



Munich Personal RePEc Archive

# **Effects of Option Introduction on Price and Volatility of Underlying Assets - A Review**

Hiremath, Gourishankar S

2009

Online at <https://mpra.ub.uni-muenchen.de/46512/>  
MPRA Paper No. 46512, posted 21 Jul 2013 13:45 UTC

## Effects of Option Introduction on Price and Volatility of Underlying Assets A Review

Gourishankar S. Hiremath\*

### Abstract

*The effect of options' introduction on underlying market is one of the frequently debated themes in financial research. A significant body of literature addresses the question of effects of options' introduction. A critical review of the literature shows that there is no consensus regarding the impact. Theoretically, it has been argued that the option market stabilizes the underlying market. Though the empirical evidence of stabilization has not led to consensus, there is little evidence for the destabilization effect of options. Given increasing growth of options in financial markets, especially in emerging markets, the future studies from these markets may shed new light on the debate.*

### 1. Introduction

The derivative products have assumed increasing importance in financial market since the last two decades. The globalization process has further facilitated their rapid growth across the world especially in the emerging markets. The increasing importance of derivatives can be ascribed to the fact that the risk-averse economic agents try to minimize, share or transfer the risk by locking in assets. Derivative instruments such as options, futures, swaps, and currency futures are traded actively on many exchanges throughout the world. Options are one of the important derivative products, that are traded on both exchanges and over the counter markets (OTC). Do options affect the underlying market? This is one of the frequently debated themes in financial research for sometime. There has been no consensus regarding the impact of options introduction, as an instrument of derivative, on underlying stocks, That is, introduction of options might stabilize or destabilize the cash market.

---

\* The author is a Ph.D. student in Economics at the University of Hyderabad. The usual disclaimer holds

Theoretically, it has been argued that options introduction leads to decline in volatility and results in efficiency of the market (Ross 1976, Grossman 1988). The non-linear pay-off structure of the options has encouraged an insightful research in finance. The early empirical works have found no significant change after the introduction of options. However, the later studies challenged this view and provided evidence of decline in volatility and enhancement in efficiency following their introduction. Furthermore, as options are being introduced across the globe, especially in emerging markets, the recent studies from emerging markets may offer interesting insights.

The existing literature dealing with the effects of options introduction on cash market is truly extensive. It covers issues such as volatility, liquidity, lead-lag relation, expiration day effect. The present paper attempts to review the theoretical and empirical research relating to impact of options on underlying cash market, by confining to volatility and price effects. A comprehensive review, covering options, futures and other options, is available in Damodaran and Subrahmanyam (1992), Mayhew (2000). The remainder of the paper is organized as follows. The theoretical hypotheses and models are presented in Section – II, empirical evidences of effect of option on volatility is summarized in Section- III and Section – IV captures the price impact of options introduction. The concluding remarks are mentioned in last section.

## **2. Theoretical Analysis**

Conventionally, options are regarded as redundant in a complete market and therefore, they do not affect the underlying market. However, practically, markets are incomplete and the options contracts do have an impact. (Ross 1976, Jarrow 1980, Grossman, 1988, Detemple and Jorion 1991). Ross (1976) is perhaps the first to theorize the effects of options on underlying assets. He suggested that the options, by disseminating information, expand the investment opportunity set available to the participants/investors. The increased investment opportunities cause decrease in the rate of return and stabilize the market. Ross concludes that the options help to attain efficiency in incomplete markets, by making them complete. Ross (1976) however, has not provided a direction or magnitude of the effects of options.

Like Ross (1976), Grossman (1988) also holds that options make the market complete. The imperfect markets are characterized by presence of asymmetric information. Introduction of options in financial markets affect information revelation through prices. However, a real security may become redundant if dynamic trading strategies synthesize it. In such conditions, options may not have any impact. Back (1993) criticizes this notion by arguing

that such dynamic strategy ignores the information role of real security market. Grossman developed a market model to examine the information asymmetry among market participants. The model explains that, in the absence of options, market participants would be unaware of the fraction of participants following similar strategies and thus volatility remains unidentified. Under such conditions, a market participant finds, the strategy unfeasible if a large fraction of participants use similar strategies. The model further explains, participants would not have to know what the other traders are doing since the options reveal such information. In other words, option price convey the information about anticipated volatility and fraction of market participants following a particular dynamic strategy. Grossman concludes that in the absence of option market, it is difficult to forecast volatility and hence the demand for liquidity.

In reality, financial markets being incomplete, derivatives affect the stocks (Detemple 1989). Detemple and Selden (1991) further illustrate this in a general equilibrium model of an incomplete market framework, and demonstrate that the asset price is not independent of derivative contracts as Black and Schole (1973) model assumes. Through the mean-variance model of Mossin (1969), they analyze the interaction between stocks and options. The model shows that there exists generic interaction between stocks and options. Given the diversity among investors, options increase the span of pay-off space and would be traded in equilibrium. The introduction of options, thus, causes an upward shift in price of the stocks and decline in rate of return leading to market stabilization. The view of less risk-assessing investor that option is complement to stock substantially contributes to this stabilization

Back (1993) extends the model of Kyle (1985) to analyze the relation between asymmetric information and options. The model assumes that the value of the underlying asset is normally distributed and that the liquidity trades in the stock and options have a constant coefficient. The model shows that options can affect the underlying stock by influencing the flow of information into the market. Thus, options trading affects stock price despite options appear to be redundant and can be synthesized by a dynamic strategy as seen in Grossman (1988). The Back's model predicts that options introduction causes volatility to become stochastic. However, the average volatility does not change. There is a major difference between the models formulated by Grossman (1988) and Back (1993). In the former model, the removal of traded options from market would have "real consequences" since they contain trading plans information. In contrast, the inclusion of non-traded option in market reveals information relating to basic value of asset as seen in Back (1993).



The interaction between asymmetric information and market incompleteness is projected to be the cause of market breakdown. Options can mitigate this problem; because, option contracts make the market complete and increase informational efficiency by reducing trading costs of asymmetric information. The introduction of options enables the liquidity traders to better hedge their risk. In other words, the liquidity traders can better match their risk to the new increased pay-off structure in a complete market, once options are introduced (Biais and Hillion 1994). Drees and Eckwert (1995) analyze the risk and volatility in a general equilibrium framework. They suggest that the risk and price volatility are two different concepts and hence arbitrage-based option formula may not be accurate. The study following Lucas (1978) model states that the equilibrium prices will be determined such that individuals bear the existing risk willingly. This is attributed to the no risk sharing among heterogeneous agents.

The introduction of options, which makes the incomplete market to become complete, is a welfare enhancement process as Hakansson (1982) illustrates it. In a general equilibrium framework, Hakansson (1982) analyses the impact of changes in financial market on welfare and prices. The welfare implication of option introduction results in trivially satisfied strong endowment neutrality that is, either feasibility preserving or feasibility expanding. Thus, the interaction of options trading leads to Pareto improvement. However, Diamond (1985) observed that private information could make everybody worse off. This view is further supported by Cao (1999) who argues that the introduction of certain kind of derivative contracts increase trading opportunities and results in increase in incentive to acquire private information. This makes the information to be determined endogenously and therefore risk endowment of investors who acquire private information increases. Cao claims that, in this sense, private information can make every body worse off as analyzed by Diamond (1985).

Brennen and Cao (1996), who analyzed the value of improving trading opportunities by frequent trading, support the view that options lead to Pareto efficiency. They used Hellwig's (1980) model of noisy rational expectations, as an alternative framework. The model of Brennen and Cao (1996) suggests that pay off structure of option contracts is a quadratic function of the risk asset, which leads to Pareto efficient allocation. The option contract leads to increase in market depth by eliminating tendency of informed traders to trade according to trend. However, the model suggests that the prices remain unaffected by option contracts.

The view that introduction of options does not affect the equilibrium prices is further supported by John *et al* (1991). However, the contracts enhance liquidity and reduce volatility. Cao (1999) through a model constructed by him based on noise rational expectation, shows that the introduction of options do affect the price of the underlying asset. The introduction of derivative contracts increases the trading opportunities and the incentive to acquire private information. Consequently, information acquisition will be determined endogenously, which in turn, makes the price more informative. The model further predicts that increase in informational efficiency causes rise in price and decrease in volatility. Furthermore, Cao following the model of Admati (1985) for multi risk assets suggests that as the market becomes more complete because of introduction of options; the additional new options trading will have less effect on price of the underlying stocks.

The existence of price contingent contracts such as options can fundamentally alter the equilibrium in the market for the underlying security. This is further demonstrated by Kraus and Smith (1996). They show that despite the possibility that different investors possess different sets of information and prices, once options are introduced, option prices aggregate the information across heterogeneous investors. This does affect the equilibrium price of the stock. Faff and Hiller (2005) give an alternative hypothesis in contrast to market completeness and short selling constraint hypotheses. They argue that once option trading on security begins, the informed traders migrate to options market in order to exploit the advantages of high leverage offered by options market. Informed traders utilize the options market to speculate on their privileged position. As a consequence of flow of informed traders along with existing active informed traders, information in aggregate market increases. Due to increased informed trading, the volatility increases. Therefore, the options market may be detrimental to functioning of stock market.

The introduction of derivatives such as options destabilizes the underlying market. Stein (1987) theorized this view. The model of Stein explains that the introduction of derivatives provide a conduit through which the additional number of speculators enter the existing market. He recognizes the possible increase in risk-sharing character of increased speculation. Besides, the low marginal requirements lure the speculators to options market (Hardouvelis, 1988). However, the information transmit aspect of options is crucial. The entry of new speculators can change the informational content of the prices. The influx of uninformed speculators inflicts negative externalities on the existing people. Hence, the "misinformation" perceived by uninformed traders destabilizes the market. Besides, if the "misinformation" effect outweighs the risk sharing

effect, it will result in loss in total welfare. Stein, however, does not attribute the misperception to the irrationality of uninformed speculators but to imperfection in their information. Furthermore, the exodus of uninformed traders enhances the asymmetric component of bid-ask spread. This increase in bid-ask spread leads to increase in underlying volatility (Gorton and Pennacchi 1993).

The informed traders face new set of trading strategies in option market. This causes an increase in asymmetric information (Biais and Hillion). The other possible reason for destabilization following options introduction is the decline in the liquidity as a result of trading volume diversion from stock market to option market. The derivative securities, by allowing institutional investors to exploit the price discrepancies cause trading volume to increase. This puts an upward pressure on underlying market and volatility. (Kumar, Sarin and Sastri 1998).

Thus, the foregoing discussion reveals that the theoretical propositions are not unambiguous and hence the theory governing effects of introduction of options on stock market remains inconclusive. We now turn to the empirical evidences that validate the different hypothesis discussed above.

### **3. Volatility Effects of Options Trading**

A significant body of empirical literature on effects of options on underlying market emerged in United States. The early empirical literature on options' impact on volatility is inconclusive. The empirical studies of Nathan (1974), CBOE (1976), Hayes and Tennenbaum (1979), Trennennpohl and Dukes (1979) have reported a decline in volatility around options listing. The study by Nathan (1974) which used sixteen stocks listed on Chicago Board of Exchange (CBOE) found decline in volatility, as measured by standard deviation after option listings. Hayes and Tennenbaum (1979) and CBOE (1976) further confirmed these results. Hayes and Tennenbaum (1979) conducted the cross-sectional and longitudinal analysis for a sample of 43 option contracts against the 21-control group. Trennennpohl and Dukes (1979) also reported declining beta following option listings date. The findings of CBOE (1976) suggest that decline in volatility is due to hedging by option position in related equities. The variation in option strategy and investment objectives caused increase in trading volume of underlying shares. Consequently, volatility declined (Hayes and Tennenbaum, 1979). Nonetheless, a few earlier studies provided evidence of unchanged beta (Klemkosky and Manus 1980, Whiteside et al, 1983). The study by Klemkosky and Manus (1980) measured the volatility by monthly return variance, while Whiteside, Duke and Dunne (1983) used daily data

to calculate returns. These studies found that volatility remained unchanged in pre and post option listings date. However, it is interesting to note that Branch and Finnerty (1981) found increase in variance of the underlying asset, and concluded that options destabilize the cash market. The empirical works cited above however suffer from small sample bias.

The limitations of small sample was overcome by Rao and Ma (1987), Ma and Rao (1988), Nabar and Park (1988), Bansal et al (1989), Conard (1989) and Skinner (1989). By employing multivariate analysis technique, Rao and Ma (1987) and Ma and Rao (1988) documented a decline in volatility after options introduction. With the help of multivariate analysis, Ma and Rao (1988) showed that options introduction strongly stabilize those stocks, which have low return, low trading volume and high risk. They justify their argument by stating that options introduction causes speculation in stable stocks and thus volatility increases. On the other hand, options stabilize volatile stocks since traders use options to hedge their risk. Nabar and Park (1988) who used event study method for a sample of 390 stocks reported similar results. After option listings, volatility declined between 4 to 8 percent. Bansal et al (1989) also provided evidence of decrease in volatility following option listings. They used a sample of 175 stocks for a period 1973-1980.

Furthermore, Conard (1989) investigated the impact of options introduction on a sample of 96 stocks traded on Chicago Board of Exchange (CBOE) and American Option Exchange (AMEX) for the period 1973-1984. She performed event study method with market model. Based on Scholes-Williams (1977) betas, she concluded that introduction is not associated with systematic risk. Nevertheless, she reported decline in variance of average excess returns. She attributed this decline to the selection bias by options exchanges. Conard claimed that, put options do not have any effect on optioned stocks and thus puts are redundant. Kim and Young (1991) also provided support for this conclusion. Nevertheless, Chaudhury and Elfakhani (1997) documented a decrease in the beta risk following the listing of put options. The authors chose 38 stocks, which were put-only listed on Canadian Exchanges for the period September 1975 to June 1993. Based on their results, they conclude that the put options listing is not volatility-neutral and thus put options is not empirically redundant. They explained that the decrease in variance was due to increased liquidity leading to a variance-stabilization effect. Although sample size is low and results are not statistically significant. Chaudhury and Elfakhani, based on arguments of McClosky and Zillack (1996) justify that economic significance of a reduction in the beta risk is more relevant than its statistical significance.

An important study by Skinner (1989) reported 10 to 20 percent decline in volatility after listings, but the beta of the optioned stock is insignificant. The decline in variance was a result of changes in trading activity. However, the study emphasized unduly on median ratio rather than average ratio to estimate changes in variance. Detemple and Jorion (1990), Haddad and Voorhuis (1991) examined the effects of option trading on underlying volatility in the US and found negative changes in volatility and significant decrease in 'beta'. These findings seem inconsistent with Conard (1989), Skinner (1989). The volatility effect dissipated in the later years (late 1980s) however. The price and volatility effects of options dissipate as options are sequentially listed (Detemple and Jorion, 1990). Nevertheless, the initial effect of option before 1981 was due to the speculative activities of the informed trader who influxed into options market (Faff and Hiller 2005). Besides, the rational choice of stocks for listing by forward looking exchanges can be another reason for the initial reaction of stock market to the options listing (Mayhew and Mihov 2000).

An alternative explanation for the relationship between options and underlying assets is given by Damodaran and Lim (1991). For the purpose, a sample of 200-listed stocks on CBOE and AMEX for the period from 1973-1983 was taken. The study explained that first, the options induce investors to acquire additional information and hence price adjustment to information takes place quickly. Secondly, decline in bid-ask spread as a result of options introduction causes decline in noise. Consequently, market becomes stable. Damodaran and Lim (1991) reported a negative variance. Lamoureux and Panikkath (1994) pointed out that volatility is not consistent over time. After controlling market-related changes, they found little evidence of volatility change after option listings in the US. Similarly, Freund *et al* (1994) who divided the sample into three periods and used control sample showed that in the initial periods, there was a decrease in volatility. The observed changes in volatility are not necessarily caused by option listings alone. On the same line of reasoning, using regression methodology linked to control groups, Freund *et al* showed that variance remained unchanged for period between 1986 and 1990.

The studies by Neindorf and Peterson (1997) and St. Pierr and Eileen (1998) provided evidence of a decline in variance in the U S in the early periods of options introduction and no change in the later period. In the post 1981 period, Neindorf and Peterson found minimal and statistically insignificant changes in variance. In the later years, markets have become complete and efficient and therefore the options introduction did not have any impact

on underlying stocks. The observed changes in earlier period of options introduction is not applicable to current market conditions (Neindorf and Peterson, 1997).

Most of the earlier studies used unconditional volatility to investigate the impact of options introduction on underlying market. However, the unconditional volatility measure seldom captures the distinction between volatility change due to event of options introduction and that caused by return dependences. Highlighting this point and making a departure from the earlier studies, Mazouz (2004) employed GARCH (1,1) process, as an alternative measure, to investigate the impact of option listings. He considered a sample of 144 NYSE-listed stocks. For a comparison purpose, he used Merton (1980) variance approximation. Mazouz (2004) found the impact of listing neither on volatility nor on the speed of stock price adjustment to information<sup>2</sup>.

An important study, set within the background of market crash of 1987, defends continuation of development of derivative market. The importance of the paper stems from its data period, 1987 to 1992, i.e. in the post market crash of 1987. Using an extensive sample and control group of stocks to account for market-wide and industry wide influences, Bollen (1998) documented no change in the underlying variance for the stocks traded on CBOE and Nasdaq. The empirical study used Hansen's (1982) Generalized Method of Moment to estimate the parameters. The results of the study showed that the control group exhibits changes in variance that matches changes in the variance of optioned stocks. The t- statistic is not significant to reject the similar variance in control and non-control group.

The exchanges and regulators make decisions concerning listing of options. As a result, the listing event could be considered as an endogenous variable. In such case, the selection bias for listing may influence the effect of options introduction on cash market. Therefore, it is essential to correct the bias before investigating the impact of listing. Mayhew and Mihov (2000) made an attempt in this direction which has seldom received attention in previous works. They interpreted the results of effects of introduction of options on volatility, price and volume after taking into account of endogeneity of listing decision. Based on their control model results, they reasoned that the reported increase in volatility was caused by rational choice in listing by forward looking exchanges

After introduction of options in US, Canada also followed suit. Halpern and Turnbull (1985), Chamberlain et al (1993), Elfakhani and Chaudhury (1995),

Chaudhury and Elfakhani (1997) provided evidence for the relation between option market and stock market in Canada. Taking a sample of thirty-seven stocks that listed between November 1979 and January 1987, Chamberlain *et al* (1993) focused on gradual change in return volatility at the time of listings. To measure change in volatility, they calculated standard deviations of daily returns of stocks before and after listings. Their results indicated little evidence of change in volatility following option listings. Further, there was no change in volatility for adjusted and unadjusted market volatility measure for all periods and the beta coefficient, though indicating negative sign, is not statistically significant. The authors, however, have not explained volatility-neutrality of option listings.

In contrast to the finding of Chamberlain *et al*, empirical evidence provided by Elfakhan and Chaudhury (1995) suggested that Canadian stock market follows the hypothesis of stabilization effect of option listings. They examined the effect of the Canadian option listings on underlying volatility. The data for the study ranged from September 1975, the year options were introduced, to June 30, 1990. Following Conard (1989), and Skinner (1989), the study used four different sampling intervals, 100, 200, 250 and 500 trading on either side of listing date, to estimate stock return volatility. The number of intervals and sample size were sufficiently large. Daily return variance and market model beta tests conducted for each optioned stock. Moses test (Daniel, 1978) of a change in variance was performed. The results indicated a significant increase in variance following option listings for all intervals except 100 days. The average increase ranged between 14 to 49 percent. Moreover, the study provided evidence of increase in beta for an average stock. Thus, the option listings in Canada had a stabilizing effect on the underlying stock in a total risk and non-diversifiable risk situations as well. Nevertheless, there was evidence of increase in non-diversifiable risk following option listings around the market crash of 1987. In contrast to Conard (1989), Kim, and Young (1991), the findings by Elfakhani and Chaudhury (1997) showed that put options also reduce the total as well as non-diversifiable risk and thus they are non-redundant.

There is dearth of empirical research relating to effects of options introduction on stocks traded at OTC. Rao *et al* (1991), Fedenia and Grammatikos (1992) and Wei *et al* (1997) among others, attempted to fill this vacuum in empirical work. Rao *et al* documented a decrease in spread resulting in increase in liquidity following option listings. In contrast, Fedenia and Grammatikos (1992) reported a substantial increase in price volatility and bid-ask spread and provided evidence that options introduction might destabilize



the stock market. Furthermore, using a sample of 144 OTC stocks Wei *et al* also documented increase in volatility. This increase, they attribute to an increase in unsystematic risk. Long, *et al* (1994) maintained that options do not increase volatility and have destabilizing effect on cash market. Instead, the derivative products enhance efficiency of the cash market. Dividing the sample of 527 stocks into large and small traded at OTC between the period 1973-1988 in US, their empirical results showed significant reduction in volatility for OTC stocks.

There are also empirical findings documented by researchers for markets other than the US. Watt, Yadav and Draper (1991) provided evidence from the UK of the interaction between option and stock market. For a sample of 39 stocks (1973-1983), the study reported a decline in volatility following options introduction at London Stock Exchange. Stucki and Wasserfallen (1994) for Switzerland, Aitken *et al* (1994) for Australia and Alkeback and Hagelin (1998) for Sweden, reported similar findings. For Germany, Heer *et al* (1997) undertook a comprehensive study of the relation between stock options and stocks. Using a sample of 15 stocks that were listed on Deutsche Terminborse (DTB) during the period 2 March 1987 to 31 August 1993, they observed increase in volatility on an average for optioned stocks. Further, Heer *et al* (1997) reported 34 percent rise in median variance of optioned stocks over a 250-day interval and at the same time, 15 percent fall for non-DTB stocks. They explained the increase in volatility of underlying market due to an increase in trading volume.

The volatility-neutral hypothesis is further supported by findings documented by Kabir (2000) for Netherlands. The study empirically examined the effect of options listing on underlying stocks for Netherlands. Kabir defined three alternative measures of volatility namely, total risk, non-systematic risk and systematic risk and used three different samples covering simultaneous listings of call and put options, call options alone and put options alone for the purpose of analysis. The study covered a relatively longer period from 1978 to 1993. The results indicated no significant change in volatility following option listings. The findings are consistent with those of Bollen (1998).

A significant body of empirical literature is concentrated on larger markets like the US followed by the UK and other developed markets. The empirical findings in small yet emerging markets may shed new light on the ambiguity over the effect of options introduction on underlying market. The market completeness and information efficiency hypothesis may not be disproved in small and emerging markets. This can be expected since smaller and



emerging markets are characterized by relatively infrequent trading and inefficiency. Scholars such as Kraus and Zammermann (2001) for Switzerland, Sahlstrom (2001) for Finland, Draper et al (2001) for Hong Kong, Pilar and Rafael (2002) for Spain, Calado et al (2005) for Portugal, Golakanath (2003) for India, Chen and Chang (2008) for Taiwan empirically investigated impact of options introduction on stock market for small and emerging markets.

The relation between options market and stock market for Finland was examined by Sahlstrom (2001). He calculated standard deviations of daily returns on either side of the option listings to observe the changes in volatility. In addition, standard deviations of excess return were calculated for pre and post options introduction periods to analyze the changes in unsystematic risk and to make market adjustment. The study reported lower average standard deviation of raw return after introduction of options for all intervals. The results of standard deviation of excess returns also were similar. Hence, the study concluded that the options introduction in Finland led to decrease in volatility supporting the hypothesis that stock option market increases the efficiency of underlying market. Unlike the findings for Finland, the findings for Portugal suggest that on an average total and systematic risk remain unaffected after introduction of option contracts. Similarly, Draper *et al* for Hong Kong found decline in volatility over 80 percent of stocks but average volatility instead increased. The evidence of Pilar and Rafael (2002) for Spanish market indicated decline in volatility after options introduction and concluded that options increases liquidity and hence efficiency in Spanish finances market.

Like Pilar and Rafael (2002), a recent study by Chen and Chang (2008) also supported the efficiency hypothesis of options introduction. Chen and Chang (2008) employed GARCH (1,1), a sophisticated time series tool, to measure the volatility in pre and post listing event for Taiwan stock market. The conditional variance estimated on the basis of a sample of thirty stocks between periods January 2002 to September 2004, showed significant reduction in volatility after options introduction. The presence of warrants on the same underlying security, that was listed, contained the influence of options listing on volatility. However, the results documented a negative volatility both when stocks with warrants were included and excluded.

The evidence from small and emerging markets, with some exceptions, suggested decline in volatility due to increased liquidity and information and thereby supporting the efficiency hypothesis. Does variance influence more by liquidity or information? Kraus and Zammermann (2001) attempted to find an answer to this question. They performed event study methodology

to investigate the impact of option listings. The event day was defined as the first trading day. Intervals of 30, 100, 250, 400 trading days were constructed. The study made a departure from earlier studies by discriminating between share specific liquidity effect and the firm specific information effect. Applying non-parametric approach for 11 stocks (SOFEX), the study reported 22.8 percent increase in variance over 30 days interval and a negative change in variance as the length of window (intervals) increased. The study ascribed the initial spurt in volatility to entry of noisy traders and shift in stock prices. The study concluded that information effect is stronger than liquidity effect on variance following introduction of options. The study however, ignored other possible influences.

The financial sector reforms introduced in India have drastically changed the nature and environment of financial market in India. As a part of financial liberalization, derivative products were introduced in India in 2000. Since the Indian derivative market is young and emerging, very few studies empirically analyzed the effect of derivative trading on cash market and most of them concentrated on futures trading and index option rather than stock options. Thenmozhi (2000), Shenbagaraman (2003), Gupta and Kumar (2002), Golakanath (2003), Nair (2008) are among others.

Golakanath (2003) examined the behaviour of stock market after listing of index (both index futures and index options), and individual stocks. He used benchmark indices such as S & P CNX NIFTY and S & P CNX NIFTY Junior, and 20 individual stocks for the period from January 1999 to December 2002. The results indicated a decline in volatility following listing of futures and options. A few individual stocks however experienced higher volatility after listing. Although the study used the data for longer period than previous studies, small sample size of the individual stocks might not allow concluding anything definitely.

Nair (2008) confirmed the findings of Golakanath (2003). Unlike the previous studies, Nair used both symmetric and asymmetric GARCH methods for a sample of 72 scripts traded on NSE. The results revealed a decline in volatility after introduction of derivatives in India. The results also indicated existence of asymmetric response to new information and increase in the efficiency of processing of new information.

#### 4. Price Impact of Options

The issue of price impact has gained importance in recent years and has attracted the attention of many scholars to address the issue empirically. A positive price impact for US Market was documented by Brench and Finerty (1981), Rao and Ma (1987), Conard (1989), Detemple and Jorion (1990), Kim and Young (1991).

Conard (1989) found increase in price of underlying stocks around option listings in the US. She performed an event study with market model to examine the price impact of option listings on stocks traded on CBOE and AMEX, for the period from 1973 to 1984. The results indicated a permanent price increase around option listings. She suggested that the increase in price is more associated with introduction than announcement of options date. She attributed the positive price effect to an increase in dealers' supply of call to investors, and demand for the underlying stocks. The findings of Detemple and Jorion (1990) supported the positive abnormal returns as evidenced by Conard (1989). However, the returns after 1980 dissipated. This finding is consistent with short selling restriction hypothesis. The recent studies by Ho and Liu (1997), Sorescu (2000), Danielson and Sorescu (2001) and Mahew and Mihov (2000, 2004) documented variation in return trends.

Ho and Liu used long window for the period 1983-1990 to document that in post 1980 option listings were associated with negative returns. Like Ho and Liu, Sorescu (2000) found flipping of positive abnormal returns to negative excess returns associated with introduction of option in the US (from 1970-1996). This is because of change in regime in the US. The positive price impact for the period from 1973-1980 documented in this study is consistent with findings of Conard (1989), Detemple, and Jorion (1990). The negative price impact in the study for the period 1981-1996 was, due to severity of short sale restrictions and thus followed the short-selling hypothesis of Miller (1979). The regime switch may have occurred because of market completeness as argued by Detemple and Jorion (1990) or the changing regulatory environment in the US and dissemination of unfavourable information by informed traders (Sorescu 2000). Sorescu (2000) did not provide any convincing explanation for flip in price impact in the US. The flip in price reaction can be explained by an alternative hypothesis. The futures price expectations of traders and changes in the listing criteria in the US in the post 1980 might have caused such non-consistent trend (Faff and Hiller 2005).

Consistent with the results reported by Sorescu (2000), Mayhew and Mihov (2000) document positive price impact of options introduction before 1981 but negative price impact in post 1981 period in the US though the negative price impact is not as pronounced as in Sorescu (2000). The significance of this study is because of the fact that the study had appropriately modeled the endogeneity of listing decisions, which was not often attempted in previous studies. The interaction between short selling constraints and security prices in the context of options listing event was studied by Danielson and Sorescu (2000) using the theoretical framework of Miller (1977) and Jarrow (1980)<sup>4</sup>. The study empirically documented a decline in abnormal returns and increase in short interest around options listings. This result reasoned and supported the Miller's hypothesis.

Further, Watt, *et al* (1992) found that option listings were closely associated with abnormal returns. But the shift in price is not permanent. Recent evidence by Faff and Hiller (2005) confirmed these findings. Unlike in the US, the UK markets experienced consistent trend of positive returns around option listings. The short-selling hypothesis cannot explain this consistent trend in UK as it can explain markets in US. The future expectations of traders and different financial environment in UK could be reasoned for such consistent trend over a long period. Like Faff and Hiller (2005), Stucki and Wasserfallen (1994) reported permanent price increase while Draper *et al* (2001) documented temporary price increase for Hong Kong. Abnormal returns closely around options listings were documented by Gjerde and Sættem (1995) for Norway, and Alkeback and Hagelin (1998)<sup>5</sup>

Using data of a relatively longer period from 1978 to 1993, Kabir (2000) documented a decline in price of optioned stock after listings. The study performed a standard event study to examine the price impact of options introduction. The study used market model to estimate daily excess stock returns and the 79 percent of stocks in the sample showed negative returns. In all the periods, the results suggested that equity options introduction has led to a decline in stock price. These finding of Kabir for Netherlands are consistent with earlier studies by Watt *et al* (1992) for the UK. The negative price impact is consistent with theoretical arguments that a relatively easy possibility of getting around with restrictions on short sales and the faster incorporation of negative information into stock prices (Kabir, 2000).

The presence of certain warrants can contain the price impact of options to a greater extent. The warrants provide hedging and speculative function for individual securities. If warrants and options are allowed on same stocks,

hedging and speculative opportunities offered by warrants negatively influence the demand for stocks (Chen and Chang 2008). Using a sample from Taiwan stock market, Chen and Chang provided evidence that presence of warrants crowds out the demand for stock options and thus the effect of stock option listings on price would remain unchanged. The study employed Faff and Hiller (2005) approach to examine the price impact of options listings and performed event study with market model. The findings indicated no impact on price due to option listings. However, after excluding those stocks on which both warrants and option were traded simultaneously, the abnormal returns positively responded to options listing. Thus, the results support the market completeness hypothesis.

## **5. Concluding Remarks**

A significant body of literature addressed the question of how options trading affects the underlying assets. The theoretical models have formulated different propositions and hypotheses. The larger number of studies concluded that options trading contributed to reducing volatility in the US. Similar conclusions were drawn for other developed and developing economies. However, a portion of literature indicated an increase in volatility following options introduction. As far as price impact is concerned, the US experienced positive impact before 1980 and either negative or no impact in the post 1980 period. The studies evidenced consistent positive trend for other countries with a few exceptions.

It is important to note that though the empirical evidence of stabilization effect has not lead to a consensus, but there is little evidence for the destabilization effect of options on the underlying assets. Given the increasing growth of options in financial markets across the world, with corresponding availability of high frequency data and recent advancements in time series techniques, the future studies especially from emerging markets might shed new light on the debate, which is inconclusive for the time being.

### **Notes:**

1. Regulators again raised concern over impact of derivatives on market volatility, after the market crash of 1987. Mazouz (2004) suggested that there is no need to worry over the effect of derivatives on volatility.
2. Thenmozhi (2000), Shenbagaraman (2003), Gupta and Kumar (2002) studied impact of index futures and index options for India.

3. Miller (1977) theorized that elimination of short sale restrictions might lead to a fall in stock price. However, Jarrow (1980) maintained that underlying stock can either increase or decrease when short sale restrictions are eliminated.
4. Gjerdea and Sættem (1995) for Norway and Alkeback and Hegelin (1998) analyzed the impact of warrants on stock market. The warrants in Hong Kong and Australia possess similar characteristics of stock options.
5. Unlike in Hong Kong and Norway, the warrants in Taiwan though appears as stock options, certain features distinguish them from stock options.

### References

- Admati A (1985): 'A Noisy Rational Expectations Equilibrium for Multi-Asset Securities Markets'. *Econometrica*. Vol. 53, pp. 629-657.
- Aitken M, A. Frino and E. Jarnećić (1994): 'Option Listings and Behaviour of Underlying Securities: Australian Evidence'. SIRCA Working Paper.
- Alkeback P, and N. Hagelin (1998): 'The Impact of Warrant Introduction on the Volatility on the Underlying Stocks, with comparison to Warrants'. *Journal of Futures Markets*. Vol. 18, pp. 307-328.
- Back Karry (1993): 'Asymmetric Information and Options'. *The Review of Financial Studies*. Vol. 6, No. 3, pp. 435-472.
- Bansal V.K, S.W. Pruitt and K.C.J. Wei (1989): 'An Empirical Reexamination of the Impact of CBOE Option Initiation on Volatility and Trading Volume of the Underlying Equities: 1973-1986'. *Financial Review*. Vol. 24, pp. 19-29.
- Biais Bruno and Pierre Hillion (1994): 'Insider and Liquidity Trading in Stock and Options Market'. *The Review of Financial Studies*. Vol. 7, No.4, pp. 743-780.
- Black M, and M. Scholes (1973): 'The Pricing of Options and Corporate Liabilities'. *Journal of Political Economy*. Vol. 81, 637-654
- Bollen N.P.B (1998): 'A Note on the Impact of Options Listings on Return Volatility'. *Journal of Banking and Finance*. Vol. 22, pp.1181-1191.
- Branch B and Finnerty J.E (1981): 'The Impact of Option Listings on the Price and Volume of the Underlying Stock'. *Financial Review*. Vol. 16, pp. 1-15.
- Brenen Michael J, and Henry Cao (1996): 'Information, Trade and Derivative Securities'. *The Review of Financial Studies*. Vol.9, No. 1, pp.163-208.
- Calado J.P.T, M.T.M Garcia and S.E.T.M Pereira (2005): 'An Empirical Analysis of Effects of Options & Futures Listings on the underlying Stocks' Return Volatility: The Portuguese Case'. *Applied Financial Economics*. Vol. 15, No. 13, pp. 907-913.

Cao Henry H. (1999): 'The Effect of Derivative Assets on Information Acquisition and Price Behaviour in a Rational Expectations Equilibrium'. *The Review of Financial Studies*. Vol. 12, No. 1, pp. 131-163.

Chamberlain T.W, C.S. Cheung and C.C.Y Kwan (1993): 'Options Listing: Market Liquidity and Stock Behaviour: Some Canadian Evidence'. *Journal of Business Finance and Accounting*. Vol. 20, No. 5, pp. 687-698.

Chaudhury Mohammed and Said Elfakhani (1997): 'Listing of Put Options: Is there any Volatility Effect?' *Review of Financial Economics*. Vol. 6, No.1, pp.57-75.

Chen Dar-Hsin and Po-Hsun Chang (2008) 'The Impact of Listing Stock Options on Underlying Securities: The Case of Taiwan'. *Applied Financial Economics*. Vol. 18, pp. 1161-1172.

Chicago Board Options Exchange (1976): 'Analysis of Volume and Private Patterns in Stocks Underlying CBOE Options from December 31, 1975 to January 16, 1976. Chicago.

Conard Jennifer (1989): 'The Price Effect of Option Introduction'. *The Journal of Finance*. Vol. 44, No. 2, pp. 487-498.

Damodaran Ashwath and Joseph Lim (1991): 'The Effects of Option Listing on the Underlying Stocks' Returns Process'. *Journal of Business and Finance*. Vo. 15, pp. 647-664.

Damodaran Ashwath and Marti Subramanyam (1992): 'The Effect of Derivative Securities on the Markets for the Underlying Assets in the United States: A Survey'. *Financial Markets, Institutions and Instruments*. Vol. 1, No. 5, pp. 1-22.

Daniel Wayne (1978): 'Applied non-parametric Statistics'. Houghton Mifflin Company, Boston. Pp. 97-101.

Danielson B.R, and S.M. Sorescu (2001): 'Why Do Option Introduction Depress Stock Prices? A Study of Diminishing Short Sale Constraints'. *Journal of Financial and Quantitative Analysis*. Vol. 36. pp-451-484.

Detemple J.B (1989): 'Financial Innovation, Values and Volatilities when Markets are incomplete. Geneva Papers on Risk and Insurance.

Detemple and Jorion (1990): 'Option Listing and Stock Returns'. *Journal of Banking and Finance*. Vol. 64, 781-801.

Detemple J.B and L. Selden 1991): 'A General Equilibrium Analysis of Option and Stock Market Interactions'. *International Economic Review*. Vol. 32, No. 2, pp. 279-303.

Diamond D.W (1985): 'Optimal Release of Information by Firms'. *The Journal of Finance*. Vol. 40, pp. 1071-1094.

Draper Burkhard and Bernhard Eckwert (1995): 'The Risk and Price Volatility of Stock Options in General Equilibrium'. *The Scandinavian Journal of Economics*. Vol. 97, No.3, pp. 459-467.

- Draper Paul, Billy S.C, and G.Y.N. Tang (2001): 'The Derivative Warrant Market in Hong Kong: Relationship with underlying Assets'. *Journal of Derivatives*. Vol. 8, pp. 72-83.
- Drees Burkhard and Bernhard Eckwert (1995): 'The Risk and Price Volatility of Stock Options in General Equilibrium'. *The Scandinavian Journal of Economics*. Vol. 97, No.3, pp.459-467.
- Elfakhani Said and Mohammed Chaudhury (1995): 'The Volatility Effect of Options Listings': Some Canadian Evidence. *The Quarterly Review of Economics and Finance*. Vol. 35, No. 1, Spring. pp. 97-116.
- Faff Robert and David Hiller (2005): 'Complete Market, Informed Trading and Equity Option Introduction'. *Journal of Banking and Finance*. Vol. 29. pp. 1325-1384.
- Fedenia M and T. Grammatikos (1992): 'Option Trading and the Bid-Ask Spread of the Underlying Stocks'. *Journal of Business*. Vol. 65, pp. 335-351.
- Freund S.P, Douglas Mc. Cann and G.P. Webb (1994): 'A Regression Analysis of the Effects of Options Introduction on Stock Variances'. *Journal of Derivatives*. Vol. 1, pp. 25-38.
- Golakanath (2003): 'Behaviour of Stock Market Volatility after Derivatives'. NSE Working Paper  
<http://www.nseindia.com/content/press/nov2003a/pdf>
- Gorton G and G Pennacchi (1993): 'Security Baskets and Index linked Securities'. *Journal of Business*. Vol. 66, pp. 1-28.
- Grossman S.J (1988): 'An Analysis of the Implications for Stock and Futures Price Volatility of Program Trading and Dynamic Hedging Strategies'. *Journal of Business*. Vol. 61, No. 3, pp. 275-298.
- Gupta O.P, and M. Kumar (2002): 'Impact of Introduction of Index Futures on Stock Market Volatility: The Indian Experience'. <http://www.pbfea2002.ntu.edu.sg/ppaers/2070.pdf>
- Haddad Mohamound and F.L. Voorheis (1991): 'Initial Option Trading and Security Risk and Return'. *Journal of Business, Finance and Accounting*. Vol. 18, No. 6, pp. 963-913.
- Hardouvelis G (1988): 'Margin Requirements and Stock Market Volatility'. *Federal Reserve Bank of New York Quarterly*.
- Hakansson H. Nills (1982): 'Changes in the Financial Market: Welfare and Price Effects and the Basic Theorems of Value Conservation'. *The Journal of Finance*. Vol. 37, No. 4, pp. 977-1004.
- Halpern P.J and S.M. Turnbull (1979): 'Empirical Tests of Boundary Conditions for Toronto Stock Exchange Options'. *The Journal of Finance*. Vol. 40, pp. 481-500.
- Hansen L (1982): 'Large Sample Properties of Generalized Method of Moment Estimates'. *Econometrica*. Vol. 50, pp. 1029-1054.



- Hayes S.L and M.E. Tennenbaum (1979): 'The Impact of Listed Options on the Underlying Shares'. *Financial Management*. Vol. 8, Winter. pp. 72-76.
- Heer Burkhard, Mark Trede and Wahrenburg (1997): 'The Effect of Option Trading at the DTB on the Underlying Stocks' Return Variance'. *Empirical Economics*. Vol. 22, pp. 233-245.
- Hellwig M (1980): 'On the Aggregation of Information in Competitive Markets'. *Journal of Economic Theory*. Vol. 22, pp. 477-498.
- Ho Li Chin Jennifer and C.S. Liu (1997): 'A Reexamination of Price Behaviour Surrounding Option Introduction'. *Quarterly Journal of Business and Economics*. Vol. 36, No. 4, pp. 39-50
- Jarrow R (1980): 'Heterogenous Expecations, Restriction on Short Sales and Equilibrium Asset Prices'. *The Journal of Finance*. Vol. 35. pp. 1105-1113.
- John Kose, Apporva Koticha and Marti Subrahmanyam (1991): 'The Micro-Structure of Options Markets: Informed Trading, Liquidity, Volatility and Efficiency'. Working Paper. New York University.
- Kabir Rezual (2000): 'The Price and Volatility Effects of Stock Option Introduction: A Reexamination. *Research in Banking and Finance*. Vol. 1, pp. 261-279.
- Kim W.S, and C.M. Young (1991): 'The Effect of Traded Option Introduction on Shareholder Wealth'. *Journal of Financial Research*. Vol. 14, No. 2, pp. 141-151.
- Klemkosky R.C. and T.S Manes (1980): 'The Impact of Options on the Underlying Securities'. *Journal of Portfolio Management*. Vol. 6, Winter. pp. 12-18
- Kraus Thomes and Heinz Zimmermann (2001): 'Stock Option Listings: Information Vs. Liquidity Effects'. *Swiss Journal of Economics and Statistics*. March, pp. 83-97.
- Kraus Alian and Maxwell Smith (1996): 'Heterogeneous Beliefs and the Effect on Replicable Options on Asset Prices'. *The Review of Financial Studies*. Vol. 9, No. 3, pp. 723-756.
- Kumar R, A. Sarin and K. Sastri (1998): 'The Impact of Options Trading on the Market Quality of the Underlying Securities: An Empirical Analysis. *The Journal of Finance*. Vol. 53, pp. 712-732.
- Kyle Albert (1985): 'Continuous Auctions and Insider Trading'. *Econometrica*. Vol. 53, No. 6, pp. 1315-1335.
- Lamoureux C. C and Sunil K. Pannikkath (1994): ' Variation in Stock Returns: Asymmetries and other patterns. Working Paper.
- Long D. Michael, M.D. Schinski, D.T Officer (1994): 'The Impact of Option Listings on the Price Volatility and Trading Volume of Underlying OTC Stocks' *Journal of Economics and Finance*. Vol. 18, No. 1, pp. 89-100.

- Lucas R.E (1978): 'Asset Prices in an Exchange Economy'. *Econometrica*. Vol. 46, pp. 429-445.
- Ma C.K and Rao R.P (1988): 'Information Assymetry and Options Trading'. *Financial Review*. Vol. 23, pp 39-51.
- Mayhew Steward (2000): 'The Impact of Derivatives on Cash Markets: What Have We Learned'. <http://media.terry.uga.edu/documents/finance/impact.pdf>
- Mayhew Steward and Vassil Mihov (2004): 'Another Look at Options Listing Effects'. *The Journal of Finance*. Vol. 59, pp. 447-471.
- \_\_\_\_\_ (2005): 'Short sale constraints, Overvaluation and Introduction of Options'. AFA - 2005 Philadelphia Meetings.
- Mazouz Khelifa (2004): 'The Effects of CBOE Option Listings on the Volatility of NYSE Traded Stocks: A Time-Varying Variance Approach. *Journal of Empirical Finance*. Vol.11. pp. 695-708.
- McClosky D.N. and S.T. Zillak (1996): 'The Standard Error of Regressions'. *Journal of Economic Literature*. Vol. 34, pp.97-114.
- Merton R (1980): 'On Estimating the Expected Return on the Market. An Explanatory Investigation. *Journal of Financial Economics*. Vol. 8, pp. 323-361.
- Miller E (1977): 'Risk, Uncertainty and Divergence of Opinion'. *The Journal of Finance*. Vol. 32, pp. 1151-1168.
- Mossin J (1969): 'Security Pricing and Investment Criteria in Complete Markets'. *American Economic Review*. Vol. 59, pp. 744-756.
- Nabar P and Park S (1988): 'Options Trading and Stock Price Volatility'. Working paper. Solomen Brothers Centre, New York.
- Nair S. Abhilash (2008): 'Impact of Derivative Trading on Volatility of the Underlying' Evidence from Indian Stock Market: The paper presented at Conference on Money and Finance-2008 organized by IGIDR, Mumbai.
- Nathan Associates (1974): 'Review of Initial Trading Experience at Chicago Board of Options Exchange'. Chicago, USA.
- Niendorf B.D and D.R. Peterson (1996): 'The Cross-sectional Effects of Option Listing on Firm Stock Return Variances'. *Journal of Financial Research*. Vol. 9, No. 4, pp. 515-539.
- Pilar C and S. Rafael (2002): 'Does Derivative Trading Destabilize Underlying Assets? Evidence from Spanish Stock Market'. *Applied Economics Letter*. Vol. 9, pp. 107-110.
- Rao R.P and C.K. Ma (1987): 'The Effect of Call-Option-listing Announcement in Shareholder Wealth'. *Journal of Business Research*. Vol. 15, 449-465.