Futures Option Expirations and Volatility in the Stock Index Futures Market

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INTRODUCTION

Options on futures were initially approved in 1982 by the Commodity Futures Trading Commission. In that year, each commodity exchange was allowed to trade options on one of its futures contracts. Options on futures now trade on every major futures exchange. On January 28, 1983, both the New York Futures Exchange (NYFE) and the Chicago Mercantile Exchange (CME) began trading options on equity index futures contracts.

In principle, these options are no different than the options on individual stocks or stock indexes. A call option on a stock index futures contract gives the buyer the right to assume a long position in the underlying stock index futures contract while a put option gives the buyer the right to go short in the underlying futures contract. The long (short) position in the stock index futures contract represents a commitment to buy (sell), for a predetermined price, an amount of dollars equal to the index value times some given multiplier.

When the concept of listed options on futures contracts was first proposed, some observers felt that these securities served no economic purpose and were merely gambling instruments. However, futures options are more frequently seen as giving users of the futures market an enhanced ability to tailor their risk/return exposure to individual needs. Futures options also provide an opportunity for the speculator to avoid the unlimited losses that are theoretically possible with futures contracts (Ross (1976), Rubinstein, (1979)).

Despite the evidence on the useful economic role of options, there has been increasing concern, especially since October 1987 when the market declined by more than 30% within four trading days, that option trading adversely affects the price behavior of the underlying asset. While this issue has been extensively investigated for stock options (Officer and Trennepohl (1981), Pettengill (1989), Ferris, Chance, and Wolfe (1989), Stoll and Whaley (1987, 1990)), it has received only scant attention in the stock index futures literature.

Nonetheless, the impact of option expirations on the underlying asset is considered to be of vital importance for financial markets, as exemplified in the wake of the October 1987 market crash by the reports of the Commodity Futures Trading Commission (CFTC), the Securities and Exchange Commission (SEC), the General Accounting Office (GAO), and the Brady Task Force. While each of the reports

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find different areas of concern, they agree that the events of October 1987 demonstrate that the "...previously segregated stock, options, and futures markets have become linked and international in scope" (Barro et al., 1989, p. 384). Although there is disagreement about the extent and effect of trading activity in each market, the interconnection is no longer disputed.

The impact of option trading on stock index futures is, as yet, an unanswered empirical question. The objective of this research effort is to fill this void, using minute-by-minute trade data from June 1987 through the first quarter of 1989 and by examining the behavior and volatility of S&P 500 stock index futures near contracts around the time their options expire.

Option expirations may influence underlying securities in at least two ways. First, the existence of options on the S&P 500 futures contract can increase activity in that contract by providing opportunities for intermarket arbitrage around the time of option expirations. Trading in the S&P 500 futures motivated by option expirations may increase its volatility. This hypothesis is tested using a form of the Generalized Autoregressive Conditional Heteroskedastic (GARCH) model in conjunction with an F test to compare nonexpiration-day volatility of the S&P 500 futures near contract to expiration-day volatility.

Second, increased trading of securities near option expirations may result in pricing discrepancies during this period. When a call option is close to expiration, it has only negligible time value such that its price is only slightly greater than its intrinsic value. If the price of an expiring call option, which is in-the-money, moves much above its intrinsic value, there are possibilities for making arbitrage profits by selling the option and buying the S&P 500 futures contract. This would have the effect of creating upward pressure on futures prices. In the reverse case, where the price of a call option close to expiration slips below its intrinsic value, arbitrage profits could be made by buying the option and selling the S&P 500 futures contract. This would have the effect of creating downward pressure on futures prices. When put options are considered, however, the price effect is indeterminant since the price pressure on the underlying asset is in the opposite direction of the call. Besides these possibilities for arbitrage, market participants who are unwinding their positions may exert further pressure on futures prices near option expirations. Whether these activities cause price discrepancies to occur is tested using a form of the Comparison Period Approach (CPA) in conjunction with a pooled t test.

OPTION EXPIRATIONS AND UNDERLYING ASSET PRICES

The academic view of volatility is probably not central to investors when they complain about increased volatility. The investor is concerned with the stability of his wealth and the certainty of future wealth. In this context any increased volatility may be bad since it increases the prospects of unforeseen future losses. To academics, however, more asset volatility is not necessarily bad. It may well be a manifestation of a well-functioning market where prices are quickly adjusting to new, relevant information. However, price volatility greater than that which can be justified by relevant new information may be viewed as bad since it causes price indicators to be inefficient reflectors of underlying values. Likewise, too little volatility may be equally bad if prices are reacting in a "sticky" manner to relevant new information. Thus, price efficiency does not imply little or no volatility.

Therefore, in evaluating the impact of option expirations on the volatility of the underlying asset, the goal is to ascertain whether the level of volatility exceeds that which can be justified by new information in the market. Without doubt, the existence of options can increase activity in the underlying asset and provide previously unavailable opportunities for intermarket arbitrage. But does this arbitrage activity cause price distortions?

Stoll and Whaley (1987, 1990) believe that arbitrage activity does not cause price distortions. In analyzing stock market price changes in the last hour of expiration days and the first half-hour of the following day, they find that the volatility of price changes are significantly higher on expiration days, with the stock market tending to fall. Interestingly, the price effects appear to be associated with only the S&P 500 futures contract expirations, not with the index option expirations. They also find that stocks not in the S&P 500 exhibit no price effects which, again, suggests that the expiration of options alone does not cause price effects. The price effects which are observed are attributed, by Stoll and Whaley, to trading imbalances rather than to any problem with the flow of information.

Officer and Trennepohl (1981) use daily price changes of 152 underlying securities in 1977 and 1978 during a 4-day period surrounding option expirations. Their data indicates some evidence of abnormal returns around the period of option expirations. However, since the abnormalities are small, after taking search costs and transaction costs into consideration, it is unlikely that this information could be used to generate systematic excessive returns.

Ferris, Chance, and Wolfe (1989) search for an option expiration effect using a sample of 30 securities over the period 1980–84. They compare returns on expiration Friday and the following Monday to returns 10 trading days after the event. They find returns to be lower on expiration Friday than 10 trading days later, and somewhat higher on the Monday following expiration than on trading day 11. However, in both cases, the difference is not statistically significant.

In a comprehensive study of 79 securities from July 1962 through October 1985, Pettengill (1989) analyzes the effect of option expirations using a larger sample period than previous studies; corrects for possible bias from seasonal influences; and presents several contrasting comparisons. His findings suggest that option expirations have very little, if any, impact on the underlying security and finds little evidence of an option effect even in the early experience of option expirations.

The above studies are only a few of the vast number of studies that examine the impact of option expirations on stocks. Relatively little research examines the impact of option expirations on other optionable assets. Bhattacharya (1987) does examine the expiration of options on Treasury-bond futures prices. Using daily price information for October 1982 through July 1985, Bhattacharya finds no evidence of abnormal price behavior in the Treasury-bond futures market either before or after the date of the option expiration.

In conclusion, previous studies provide evidence that the expiration of options does not cause pricing discrepancies in the underlying asset. The markets appear to display a high degree of efficiency with regard to option expirations. This study extends previous research by testing the impact of option expirations on the stock index futures market.

METHODOLOGY

A pooled F test is used in conjunction with a form of the GARCH model to investigate the impact of option expirations on futures contract returns.[1] A pooled t test is

[1]Neftci (1984) points out that all futures prices are characterized by heteroskedastic behavior because of the periodicities created by non-continuous trading. Collins (1986) notes the same is true, specifically for stock index futures.

used also in conjunction with the Comparison Period Approach (CPA) to determine whether pricing discrepancies arise on futures contracts during the futures option expiration period.

On January 28, 1983, when options on the S&P 500 futures index first began trading, the only contracts traded were on a March, June, September, and December expiration cycle (referred to as the March cycle). In June, 1987 serial contracts were added, and the last trading day was changed to the third Thursday for the March cycle contracts. Serial month contracts kept the third Friday as the last trading day.

Since the underlying S&P 500 futures contract also expires on the third Thursday in March cycle months, only serial month option expirations are studied to avoid any abnormal price volatility which is normally observed on the last trading day of futures contracts. For this reason, the scope of the study is from June 1987 through the first quarter of 1989, which results in 14 serial option expiration dates.

The GARCH Model

To ascertain whether securities trading motivated by option expirations increases the underlying asset's volatility (i.e., risk), the price volatility of the S&P 500 stock index futures near contract on expiration days is compared with that of nonexpiration day volatility using a standard F test.

Using minute-by-minute trade data, nonexpiration days are designated as the second Friday of each serial month. This designation of a representative period is chosen as a way of holding constant the month and day of the week, as well as the number of observations, so that only price performance due to the expiration of option contracts is measured. This results in 405 observations for each of the 14 months, or 5670 total observations.

The expiration period is given as the third Friday of each serial month, and the data set consists of near-contract prices for each minute of the trading day which again results in a total of 5670 observations. Near-contract prices are used because the trading in these contracts is more active than in the far contracts. In cases where more than one trade is made per minute, the last trade's price is used.

The analysis of a time series requires that the series first be stationary. Thus, a plot of the minute-by-minute prices is first reviewed in an effort to determine the stationarity of the series. The time series plot reveals that neither the variance nor the mean are constant, as required for stationarity. Therefore, the data are transformed as follows:

$$d_{i,t} = \ln(F_{i,t}) - \ln(F_{i,t-1}),$$

where $F_{i,t}$ is the value of the S&P 500 near futures contract at minute t around the time of option expiration i. A review of the time series plot of $d_{i,t}$ shows that the log and first difference transformations are sufficient to induce stationarity.

To estimate the variance during expiration and nonexpiration periods, a GARCH model is fitted for each of the 14 expiration periods and each of the 14 nonexpiration periods. The general form of the GARCH model is (Bollerslev, 1986):

$$d_{i,t} = \alpha_i + \sum_{j=1}^{n} \alpha_{i,j}\epsilon_{i,t-j}^2 + \sum_{j=1}^{m} \beta_{i,j}d_{i,t-j}, \tag{1}$$

where:

$d_{i,t}$ = the log of the price change at minute t around the time of option expiration i;

$\epsilon_{i,t-j}$ = n lagged values of an autoregressive residual for option expiration i obtained from the following equation:

$$d_{i,t} = \alpha_i + \sum_{j=1}^{p} \beta_{i,t-j} d_{i,t-j} + \epsilon_{i,t}; \tag{1a}$$

$d_{i,t-j}$ = m lagged values of $d_{i,t}$;
α_i, $\alpha_{i,j}$, and $\beta_{i,j}$ = are regression coefficients.

Theil's (1971) minimum residual variance criterion is used to determine the appropriate length of the lags for each lagged variable in eqs. (1) and (1a). The significance of the variables is then tested using Theil's criterion to determine which are relevant for inclusion in the equations. In determining the appropriate length of the lag for each variable, the standard error of the regression is checked after the inclusion of each lag on each variable separately. The lag length that minimizes the standard error is then selected as optimal.

Table I shows the results of the F tests using the variance of eq. (1) when estimated for each of the expiration periods compared with each of the nonexpiration

Table I
RELATIVE VOLATILITY OF THE S&P 500 FUTURES NEAR CONTRACTS DURING EXPIRATION AND NONEXPIRATION PERIODS

Month/Year[a]	Last 15 Minutes[b]	Last Hour[c]	All Day[d]
7/87	F = 102.4104*[e]	F = 56.7814*[f]	F = 31.7945*[g]
8/87	F = 6.4101*	F = 7.5910*	F = 11.8150*
10/87	F = 3.8388*	F = 1.6384*	F = 2.2345*
11/87	F = 13.2277*	F = 29.7399*	F = 2.9727*
1/88	F = 3.8107*	F = 3.7030*	F = 3.0646*
2/88	F = 42.2688*	F = 15.0587*	F = 4.7006*
4/88	F = 2.0166	F = 2.5013*	F = 1.8204*
5/88	F = 10.1523*	F = 15.1679*	F = 3.9467*
7/88	F = 2.3626	F = 2.5416*	F = 2.9504*
8/88	F = 27.3202*	F = 27.1037*	F = 23.2916*
10/88	F = 4.8023*	F = 4.8668*	F = 4.2166*
11/88	F = 8.0159*	F = 9.1561*	F = 9.2479*
1/89	F = 2.8400*	F = 2.8573*	F = 3.7544*
2/89	F = 6.1298*	F = 4.6467*	F = 3.5512*

Overall F test (last 15 minutes) = 1.3710*; df = 210-k_e, 210-k_c; $S_e > S_c$
Overall F test (last hour) = 1.2961*; df = 840-k_e, 840-k_c; $S_e > S_c$
Overall F test (all day) = 1.2720*; df = 5670-k_e, 5670-k_c; $S_e > S_c$

*Significant at the 5% level.
[a]Expiration Fridays are the third Friday of the given month while nonexpiration Fridays are the second Friday of the given month.
[b]Degrees of freedom = 15-k_e, 15-k_c. Where k_e = number of parameters in the expiration period GARCH models and k_c = number of parameters in the nonexpiration period GARCH models.
[c]Degrees of freedom = 60-k_e, 60-k_c.
[d]Degrees of freedom = 405-k_e, 405-k_c.
[e]The F ratio is: S_e/S_c when $S_e > S_c$ and S_c/S_e when $S_c > S_e$. In 10 of 14 cases (71.43%) $S_e > S_c$.
[f]In 10 of 14 cases (71.43%) $S_e > S_c$.
[g]In 9 of 14 cases (64.28%) $S_e > S_c$.

periods.[2] The tests reveal that when the last 15 minutes of the trading day are evaluated, there exists a significant difference between the volatility of the expiration, S_e, and nonexpiration, S_c, periods except in April 1988 and July 1988. In 10 of the 14 periods studied (i.e., 71.43%), the expiration period variance exceeds the comparison-period variance. When the 14 expiration periods and 14 nonexpiration periods are pooled, and an overall F test performed, it is again significant with S_e exceeding S_c.

The tests confirm that significant differences in volatility (i.e., risk) persist when the last hour of the trading day and the entire trading day are evaluated. While the expiration period variance continues to exceed the nonexpiration period variance in 71.43% of the cases when the last hour is examined, it falls to 64.28% of the cases when the entire day is examined. Thus, it appears that the expiration period variance does not exceed the nonexpiration period variance consistently. This finding is confirmed when two nonexpiration days are tested. That is, there remains a significant difference in the variance between one nonexpiration period and another nonexpiration period.[3]

These results imply that consistent risk differences do exist over time; however, they are not due to the expiration of options since no pattern of either increases or decreases in volatility around that time can be identified. Additionally, other time periods are tested, although not reported here, which show that even when two nonexpiration periods are used, significant differences in volatility frequently exist. This raises the question of why significant differences in volatility do, for the most part, exist and why they did not appear to exist in April and July of 1988.

Samuelson (1965) theorizes, based on a set of strong assumptions, that futures price volatility increases as expiration nears. Previous empirical studies produce mixed results regarding the testing of Samuelson's theory, however, most of them use perishable commodity samples. Collins (1986) tests Samuelson's theory using stock index futures and finds the theory not to hold for equities. Instead, he finds support for Anderson's (1982) hypothesis that the variance is a function of demand and supply conditions for the underlying asset. The results reported here do not uphold Samuelson's theory since, frequently, the volatility in nonexpiration periods exceeds that of expiration periods. The results do, however, lend support to the consensus opinion that futures price volatility is not constant over time.

The Comparison-Period Approach

The CPA approach used in this study is a variant of the methodology first developed by Masulis (1980) and applied to T-bond futures options by Bhattacharya (1987). This approach requires the use of an estimate of the mean price performance of the S&P 500 stock index futures prices obtained from a representative period, designated the *comparison period.* The comparison period does not include the period surrounding option expiration. The mean price performance of the S&P 500 stock index futures near contract, obtained from the representative period, is then compared with the mean price performance around the option's expiration. If the S&P 500 stock index futures price performance around the time of the option

[2]The F-ratio is: S_e/S_c when $S_e > S_c$ and S_c/S_e when $S_c > S_e$.

[3]The second and fourth Fridays of each serial month are tested and in 11 of 14 cases show significant differences in volatilities. Also, when the fourth Friday is defined as the nonexpiration period, the test results are similar to the ones presented here. That is, significant differences in volatility exist with $S_e > S_c$ in 64.28% of the cases.

expiration is not significantly different from the price performance in the comparison period, then the hypothesis that option expirations affect underlying futures prices can be rejected.

As noted by Bhattacharya (1987), the appeal of the CPA is not only its simplicity but it also avoids the problems associated with research relying extensively on the market model (see, e.g., Dusak (1973), Bodie and Rosansky (1980)) and is shown by Brown and Warner (1980) to be at least as powerful as approaches which are based on the explicit adjustment of market risk.

In analyzing the data, the $d_{i,t}$ stationary series defined in the previous section is used. This avoids the negative autocorrelation observed for intraday futures price changes induced by the bid-ask price effect since one of the characteristics of a stationary series is that autocorrelations do not depend on the segment of time from which data used to calculate the correlations originates. That is, the prices are independent of the time period chosen and are only determined by the lag.

Thus, let $D_{i,t} = d_{i,t} - d_{i,t-1}$ denote the price change at minute t around the time of option expiration i. A pooled t test (Inman and Conover, 1983) is used to test for the equivalence of the mean abnormal price performance for option expiration i (MAE_i) and the mean abnormal price performance for comparison period i (MAC_i). The MAE_i for option expiration i, based upon minute prices, is given as:

$$\text{MAE}_i = \sum_{t=1}^{Ne} D_{i,t}/N_e. \tag{2}$$

The MAC_i is likewise given as:

$$\text{MAC}_i = \sum_{t=1}^{Nc} D_{i,t}/N_c. \tag{3}$$

The test statistic for equality of means around the time of option expiration i is denoted as:

$$\frac{\text{MAE}_i - \text{MAC}_i}{\text{SE}_p[1/N_e + 1/N_c]^{1/2}} \tag{4}$$

where:

SE_p = pooled standard error of the difference between means, which is defined as:

$$[(N_e - 1)S_e + (N_c - 1)S_c/(N_e + N_c - 2)]^{1/2}$$

where:

N_e = number of observations in the expiration period;
N_c = number of observations in the comparison period;
S_e = expiration period variance; and
S_c = comparison period variance.

Table II shows the pooled t test and degrees of freedom for the last 15 minutes, last hour, and all day on expiration Fridays relative to comparison period Fridays. Part A of Table II compares the mean price performance of expiration and comparison period Fridays using only the last 15 minutes of the trading day. The results of the pooled t test, for this short time period, show that the impact of option expirations is not strong enough to cause price distortions (i.e., the t tests are all insignificant at the 5% level). Not surprisingly, the overall pooled t test for this time period is also insignificant at the 5% level.[4]

Part B of Table II shows the last 60 minutes of trading on expiration and comparison period days and shows the relevant degrees of freedom. With the exception of April 1988, all pooled t test results suggest that option expirations do not cause price distortions. Likewise, the overall pooled t test, which includes April 1988, implies that the difference in the mean price performance between expiration and comparison periods is insignificant.

The significant difference in mean price performance found in April 1988 can be explained, in part, by the difference in news on the second and third Friday. According to Powers (1988), on April 8, 1988, stock index futures prices "see-sawed in light, trendless trading." However, Valentine (1989) reports that on April 15, 1988 the February trade deficit was much worse than anticipated and sent the financial-futures markets into a "tailspin." These reports are consistent with the significantly negative pooled t tests in both parts B and C of Table II since they suggest that $MAC_i > MAE_i$.

Lastly, part C of Table II displays the results of the pooled t tests and degrees of freedom for all day on expiration and comparison Fridays. As mentioned above, April 1988 once again shows a significant difference between the mean price performance in the comparison and expiration periods, as does February 1989. The remaining 12 periods, however, along with the overall pooled t test, suggest that the expiration of options does not cause significant differences in the mean price performance between expiration and comparison periods.

Like April 1988, the second and third Fridays of February 1989 are also characterized by a difference in the impact of current news on the financial markets.[5] Sease (1989) reports that on Friday, February 10, 1989, the financial markets were "rattled" by Bush's budget proposal and its implications for the deficit. Stocks, bonds, stock index futures, and the dollar all "plummeted." Friday, February 17, 1989, however, was a relatively calm, uninspired trading day. These reports suggest that $MAC_i < MAE_i$, which supports the positive t test reported in part C of Table II.

The degrees of freedom for the pooled t test are normally defined as $N_e + N_c - 2$ except in cases where there exists a significant difference between the variances in the periods under evaluation. In those cases, the degrees of freedom are redefined as follows using Satterthweite's adjustment (Inman and Conover, 1983):

$$df = \frac{[(S_e/N_e + S_c/N_c)]^2}{[(S_e/N_e)^2/(N_e - 1)] + [(S_c/N_c)^2/(N_c - 1)]} \tag{5}$$

The results indicate that price distortions are not systematically evident around option expirations on the S&P 500 near futures contracts. Therefore, the use of trading rules to earn abnormal risk-adjusted returns on futures contracts during the option expiration period will not be consistently possible.

[4]The test statistic used for the overall pooled t test is:

$$\frac{\overline{MAE} - \overline{MAC}}{SE_p[1/N_e + 1/N_c]^{1/2}},$$

where $\overline{MAE} = \Sigma_{i=1}^{14} MAE_i/14$ and $\overline{MAC} = \Sigma_{i=1}^{14} MAC_i/14$.

[5]The second and third Friday of each month under study is compared to determine whether the financial markets are reacting to unanticipated news on one day but not on the other. This occurs in only two months: April 1988 and February 1989.

IMPLICATIONS

With the rapid growth in both the options and futures markets, and with the growing number of contract alternatives, new issues for concern by regulators and traders are opened. Like all innovations, futures options prompt some initial skep-

Table II
PRICE PERFORMANCE OF THE S&P 500 FUTURES NEAR CONTRACTS DURING THE EXPIRATION PERIOD RELATIVE TO THE COMPARISON PERIOD

PART A: The Last 15 Minutes on Expiration Fridays is Compared with the Last 15 Minutes on Nonexpiration Fridays

Month/Year[a]	Pooled t test[b]	Degrees of Freedom[c]
7/87	−0.9207	15.0027
8/87	1.1136	15.7775
10/87	−0.9194	15.8913
11/87	−0.8422	14.6101
1/88	1.1598	15.9191
2/88	1.0043	14.0156
4/88	−1.4159	28.0000
5/88	−1.0011	14.2914
7/88	1.2719	28.0000
8/88	0.9320	15.1631
10/88	1.1444	15.2119
11/88	−1.0412	14.4664
1/89	0.5813	17.6314
2/89	1.1334	14.7458

Overall pooled t test $= -0.2887$, $df = 359.4810$

PART B: The Last 60 Minutes on Expiration Fridays is Compared with the Last 60 Minutes on Nonexpiration Fridays

Month/Year	Pooled t test[d]	Degrees of Freedom
7/87	−0.9773	60.0353
8/87	1.1298	62.1168
10/87	−0.7647	97.6017
11/87	−0.8516	59.1376
1/88	1.1666	67.5604
2/88	1.1143	59.5252
4/88	−1.9710*	73.0543
5/88	−1.0116	59.5352
7/88	1.3971	76.8363
8/88	0.9793	58.1545
10/88	1.2282	63.9723
11/88	−1.0535	60.7168
1/89	0.6572	71.9928
2/89	1.3109	62.1639

Overall pooled t test $= -0.3030$, $df = 1422.4117$

Table II (continued)

PART C: All Day Expiration Fridays is Compared to Nonexpiration Fridays

Month/Year	Pooled t test[e]	Degrees of Freedom
7/87	−1.0256	388.7641
8/87	1.1429	409.8989
10/87	0.4216	326.6000
11/87	0.8733	414.1021
1/88	1.1333	487.4112
2/88	1.3689	421.6356
4/88	−3.0106*	639.4778
5/88	−1.1620	435.5987
7/88	1.4640	492.3421
8/88	0.9546	395.4669
10/88	1.2164	443.8578
11/88	−1.0270	389.0828
1/89	0.6740	430.1251
2/89	2.3014*	463.8776

Overall pooled t test = −0.3176, df = 10,070.3541

*Significant at the 5% level.

[a]Expiration Fridays are the third Friday of the given month while nonexpiration Fridays are the second Friday of the given month.

[b]$N_e = 15$ and $N_c = 15$.

[c]When the variance of the expiration period is equal to the variance of the comparison period, the relevant degrees of freedom for the pooled t test equals $N_e + N_c - 2$. However, in cases where the two period variances are not equal, the following Satterthwaite adjustment is applied (Inman and Conover, 1983):

$$\frac{[(S_e/N_e + S_c/N_c)]^2}{[(S_e/N_e)^2/(N_e - 1)] + [(S_c/N_c)^2/(N_c - 1)]}$$

[d]$N_e = 60$ and $N_c = 60$.

[e]$N_e = 405$ and $N_c = 405$.

ticism. As with index options and index futures, futures options are criticized as corrupt gambling instruments, toys for small-time investors, and feared for their potential to further attract capital from the stock market. This research attempts to resolve some of these concerns.

Although the futures options are used for speculation, they are also useful tools for hedging and asset allocation. They are most frequently used by institutional investors to tailor risk/return tradeoffs for stockholder's and as instruments of portfolio insurance strategies.

Even so, there remains concern over the impact of trading options on futures contracts as well as expiration-day effects. Using a form of the GARCH model in conjunction with a standard F test, the results reported here suggest that significant differences in volatility do exist in expiration and non-expiration periods. These differences, however, cannot be attributed to an expiration-day effect for two reasons: the volatility in the expiration period is not consistently greater than in the non-expiration period, frequently it is the other way around; and, other time periods tested show that differences in volatility exist even when testing two non-expiration periods. The results of the CPA used in conjunction with a pooled t test show that pricing discrepancies do not arise during the expiration period. That is, the mean price performance in the expiration period is not significantly different from the mean price performance in the comparison period. Thus, the concern over the impact of trading options on the S&P 500 stock index futures contracts appears to be unwarranted.

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