors instrumental in reducing the spot price volatility then the reduction in volatility is expected to be more in the case of the BSE Sensex in comparison to the other indices available in BSE. In an attempt to evaluate whether the introduction of futures was the only reason behind the reduction of volatility in BSE Sensex, the same GARCH model with the same dummy variable was used to evaluate the changes in volatility for the BSE-100, BSE-200 and BSE-500. Table 2 shows the estimated coefficients of the model where the dummy variable represents the inception of index future.

a_0	a_1	b_0	b_1	b_2	I
For BSE-100					
0.07	0.13	0. 44	0.21	0.68	-0.15
(0.05)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
For BSE-200					
0. 08	0.13	0. 32	0.15	0.78	-0.08
(0.05)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
For BSE-500					
0. 08	0.11	0.28	0.14	0.81	-0.14
(0.11)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

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Conclusions

Using ARCH/GARCH methodology, this article evaluated the impact of introduction of derivative products on spot market volatility in Indian stock markets. We found that the volatility in both BSE Sensex and S&P CNX Nifty has declined in the period after index future was introduced. Recognising the fact that the decline in volatility is function of not only introduction of derivative products, but also certain market wide factors, we evaluated the volatility of BSE-100, BSE-200 and BSE-500 indices (where index futures have not been introduced) which showed a decline and indicated that the other market wide factors might have played an important role in the observed decline in volatility of BSE Sensex and S&P CNX Nifty. In order to control the market-wide factors, we used BSE-200 and Nifty Junior as surrogate indices in the GARCH model. Using this model, we found a reduction in volatility of S&P CNX Nifty even after controlling for market wide factors. The volatility of BSE Sensex, however, showed an increase, which is not in line with the expectations. This result indicates that the decline in volatility of BSE Sensex was mainly due to the overall decline in market volatility. S&P CNX Nifty, however, incorporated the contribution of both the 'market factors' as well as the 'futures effect'. This is due to increased impact of recent news and reduced effect of uncertainty originating from the old news.

In conclusion, the empirical results of this study indicate that there has been a change in the market environment since the year 2000, which is reflected in the reduction in volatility in all the BSE indices and S&P CNX Nifty. The impact of a derivative product, however, on the spot market depends crucially on the liquidity characterising the underlying market. This is evident from the differential results obtained for BSE Sensex and S&P CNX Nifty. It may be added, that turnover in the derivative market of BSE constitutes not only a small part of the total derivative segment, but is miniscule as compared to BSE cash turnover. Thus, while BSE Sensex incorporates only the market effects, the reduction in volatility due to "future's effect" plays a significant role in the case of S&P CNX Nifty.

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