AN ANALYSIS OF RISK AND RETURN ON PUT AND CALL OPTION STRATEGIES

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This is to certify that the

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ABSTRACT

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By Martin Edward Zweig

Problem

Put and call option investing has been studied based on three objectives: First, to improve upon the methodology of past studies in the option investment area which exhibited conflicting findings. Second, to incorporate risk as well as return in measuring and analyzing option investment performance in order that meaningful comparisons of different option and stock strategies can be made. Third, to offer guidance to option practitioners in planning their investments.

Methodology

A stratified random sample of 210 stocks or 30 per year, which at the time of their inclusion had significant option activity, was drawn over a seven-year period between 1961 to 1968. Stratification of the sampled stocks was made on the basis of the stocks' expected price volatility.

High, Medium and Low Volatility Classes were defined and 70 stocks were represented in each of the three classes. Eighteen option strategies and one stock purchasing strategy

were applied to every stock within each of the three volatility classes, resulting in a total of 57 different option and stock strategies.

Thirty-six option writing strategies were generated by varying the stock volatility class, the duration period of the option (95 days or 190 days), the type of option written (puts, calls or straddles), and the position taken by the writer to back up the option contract (long or short stock positions or cash positions). By varying volatility classes, duration periods and the option type, eighteen option buying strategies were also developed.

Based upon 45,570 hypothetical transactions over a seven-year period, calculations were made of the rate of return and the risk associated with the return on all 57 option and stock strategies. The strategies were then independently measured and ranked by return-risk ratios, where the ratios were based upon the incremental return per unit of risk above the risk-free rate of return. Risk on each strategy was measured by its seven-year standard deviation of return.

A Treatment by Levels Analysis of Variance and several t Tests for Differences Between Means were made in

order to determine significant differences in the performance of the strategies.

Findings

The major finding of the study is that tax-free investors had superior performance investing in stocks as opposed to either buying or selling options. Purchasing 190-day calls on Medium and on High Volatility Class stocks were the only two option strategies which were not found significantly inferior to the two best stock buying strategies, but even these two had lower return-risk ratios than some other option strategies and all three stock strategies.

Selling 190-day calls against long positions on stocks in the Medium Volatility Class was the only one of thirty-six option writing strategies which had a positive return-risk ratio, but the rate of return on investment barely exceeded the risk-free rate of return. Five of eighteen option buying strategies, all involving the purchase of calls or straddles in the Medium or High Volatility Classes, produced positive return-risk ratios.

In every instance, 190-day options of all varieties to both buyers and to writers either equaled or outperformed the corresponding 95-day option strategy. When taxes were

taken into consideration, the longer duration options were even better in their relative performance.

The nine strategies with positive return-risk ratios were as follows:

Strategy	Return-Risk Ratio	Rate of Return on Investment
Buy Stock- Med. Volatility	.48	24.14
Buy Stock- High Volatility	.43	47.67
Buy Stock- Low Volatility	.32	10.70
Buy 190-day Calls - High Volatility	.27	105.03
Buy 190-day Strad.- High Volatility	.24	47.64
Buy 95-day Calls- High Volatility	.18	81.23
Buy 190-day Calls- Med. Volatility	.17	44.04
Buy 95-day Strad.- High Volatility	.09	21.10
Sell 190-day Calls vs. Long Position- Med. Volatility	.08	4.89

While most option strategies had poor performance, it is still possible that the inclusion of options might increase the return per unit of risk in a Lintner-type investment portfolio. In addition, the nature of tax laws regarding options, particularly for buyers, makes it possible to increase the return-risk ratios found in the study. For taxable investors, option buying has definite tax advantages over both option writing and stock purchasing.

If The Chicago Board of Trade should establish an auction-type market in options as planned, there is a possibility that both option buyers and writers could increase their investment performance.

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By

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CHAPTER 1

INTRODUCTION

Purpose of Study

During recent years the growth of put and call option activity has accelerated. In 1962 the number of shares optioned through The Put and Call Brokers and Dealers Association totaled about 7.8 million.[1] By 1967 the volume of shares optioned had grown to more than 22.1 million, and in 1968 put and call activity had expanded to an all-time high of almost 30.3 million shares of stock. Conservatively estimated, 1968 option activity involved stocks worth well over one-billion dollars, while probably more than one hundred million dollars worth of premiums changed hands.[2]

Option activity has expanded to the point where institutional investors have expressed a desire to enter the

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[1]Option volume figures are supplied by The Put and Call Brokers and Dealers Association to the Securities and Exchange Commission. The above figures appear in unpublished data supplied by the Division of Trading and Markets of the S.E.C. and are shown in Table A-2, Appendix A.

[2]Estimates are based upon average stock prices of $40 per share, and average premium prices of 10 per cent of the striking price.

market, providing such a market could handle the large scale requirements demanded by them. To facilitate institutions' quest for an even broader put and call market, The Board of Trade of the City of Chicago has recently undertaken a study to determine the feasibility of trading puts and calls on its exchange.[1] If the Board does initiate such a move, it would mark the first time in this country that options would be traded on an organized exchange.

Despite the fast rate of growth in option trading, the magnitude of the size of the option market, and the reasonable probability that institutional activity may appear on a significant scale in the near future, relatively little research has been done on the subject of puts and calls. Even more disconcerting is that the research studies completed have generally exhibited conflicting findings, possibly because of the differing methodology inherent in each. Furthermore, while some studies include investors' risk preferences, all fail to attempt measuring the risk associated with various returns, thereby making it difficult to

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[1] Information on the Board's proposal was supplied in interviews with Joseph W. Sullivan, Assistant to the President; Henry H. Wilson, President; and Edward O'Connor, Vice Chairman, Board of Directors, The Board of Trade of The City of Chicago, April 18, 1969.

adequately gauge the investment worthiness of the option strategies considered.

On a pragmatic basis, option writers who hold portfolios valued in the hundreds of millions of dollars generally resort to time-worn rules-of-thumb or intuition as their guiding principles to option writing strategy. On the buying side, professionals in the option business seem to be in fairly general agreement that most option buyers lack sophistication in both option and in stock dealings.[1]

The purpose of this study is thus three-fold. First, an improvement upon the research methodology used by others in the past will be attempted in order that the findings of this paper might be accorded more validity.

Second, the risk that is associated with each of the option strategies studied will be measured in order that meaningful comparisons of different option and stock strategies can be made.

Third, it is hoped that the results of this study will offer some guidance to practitioners, both buyers and writers, in planning their option investments.

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[1]This general impression is based upon several dozen interviews with option professionals over the past six years.

Review of Option Terminology

Below are several terms with which the reader should be familiar in order to comprehend the presentation:

Call Option: A call option is an option to buy and demand delivery against payment 100 shares of a specified stock at a specific price within a stipulated time period. The time period in which a call option expires is usually 95 days or six months and ten days (190 days). In the case of the latter, the additional ten days appears so as to facilitate taking advantage of the six months capital gains tax ruling. Less frequently call options are written for durations of 35 days, 65 days, and one year and ten days.

Put Option: The put option is an option to sell and tender delivery against payment 100 shares of common stock at a specified price within a stipulated time period. The time periods are essentially the same as those for call options. Whereas the buyer of a call option may purchase the stock from the writer, the put option buyer has the privilege of selling the stock to the writer. Buying a put is analogous to selling a stock short, while buying a call is often compared to purchasing a long position in a stock. These last statements are meant only in broad and general terms and are made to help one note the difference between

a put and a call.

Straddle: A straddle is a combination of one put and one call. Both the put and the call features of the straddle specify the same stock, the same striking price, and the same maturity date. Either side or both sides of the straddle may be exercised before the maturity date.

Strip: This option which is very rare, is a combination of two puts and one call.

Strap: Another rare type of option, the strap is a combination of two calls and one put.

Spread: The spread, still another type of unusual option, is a straddle that has a different striking price for each the put and the call sides. For example, a straddle might be written on XYZ with a striking price of $50 per share; while a spread on the same stock might be sold with a striking price for the call at $52, and the striking price for the put at $48. The premium paid for spreads is smaller than that on an equivalent straddle since the options on both of its sides are at less advantageous prices from the buyer's viewpoint.

Writer: A writer is one who sells options against either the stock which he owns, against a short position, or against a cash position (naked). Writers usually have

large holdings of stocks or cash and generally sell options in order to earn the premiums which are offered. By selling options on stock which the writer owns, he hopes to either increase the rate of return on his portfolio or to reduce his exposure to risk.

Striking price: The striking price is that specified price at which the option may be exercised. It is usually established at the prevailing market price of the stock at the time the contract is negotiated.

Exercise: In the case of a put, the act of exercise is to tender the stock for sale to the writer (i.e., to "put" the stock to the writer). In the case of the call, the buyer exercises his option by calling for delivery of the stock (i.e., the writer is "called").

Premium: The premium is that consideration which the buyer pays to the writer for the privilege of purchasing the option.

Pricing the Option Premium: The price of the option premium is dependent primarily upon six major factors; the first being the volatility of the stock in question. The cost of the premium varies directly with the degree of future expected volatility in the stock price.

Second, premiums vary depending upon the absolute

price of the stock. Premiums are more expensive percentage-wise on low-priced stocks than on stocks selling at say $50 or $100 per share.

Third, premiums vary with the length of time to the option's expiration. For example, a six-month option is roughly 50 per cent more expensive than a three-month option (see Table D-2, Appendix D).

A fourth factor that affects option premiums is expectations about future stock prices on the part of both buyers and writers. When future expected stock prices are viewed with great optimism, the call option buyer's demand curve will shift to the right (ceteris paribus), causing call option premiums (option prices) to rise. It is also possible that more optimistic projections of future stock prices will cause a shift to the left in the writer's supply curve since higher expected prices present a greater opportunity cost to writers. The shift would also cause premiums to rise.

The fifth major factor affecting option premiums is the need for converting puts into calls (as explained a few paragraphs below). Put options are not usually priced by the effects of normal supply and demand for them, but rather they are priced at a discount from corresponding call

options. The discount is wide enough to cover the costs and profit margins of option converters.

For example, suppose the market place is bidding $500 to writers for a three-month call option. Because of a general lack of demand for puts the normal bid for a three-month put might be say $200. However, by converting a written put into a call a writer might receive $350 for supplying a put. The discount of $150 from the going price of a call is the conversion cost. Conversion costs vary directly with the prime rate of interest and normally range about 1.5 to 2.0 percentage points above that rate, plus an additional minor charge for floor brokerage and transfer taxes.

A sixth possible factor affecting premium prices is the margin regulations which are in effect at a point in time. Low margin requirements on stock purchases make the leverage factor on option buying less favorable relative to stock purchases, therefore option demand is less at any given premium price. Furthermore, option writers usually deposit only the minimum initial margin required on stock positions or cash positions which are kept to back up options which they sell. Thus as margin requirements are lowered, most writers are willing to supply a greater volume of options at a given premium. Hence, as margin requirements are lowered,

the writers' supply curve shifts to the right and the buyers' demand curve shifts to the left, both shifts working to lower the market price of option premiums (ceteris paribus).

Expiration Date: That time in the option contract at which point the option expires. Any option that expires without having been exercised is said to have "lapsed."

Special Options: These are the options that are commonly seen advertised in The New York Times and The Wall Street Journal. They are options that have been previously written, and perhaps have even been bought and sold several times earlier. Their striking prices are apt to be above or below the current market price and their period of time to expiration is not necessarily consistent with the normal periods.

Endorser: Each option written must be endorsed by a member firm of the New York Stock Exchange. This endorsement means that the firm guarantees completion of the contract on the part of the writer. If an option writer were "called," the member firm guarantees that the stock would be supplied to the option buyer at the proper striking price.

Conversion: This is a process whereby puts are converted into calls, or more rarely, where calls are converted into puts. The process is carried out by a converter (usually

a member of the New York Stock Exchange) who buys a put at a discount, purchases the stock, and sells a call. Should the stock price rise, the converter is covered by his long position. Should it fall, the put provides protection. Since the converter receives more money from the sale of the call than he pays for the put, he necessarily makes a profit. However, the converter has to pay floor brokerage and transfer taxes on his transactions in the stock and interest on the funds required to maintain his long position. These costs are accordingly passed along to the purchaser of the converted put, who of course is actually buying a call. The major purpose of the conversion process is that it helps to facilitate an equilibrium of the supply and demand functions in the market place. Buyers heavily favor the purchase of calls, while writers like to write far more puts and straddles than are demanded. Through the conversion of puts into calls, more writers and buyers can be satisfied. It has been estimated that about 60 per cent of all calls purchased were originally written as puts or as puts as a part of straddles.[1]

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[1]Anthony M. Reinach, The Nature of Puts and Calls, (New York: The Bookmailer, Inc., 1961), p. 48. Reinach's estimate might be on the high side. Based upon data supplied by the S.E.C. for June, 1959, only 42 per cent of the calls written during that month originated as puts or as puts as a part of straddles. See: Securities and Exchange Commission, Report on Put and Call Options, Washington, U.S. Government Printing Office, August, 1961, p. 31.

Making a Market in Options: About twenty members of The Put and Call Brokers and Dealers Association make an over-the-counter type market in options. All of these members are brokers in options and most of them are also dealers. Dealers are those who take a position on either the buy or the sell side of an option contract and thereby undertake the risk associated with ownership or with contractual obligation. Most buyers and writers generally deal through stockbrokers, who in turn seek to facilitate orders through an option broker in much the same way as orders for over-the-counter stocks would be handled.

Statement of the Problem

It is generally believed that option writers make a yearly return of about 15 per cent to 20 per cent on their investment, while buyers usually lose money.[1] However, among researchers there appears to be no general agreement about the performance of either writers or buyers (as will be shown in the next section). Against such a controversial

[1] Support for the above contention may be found in: Peter Ehrlich, "Puts and Calls," Barron's, March 3, 1958; "The Hows and Whys of Put and Call Underwriting," Forbes, LXXXVIII, December 15, 1961, p. 20; Zaven A. Dadekian, The Strategy of Puts and Calls, (New York: Corinthian Editions, 1968), p. 17; and in much of the literature distributed by members of the Put and Call Brokers and Dealers Association.

background, this study is aimed at helping to answer the following questions:

Option Writing:

1. What is the rate of return on investment and the degree of associated risk found in a study of thirty-six different option writing strategies? The thirty-six strategies are developed by varying the type of option written (puts, calls and straddles), the position with which a writer backs up his options, the length of time to expiration of the options, and the degree of volatility in the stock upon which options are written.

2. How do the risks and returns found in the thirty-six strategies differ from one another and from common stock investments?

3. What are the major tax implications with which an option writer must contend?

4. What suggestions are implied by this study as to who might benefit from writing options?

Option Buying:

1. Given eighteen option buying strategies, what is the rate of return on investment and degree of related risk on each strategy?

2. How do the eighteen strategies' respective risks

and returns differ among themselves and from common stock investments?

3. With what major tax consequences must an option buyer be concerned?

4. Do the findings of this study suggest the type of investors who might benefit from purchasing puts and calls?

Background and Review of Literature

The put and call option business has long been associated with an aura of risky venture. The option market has been personified as one where speculators abound and in which conservative investors are absent. Thus, it came as little surprise in 1934 when Congress, in framing the Securities and Exchange Act, almost closed down the entire option industry.[1] The opinion of many in those depression days was that options were just one of a number of speculative devices, such as pools and short-selling, which helped to bring about the 1929 stock market crash with its subsequent bear market and economic chaos.

The option business was spared, however, and placed under the regulation of the Securities and Exchange Commission. Other than compiling the data each week on option

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[1]Louis Loss, Securities Regulation, (Boston: Little, Brown and Co., 1951), p. 306.

prices and volume which are submitted by the Put and Call Brokers and Dealers Association, the S.E.C. has taken a passive role as a regulatory agent of the option business. The S.E.C. did make a report in 1935 on abuses found in the option business by an earlier Congressional hearing, and some of the recommendations of the report were subsequently adopted by the Put and Call Brokers and Dealers Association in their original Constitution. Later, reports were made by the S.E.C. in 1939, 1944, and 1945, however the reports contained limited factual data and resulted in no changes in regulatory policy.[1] Thus in actuality, the option industry has been self-regulating since 1934 under the auspices of the Put and Call Brokers and Dealers Association.

The S.E.C. Study

With the exception of Kruizenga's dissertation,[2] the period between 1934 and 1961 evidenced no important research studies on puts and calls. Finally in 1959 the S.E.C.

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[1]Kermit C. Zieg, Jr., "A Study of Common Stock Options from the Standpoint of the Returns Accruing to the Buying and Selling Sides," unpublished Ph.D. Thesis, Department of Business Organization, The Ohio State University, Columbus, Ohio, 1968, p. 24.

[2]Richard J. Kruizenga, "Put and Call Options: A Theoretical and Market Analysis," unpublished Ph.D. Thesis, Massachusetts Institute of Technology, 1956.

initiated a special study into the industry, the result of which was its 1961 Report on Put and Call Options.[1]

Among the highlights of the 1961 Report were the following:

1. The S.E.C. found that option activity had increased about six-fold between 1934 to 1960 (it has more than tripled since then).

2. A marked contrast between option buyers and option writers was noted. Buyers were generally considered by the S.E.C. to be individual investors possessing only small amounts of funds. It was estimated that buyers exercised only 42 per cent of all options that they purchased, and that half of those exercised were done so at a loss. Thus only about 20 per cent or so of all options to buyers were found to have been profitable, and as a result, the call option buyer lost 60 per cent on his average investment.

3. Conversely, option writers numbered only about five-hundred, and consisted largely of wealthy individuals with large stock portfolios. In addition, a few institutions and a considerable number of foreigners wrote options.[2] The

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[1]Securities and Exchange Commission, op. cit.

[2]Of all option contracts outstanding on June 1, 1959, 14.8 per cent were written by foreigners. Ibid., p. 55.

profitability to the option writer was not disclosed, but the implications were that the writer, unlike the buyer, fared well.

4. The agency also found that broker-dealers take a seemingly large spread of 17.7 per cent of the premium that goes to the writer as their renumeration for maintaining an option market, while all option firms (including those which are brokers only) work on an average spread of 14.8 per cent.[1]

The S.E.C. study left many questions as to profit potential on options unanswered. More specifically, it estimated the profitability only to buyers of calls and ignored buyers of puts and straddles as well as writers of all types. Furthermore, the 1961 Report covered only actual options either outstanding or written during the month of June, 1959. For any significant conclusions to be drawn about the desirability of either buying or writing options, a much longer time span should be studied. At least five such attempts have been made.

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[1] Ibid., p. 93. The 17.7 per cent spread works as as follows: Suppose a writer is bid, and receives $1000 for an option. With the average spread as found by the S.E.C. in force, the option buyer would pay $1,177. Note, however, that all option prices are worked out on the minimum fluctuation of $12.50, hence the buyer in the example ~~might~~ typically pay $1,175. Actually spreads are greater percentage-wise on lower-priced premiums than on higher-priced premiums.

Results of Other Studies

Kruizenga[1] studied returns on options for the ten-year period from 1946 to 1956, and his findings conflicted diametrically with those of the S.E.C. He concluded that option buyers would have obtained profits of 9 per cent annually on investment through the steady purchase of three-month call options, and profits of 35 per cent annually on six-month calls. He also noted that put option buyers would have lost heavily. Conversely, he argued that option writers would have been better off just buying and holding the stocks upon which they had written options.

Boness[2] disagreed with Kruizenga. In a study covering 256 option contracts bought from dealers between 1957 to 1960, he found that buyers would have lost 82.2 per cent of their investment annually in puts, calls, and straddles combined. He also calculated that only 33 per cent of all options purchased were profitable. On call options alone just 35.6 per cent were profitable, and a buyer who purchased

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[1]Richard J. Kruizenga, "Profit Returns from Purchasing Puts and Calls," The Random Character of Stock Market Prices, ed. Paul H. Cootner, (Cambridge, Mass.: The M.I.T. Press, 1964), 392-411.

[2]A. James Boness, "Some Evidence on the Profitability of Trading in Put and Call Options," in Cootner, op. cit., 475-496.

calls exclusively would have lost 63.2 per cent annually on his investment.

Boness was far more optimistic on option writing. He found in a sample of 234 contracts sold that the typical strategies employed by most writers (backing up calls with a long position and covering puts with a cash position) would have garnered a return of 4 per cent per year on investment; but, if writers had used a 10 per cent filter technique suggested by Boness, they would have increased profits to 32.9 per cent annually on investment.

In another study by Katz,[1] the results of 851 options actually sold between 1960 to 1962 were examined. He found that in a twenty-one month period 76 writers were responsible for supplying the 851 options studied, and that the writers suffered as a whole a slight loss of .1 per cent on their investment. He likewise concluded that the option buyers of the above contracts also suffered very slight losses.

Zieg,[2] in a recent dissertation, analyzed 2,212 options assumed to have been written during six three-day

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[1]Richard Katz, "The Probability of Put and Call Option Writing," Industrial Management Review, V (Fall, 1963), 55-69.

[2]Zieg, op. cit.

periods occurring between September 23, 1965, to January 23, 1968. The options were not all necessarily written, but were based upon actual "firm bids."

Zieg concluded that option writers would have lost 7.3 per cent on their investment in puts, 1.3 per cent in calls, and 12.7 per cent on straddles. Conversely, Zieg found that buyers profited extraordinarily on all three types; namely 69.0 per cent on investment in puts, 41.5 per cent on calls, and 61.4 per cent on straddles.

Finally, Malkiel and Quandt[1] made a theoretical study of sixteen investment strategies, eleven of which involved either buying or selling six-month options. Their conclusion was that a tax-exempt investor would have lost 7.3 per cent annually on his investment in purchasing call options; lost 7.06 per cent by purchasing puts; and lost 7.2 per cent in having bought straddles. On the other hand, Malkiel and Quandt concluded that the tax-exempt investor would have profited on all six types of option writing strategies studied, with the annual rates of return on investment varying between 1.8 per cent on writing puts

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[1]Burton G. Malkiel and Richard E. Quandt, Strategies and Rational Decisions in the Securities Options Market, (Princeton, New Jersey: Princeton University Financial Research Center, 1968).

against a long position and 28.4 per cent on selling naked straddles.[1] However, no other writing strategy produced more than a 10.2 per cent annual return on investment.

Observations on the Methodology Used in Other Studies

The mere fact that no general agreement appears in various studies of option profitability implies that the methodology or scope of some of the past studies was deficient.[2] Then too, different results might occur when studies are conducted over dissimilar periods of time. However, the problem of time periods can at least be partially overcome by drawing upon a reasonably long duration as a basis for study, particularly when the period embraces the entire gamut of likely stock market conditions. Unfortunately, only Kruizenga's effort, and possibly Malkiel and Quandt's, cover a sufficiently broad time horizon.

Kruizenga's study is limited by the fact that only eight stocks were observed for option activity.[3] By employing

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[1]Naked options are those against which the option writer maintains neither a long nor a short position to cover the option which he has written. Instead, the writer keeps a cash balance in his brokerage account to cover the contingency that he may be either put or called.

[2]Of course, chance can account some of the differences found among studies.

[3]Kruizenga's stock sample included Anaconda Copper, Bethlehem Steel, Chrysler, General Motors, New York Central, Republic Steel, Southern Pacific, and U. S. Steel.

just eight securities, Kruizenga's sample had a distinct bias towards stocks with conservative price volatility characteristics; hence, his conclusions would not necessarily be valid implications of what one might expect from option activity in highly volatile stocks. None-the-less, Kruizenga's effort is probably the best contribution of those cited; however, the fact that his study terminates in 1956 beseeches a more current analysis.

Zieg's major drawback lies in his selection of only six points in time (consisting of three consecutive days each) as option transaction dates. One-third of the dates occurred near the bottom of a bear market, while another third were located near the top of a bull market. That Zieg found option buying to be so profitable is not surprising, since the purchase of puts on one-third of his buying dates had an extremely high probability of producing substantial returns. The same argument holds for the purchase of calls during another one-third of his dates. Since markets do not tend to be near their extreme peaks nor their troughs for one-third of their history, Zieg's study is gravely biased.

Boness's research is intriguing primarily because of the inclusion of his filter technique. He suggests that

writers sell naked calls and naked puts. Should the price of the stock move 10 per cent in an adverse direction to the writer's position, Boness advocates purchasing the stock against calls and going short against puts in order to cover the liability of the option contract. Long or short positions would likewise be eliminated whenever the stock moves 10 per cent adversely against those positions. Boness's technique improved the returns to writers substantially.

However, there are factors in the study which preclude comfortable generalizations. Such factors include a relatively short time span covered (1957 to 1960); a relatively small sample of option transactions (234 on the sell side and 256 on the buy side); and the fact that all transactions studied were actual ones. By analyzing only actual transactions, the personal bias of writers and buyers towards stock selection develops. In drawing conclusions about future option expectations, one is interested primarily in whether options in general are fruitful investment vehicles, not whether past buyers and sellers of options were good forecasters.

Katz's study is much like Boness's in that actual transactions were used (851 of them), and therefore is subject to similar shortcomings. In addition, his twenty-one month

time span is severely influenced by the exceptional bull market of 1961.

The most sophisticated study is that by Malkiel and Quandt, who included tax implications and investors' utility functions toward risk in their analysis. Regrettably though, the Malkiel-Quandt research is predicated upon some doubtful techniques. Only those New York Stock Exchange stocks that sold at prices between $45 to $55 on January 1 in the years 1960 to 1964 were used as a basis for option vehicles. As even Malkiel and Quandt admitted,[1] the price fluctuations of all "$50 stocks" on the New York Exchange from January to July in the respective years might not be a valid sample of the fluctuations found in stocks that had reasonable option activity. It is quite likely that perhaps half or more of Malkiel and Quandt's sample had little or no option activity during the period of time studied.

A second serious flaw in the Malkiel-Quandt work is that data on option premiums were gathered from the years 1964 through 1966,[2] and then applied to hypothetical transactions in the period from 1960 to 1964.[3] This technique

[1]Malkiel and Quandt, op. cit., footnote 3, p. 174.

[2]Ibid , p. 31.

[3]Ibid., p. 40.

might not be valid in so far as option premiums in the former period might not be fair representations of premiums in the latter period.

Malkiel and Quandt also developed theoretical probability distributions of stock prices in order to measure expected stock price performance, but they ignored the extreme tails of the distributions.[1] While they are correct in stating that extreme movements in stock prices are rare, it is precisely these extreme fluctuations that are the bane of the option writer and the dream of the option buyer. One call option sold against a long position where the stock subsequently declines precipitously could do serious damage to a writer's portfolio. Likewise, one call option purchased on a stock that soars two or three times in value could create enough profits to negate a dozen or more total losses.

Aside from the specific criticisms of the studies cited here, all have two additional shortcomings. The studies made no effort to segregate stocks according to their respective price volatility (although Malkiel and Quandt, and Boness did give it some thought). Valid generalizations about stock option strategies in issues such as Control Data or Four Seasons Nursing cannot be made based on

[1] Ibid., 92-93.

diagnoses of say American Telephone, General Motors, or of New York Stock Exchange "$50 stocks." About all that Four Seasons Nursing has in common with American Telephone is that both are common stocks. They behave in radically different ways. It appears prudent, therefore, to restrict conclusions about option performance to strategies that have been applied only to somewhat homogeneous groups of stocks.

Secondly, the above studies fail to indicate the risk that is associated with various option strategies. No investment can be properly rated and analyzed unless indications of both return and risk are estimated.

The Purpose of Option Markets

Before proceeding to the methodology used in this study, it would be of interest to suggest why option markets exist. First, however, it is necessary to explain why people buy options. According to Loss;

> their (put and call options) economic 'raison d' etre' is to serve as a hedge against future market movements. For example, a person who is long may purchase a put as insurance that he will be able to sell if the market falls to a certain level...[1]

Loss further acknowledged however that, "at the same

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[1]Loss, op. cit., p. 306.

time these instruments provide a cheap form of speculation."[1]

The 1961 S.E.C. Report cited three ways in which options provide an insurance function to the buyer. Yet, the report went on to say;

> ...this insurance feature is often mentioned in literature circulated by the industry to defend attacks upon option trading as a form of speculation or as pure gambling. From the data collected and from interviews, it appears that only a small number of options are bought for insurance.[2]

The report also quoted a statement by a partner of a New York Stock Exchange member firm: "The insurance factor as a motive for buying options is minor. I have rarely seen a purchase of an option to insure against loss in a short position."[3]

Perhaps the hypothesis that options are very rarely used for insurance purposes is hasty. Quite often an individual will purchase a call without having a corresponding short position to insure, and yet the transaction is still basically one for insurance purposes. The call was perhaps bought in lieu of a long position in an attempt not to gain leverage for speculation, not to gamble, but rather to

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[1] Ibid.

[2] Securities and Exchange Commission, op. cit., p. 76.

[3] Ibid.

restrict loss in the event of a market decline.

Of course, while it is quite possible that the insurance motive for buying options is more prevalent than is generally supposed, there is no denying that the speculative demand for options looms large. Yet the existence of broad speculative appeal for option purchases should not cast a stigma over the industry which demands the abolition of the option market. If option speculation were eliminated, it would certainly destroy the option insurance market as well. The situation is not unlike present commodity exchanges where speculators abound. If speculation on commodities were abolished, commodity users would have no market in which to hedge against future price movements.

Thus, option demand exists for either insurance (risk reduction) or for speculative motives, and there is some reasonable case to be made for the continuance of option trading. But if demand exists for options, there must be a means of supplying them in order to maintain a market, and it is the option writer who provides the supply. Of course, option writers do not operate philanthropically in order that option markets may be maintained. As a rational capitalist, a writer will supply his good only if he believes the rewards in so doing are commensurate with

the risks encountered. It is precisely the purpose of this research to measure those risks and rewards that accrue to the option writer as well as to the option buyer.

CHAPTER 2

RESEARCH DESIGN

Methodology

Stated briefly, the methodology is concerned with testing the past risk and returns on 36 option writing, 18 option buying, and three control strategies. The objective is to develop return-risk ratios for each of the 57 strategies, and then to statistically determine whether differences in the mean return-risk ratios for each strategy differ significantly from one another at some pre-determined degree of confidence. Within certain limits, the past return-risk ratios may represent reasonable approximations of future expectations.

Given a significance level (α) equal to .05, the null hypothesis (H_0) is that the mean return-risk ratios (RR_j: where $j = 1,\ldots,57$) do not differ from one another; or that the investment worthiness of all 57 strategies is the same. The alternative hypothesis (H_1) is that the 57 strategies do vary significantly in their respective investment worthiness.

The basic procedural steps in testing the null hypothesis are shown below, with more detailed explanations of each step appearing later in the chapter.

Step 1. A random sample of common stocks, stratified as to stock price volatility, is drawn. The sample covers the seven-year period from July, 1961, to June, 1968, and includes only those stocks listed on either the New York or American Stock Exchanges which had significant put and call option activity at the time of their selection.

Step 2. Put, call, and straddle premiums to both buyers and writers are estimated for the period in which each sampled stock is included.

Step 3. Puts, calls, and straddles of 95-day and 190-day duration periods are hypothetically both bought and sold once each month during the period in which a stock is included in the study.

Step 4. The rate of return on investment for each buying and selling strategy for every sampled stock is calculated.

Step 5. The mean (average) rate of return on investment is found yearly on each of the 57 strategies for all seven years of study. The seven-year rate of return on investment for each strategy and the seven-year standard

deviation of return for each strategy are also found. The latter statistic is used as a measure of risk.

Step 6. Given the mean rates of return on investment on a yearly basis, and a seven-year standard deviation, a yearly return-risk ratio is developed for each strategy.

Step 7. A mean return-risk ratio on a seven-year basis is found for each strategy (RR_j; where $j = 1,\ldots,57$).

Step 8. The 57 RR_j's are statistically tested in order to prove the validity of the null hypothesis. Should the null hypothesis be rejected, the alternative hypothesis is accepted.

Step 9. An analysis of tax considerations is made in order to determine the effect of tax laws on the return-risk ratios that are generated.

Step 10. Implications of the findings to various types of investors are discussed, and recommendations for additional pertinent studies which might contribute further knowledge to the problems studied here are extended.

Procedural Steps

Step 1. Random Sample: To overcome the objections to those past studies previously mentioned, it is imperative that the option activity studied here covers a sufficiently broad sample of stocks upon which options are bought and

sold. Furthermore, the sample should be drawn from a time horizon of such adequate duration that the generalizations developed from it might be accepted with some confidence as reasonable estimates of future expectations. In addition, it is important that the stock sample be drawn randomly so as to rid it from the bias of investment timing of past option writers and buyers[1] and from the bias of the researcher.

It is also believed that generalizations made from this research will have more validity when the stock sample is stratified into groups whose homogeneity is reasonably high. To achieve within-group homogeneity, the stock sample is stratified according to the price volatility of the stocks drawn. Price volatility is given important weight in this research because it is felt that generalizations made about

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[1]If actual past option transactions were analyzed for returns accruing to the buyers and to the writers, the personal bias of these investors as to their timing of selections would influence the results. This study is being made to determine what one might randomly expect to happen in the future, therefore it is necessary to purge the bias of past buyers and writers to the fullest possible extent. Some bias still remains in the study, namely that stocks in which there was significant option activity are the only ones being examined; hence, the bias of past option investors as to the stocks in which they traded options remains, although the timing with which these selections were made has been removed. It is necessary that hypothetical option activity in this study be based upon those stocks which had significant real option activity, because it is only on these issues which one can reasonably assume to trade options. One cannot trade in options when no market for them exists.

such stocks as American Telephone or General Motors as option vehicles probably do not adequately apply to option activity in such stocks as Solitron Devices or Control Data.

Stocks selected in the stratified random sample must also be typical of those stocks in which there had been significant option activity during the period in which they are included in the sample. Appendix A indicates that during the period of study the weekly average of stocks involved in option activity numbered 345.44. While figures are unavailable, it is likely that many of the stocks which experienced some option trading had only modest activity.[1] Those issues in which option volume was light do not offer reasonable selections from which to assume frequent option transactions might have been made. Hence, the sample used in this study includes only those issues upon which one would have been able to buy and/or sell options in quantity.

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[1]The S.E.C. Report indicated that in June, 1959, 57.2 per cent of all option activity occurred in only 20.4 per cent of those stocks in which there was any option activity at all. Conversely, 32.4 per cent of the stocks in which there was option activity accounted for only 11.2 per cent of total options transactions. The above figures were calculated from data supplied in; Securities and Exchange Commission, op. cit., p. 44.

Time Period

The random sample upon which this research is based has been taken from the period between July, 1961, to June, 1968. There are several reasons why this particular seven-year span was chosen. First, the terminal point of the period is the most recent date which this study could possibly have included. It is necessary to obtain stock prices for a period of six months after the time at which an option has been hypothetically bought or sold. Thus, to accommodate calculations of profits on options bought or sold in June, 1968, it is necessary to have stock price data through December, 1968.

Second, an examination of the past should be of sufficient nature to be useful in the future. It is felt that a seven-year period is of adequate duration to produce reasonable estimates of future expectations, provided that stock market behavior in the span was typical of what might be expected in the next five to ten years. There were two substantial bear markets (1962 and 1966) in the seven-year period, as well as significant upward and sidewise moves. Such price action indicates that most of the possible types of stock market behavior that might be expected in the future were evidenced between 1961 to 1968.

Third, the data on option premiums that was of adequate quality for research was available only as far back as July, 1961.

Sample Size

The size of the sample should be large enough so that population values of pertinent characteristics can be estimated within comfortable confidence limits, but not so large that the time and cost of obtaining the sample becomes excessive. The characteristic of stocks (in the population of all stocks having significant option activity) pertinent to this study is stock price movements over three-month and six-month periods.

The sample size will be considered sufficient if it can be reasonably assumed that the measure of sample price movements falls within certain predetermined limits of population price movements at the 95 per cent confidence level. Sample price movements are measured by the percentage change in the price of a stock over both three-month and six-month periods.

Stock price movements of six months duration within the High Volatility Class can be expected to have greater variance of price movements than the stocks in any other volatility class when measured over any period of time

considered in the study.[1] Therefore, if confidence limits can be established for High Volatility Class stocks for six-month periods, the limits so established should be quite conservative for stocks of lesser volatility, or of stocks measured over three-month periods.

The following formula is used to establish confidence limits about a sample mean:[2]

$$\sigma_{\bar{x}} = \frac{\hat{s}}{\sqrt{N}}$$

where: $\sigma_{\bar{x}}$ = standard error of the mean

$\hat{s}$ = unbiased estimate of population standard deviation

N = sample size

If values can be found for $\sigma_{\bar{x}}$ and for $\hat{s}$, the required sample size (N) can be determined.

It is felt by the author that it would be reasonable to accept a sample of highly volatile stocks (as measured by six-month price movements) if the average price movement (μ) of the population were believed to fall within four percentage

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[1]This stock price movement hypothesis has been confirmed through the use of F Ratio Tests for Significance of Variance. See: Appendix B, Tables B-1 and B-2.

[2]See: William L. Hays, Statistics for Psychologists, (New York: Holt, Rinehart and Winston, 1966), 301-303.

points of the sample average price movements ($\bar{x}$), given a 95 per cent confidence level (where: $\alpha = .05$, two-tail). The Z Statistic value of $\alpha = .05$ (two-tail) is 1.96. Thus, if the standard error of the mean were 4 / 1.96 = 2.04; one could be certain 95 per cent of the time that the population value (μ) would be within $\pm$ 4 percentage points of the sample value ($\bar{x}$).

Given a value for the standard error of the mean (2.04), one need only estimate $\hat{s}$ in order to find the required sample size (N). Since the actual population standard deviation is unknown, some estimate of the value must be made. The best estimate of the population standard deviation available ($\hat{s}$) is found in a previous study by the author.[1] In that study 1266 observations of six-month price movements on highly volatile stocks were made, with the study covering the time span between December, 1961, to June, 1966 (a period closely overlapping the present study). It was found that the average price movement ($\bar{x}$) was 27.7 per cent and the unbiased estimate of the population

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[1] Martin E. Zweig and Shelby Hunt, "An Analysis of Call Option and Straddle Purchases on Selected Volatile Stocks," unpublished paper presented to Dr. Alden Olson for Accounting and Financial Administration 893, Michigan State University, East Lansing, Mich., 1967.

standard deviation ($\hat{s}$) was 55.78 per cent.[1]

Substituting the values found for $\sigma_{\bar{x}}$ and for $\hat{s}$ into the standard error formula, the estimated required sample size (N) is 745.29. Thus, at least 746 observations of six-month price movements on volatile stocks are needed in order to be 95 per cent certain that the sample mean will be within $\pm$ 4 percentage points of the population mean.

Each stock that is eventually sampled will provide 12 observations of six-month price movements (one observation per month for a one-year period). By dividing the required number of total observations (746) by the number of observations per stock (12), it is determined that at least 63 stocks must be sampled in the High Volatility Class. Each sampled stock is observed for only one year, after which time it is discarded and a new sample is drawn. The process is repeated for each of the seven years of study. Therefore, with seven years of study it is necessary to select at least nine stocks each year for the High Volatility Class (63 / 7 = 9). To be conservative, 10 stocks were actually selected yearly in each volatility class. With three such classes, a total of 30 stocks were

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[1]These statistics compare favorably with those of the High Volatility Class found in Table B-2, Appendix B of this study.

sampled yearly; this resulted in a total sample size of 210 stocks over seven years, and of 70 stocks within each of the three volatility classes over the entire period.[1]

There are four reasons why a fresh random sample was drawn for each year of the study. First, there is a possibility that if all stocks were drawn in 1961 and included for the subsequent seven years, some of them might later experience little or no option activity, thereby rendering them inadequate for inclusion in the study. The possibility also exists that some of the firms whose stocks were selected in 1961 might later have merged with other firms or in some other way lost their identity.

Second, there exists the likelihood that one or more stocks, if included in the study throughout, could severely distort risks and returns that might be randomly expected. For example, a stock that increased by forty-fold during the seven-year period might have made option writing or buying appear deceivingly profitable. By drawing a new random sample every year, each stock is given less weight in affecting the over-all results.

Third, the market characteristics of a given stock

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[1]Occasionally the same stock was randomly selected in more than one year, but such results are to be anticipated by chance expectations.

tend to change over long periods of time. For example, after its huge mineral discovery in 1964 the price volatility of Texas Gulf Sulphur changed radically. Hence, if Texas Gulf had been included in the original 1961 sample, a problem would have developed at the time when the stock's volatility characteristics changed. At some point, say 1964, the stock would have had to have been placed in a different volatility class, thus causing an imbalance among the volatility groupings and perhaps a distortion in the final risk and return measurements.

One example in this study of a stock with changing volatility is Douglas Aircraft, which was randomly selected in the Medium Volatility Class in 1961, at which time the 190-day straddle bid to writers was 17.0 per cent of the striking price. In 1965 Douglas was again included in the sample, but this time the straddle premium as a per cent of striking price was only 11.0 per cent; hence, the stock was placed in the Low Volatility Class.

Fourth, it seems less reasonable to include a randomly selected issue in a hypothetical portfolio for a seven-year period than for a one-year period. This is particularly true when the hypothetical portfolio is generated in order to estimate real world possibilities. It is a

more realistic assumption to suppose that an option writer or buyer would randomly choose a stock for his portfolio on a one-year basis as opposed to a seven-year basis, especially if the investor accepts the Random Walk Hypothesis.[1]

Drawing the Sample

The random sample itself was drawn from bid sheets supplied by the firm of Thomas, Haab & Botts, members of the Put and Call Brokers and Dealers Association. The bid sheets are summaries of bids made to option writers on several dozen stocks during a particular day. The bids always include straddle bids and often include bids on puts, calls or both. Bids are made for option duration periods ranging anywhere from thirty days up to one year and ten days; however, the predominant option durations represented were for three

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[1]For an explanation of the Random Walk Hypothesis, see: Paul H. Cootner, "Stock Prices: Random vs. Systematic Changes," Industrial Management Review, Vol. 3, No. 2, (Spring, 1962). Stated very simply, the Random Walk Hypothesis suggests that at least in the short-run, stock selection on a purely random basis will produce returns as good as those generated through the process of value analysis or technical analysis. In the long-run the random selection method will also supposedly perform as well as technical analysis. Thus, if one accepts the Random Walk Theory, the assumption of randomly selecting stocks for one-year periods should be reasonable.

months (or 95 days) and for six months (or 190 days).[1]

Thomas, Haab & Botts has provided by far the most extensive bid sheets of any option house. In the early nineteen-sixties bids were distributed to the brokerage community on the average of two to three days per week. From 1965 to the present the firm's bid sheets were printed on virtually a daily basis. Thus, with the exception of dealers' records of actual option transactions completed, the Thomas, Haab & Botts bid sheets are probably the best evidence of interest in various options that can be found. Dealers' confidential records, which include actual transaction prices, would have provided an even better source for indications of option activity, however option dealers are extremely reluctant to let outsiders view their records. The only access to actual dealer accounts was provided by the Miami branch office of Saul Lerner Co., Inc.[2]

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[1]The S.E.C. Report found that six-month and three-month options were the most popular. Ninety-day options accounted for 14.6 per cent of all options outstanding in June, 1959, while six-month options represented 65.2 per cent. Securities and Exchange Commission, op. cit., p. 28.

[2]The Lerner records were examined in July, 1966, in conjunction with this author's Master's Thesis; Martin E. Zweig, "Analysis of Profit Potential of Systematic Call Option Purchases," (unpublished Master's Thesis, Department of Finance, University of Miami, Coral Gables, Florida, 1966).

Unfortunately, the branch office's volume was of insufficient size upon which to base this study.

In drawing the sample, eight bid sheets per month were taken from the bid sheet files on a random basis. Using this smaller more manageable sample of bids, a table of random digits[1] was employed to help select two quotes from each bid sheet. Approximately twelve-hundred bids on 190-day straddles, evenly spread over the seven-year period, were drawn. The straddle bids were then adjusted in order to better approximate actual prices that writers really would have received. The adjustment process is explained in Step 2 of this chapter.

Volatility Classes

Once bids on 190-day straddles to writers were adjusted to reflect more accurately actual premiums, the premiums were divided by the cost of 100 shares of stock (market price on the day of the adjusted bid times 100 shares). The result is the premium as a percent of the striking price.[2]

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[1]Samuel B. Richmond, Statistical Analysis, (New York: The Ronald Press Co., Second Edition, 1964), 595-596.

[2]Henceforth, the term "premium as a per cent of striking price" will be used to denote what actually should

Based upon a priori reasoning, in those cases when the 190-day straddle premium as a per cent of striking price is relatively low, the price volatility of the stock in question should also be relatively low. Likewise, when the premium as a per cent of striking price is relatively high, then the stock price volatility should also be relatively high. On the basis of the above argument, the random sample of option bids was stratified into three volatility classes. Each volatility class was then defined by the premium as a per cent of striking price as shown below:

Table 2-1

VOLATILITY CLASSES DEFINED

Volatility Class	Range of 190-day Straddle Premium as a Per Cent of Striking Price*
Low	zero to 14.5 per cent
Medium	15.0 to 22.5 per cent
High	23.0 per cent and above

*based upon adjusted premium bids to writers and rounded to the nearest one-half of one per cent.

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be called, "premium as a per cent of striking price times 100 shares." It is less cumbersome to use the former term. For example, suppose that stock XYZ currently sells for $50 per share and that a straddle is written on it for $1000 with the striking price equal to the market price. Hence, "premium as a per cent of striking price" is equal to $1000 / $50 x 100 shares = 20 per cent.

The above technique can be justified on both logical and statistical grounds.[1] On a logical basis, if a given stock XYZ were perceived as having high future expected price volatility, option writers will demand relatively high premiums. This is so in order to justify the greater risks associated with writing straddles on the stock. Likewise, if option buyers felt that XYZ were highly volatile, they would be willing to pay greater premiums since high volatility makes the possession of an option more valuable. Greater stock price volatility enhances the option buyer's chances for large profits, and at the same time affords him a known maximum limit against the adverse price movements which are more likely to occur. The reverse of the above argument applies in the case in which a stock is perceived as having relatively low future expected price volatility; hence, premiums would be relatively low.

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[1] According to the S.E.C. Report, "Premiums for options on the most volatile stocks were highest." Securities and Exchange Commission, op. cit., p. 8. The S.E.C. Report also presents empirical evidence which supports the volatility-premium relationship above; Ibid., Table 31, p. 87, which is reproduced here as Table D-4, in Appendix D.

Additional evidence is provided by the statement, "It is well known, however, that options on volatile stocks tend to command higher premiums." Malkiel and Quandt, op. cit., p. 156.

Not willing to accept only a priori reasoning as justification for the above stratifying technique, a statistical examination was also made of the volatility-premium relationship. The results of the statistical test appear in Appendix B, and clearly substantiate the volatility groupings that were made.

Stratification

The next step in selecting the sample of stocks to be studied was to randomly draw ten stocks from each of the three volatility classes in each of the seven years. With approximately twelve-hundred straddle bids having been previously randomly drawn, there were roughly 150 to 200 bids on hand for each of the seven years from which 30 stocks were selected annually. A table of random digits[1] was used to aid the stratification process. For each stock selected, all the bid sheets for that year were scrutinized in order to ascertain whether or not there appeared to be enough option interest in the stock to warrant inclusion in the study.

To qualify for selection to the final sample, a stock had to appear at least four or more times in the bid sheets for the year in question (appearances on consecutive

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[1]Richmond, loc. cit.

days count only once). Furthermore, there must have been some evidence in the bid sheets that both six-month and three-month options could have been written or sold on the stock.[1]

When a stock selected in the random process failed to demonstrate reasonable option interest, it was discarded and another stock, randomly drawn, replaced it. The process was continued until all three volatility classes of size ten were filled for all seven years.

The final sample of 210 stocks and their 190-day adjusted straddle premium bids as a per cent of striking price to writers appears in Appendix C.

Step 2. Option Premiums: The procedure for estimating the option premiums for those stocks drawn in the random sample consisted of three phases.

Need for Adjusting Straddle Bids

The stratification of the random sample in Step 1 was based upon volatility as measured by the 190-day straddle

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[1] Whether or not bids appeared for straddles, puts or calls does not matter in making the assumption that options of all three types could have been bought or sold. The conversion process discussed earlier makes it possible to equate the supply and demand for the three different types of options, so long as there is interest for any type of option on the buy side and on the sell side.

bid to writers as a per cent of striking price. Hence, it was next necessary to estimate as closely as possible the actual 190-day straddle premium that a writer would have received had he negotiated to write an offered option. Option dealers, such as Thomas, Haab & Botts, earn their principal form of income by taking a mark-up between the option premium paid by a buyer and the premium paid to the writer. Given the competitive environment in which an option dealer operates (there are about twenty option brokers and dealers), he normally attempts to maximize the spread or differential between the buying and writing premiums.

When an option bid appears on a dealer's bid sheet, it is usually the result of interest in a particular option on the part of buyers.[1] For example, suppose that a dealer receives an inquiry for one or more 190-day calls on stock XYZ, and that the buyer indicates that he might be willing to pay $500 for each one. Or perhaps a prospective buyer does not actually indicate how much he is willing to pay for calls, but the firm feels that based on its experience they could probably sell such calls for a sum in the

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[1]Occasionally a dealer will not have current interest from buyers but will still advertise bids to writers in order to keep an inventory on hand. It is expected that the inventory can usually be turned over quickly at a profit.

neighborhood of $500 apiece.

The dealer's next move is to find a writer who is willing to supply options on XYZ. It does not matter whether the writer prefers to supply calls directly or whether he chooses to write puts or straddles instead. The dealer's primary aim is to secure a writer with interest in XYZ at a price advantageous to the firm. If a writer were found who wished to supply puts or straddles in lieu of calls, a transaction can still be accommodated by means of the option conversion process.

If no writer can be found at the dealer's desired price during the day that buying interest is first indicated, the dealer may elect to enter bids to writers via his daily bid sheet (assuming that buying interest continues after the first day). If the dealer believes that he can sell calls on XYZ for $500, and assuming that the dealer is attempting to maximize his mark-up (given the constraints of his competitive environment), he will usually enter a bid on his sheet at a figure somewhat below the maximum amount that he would be willing to pay.

For example, suppose that the dealer would be willing to pay a maximum of $450 for 190-day calls on XYZ. It is then likely that he will enter a bid on his sheet for

only $400. If he is fortunate, he dealer might be able to find a writer who would be willing to accept only $400. However, the dealer has a $50 leeway for bargaining purposes. He will attempt to obtain the calls at a premium as close to $400 as is possible, but if he feels that the market will not bear such a low price, the dealer will eventually raise his bid to $450 (ceteris paribus).

To complicate matters, many option writers prefer to write straddles instead of calls; therefore, most dealers who print bid sheets include a bid for straddles when the buying interest centers on calls. To calculate how much he would be willing to bid for a straddle, the dealer first estimates how much he could obtain for two calls. Assume that his estimate is $500 per call. Next, the dealer notes the minimum spread he is willing to make on each call, say $50.

Since the put portion of the written straddle must be converted into a call, the dealer must calculate the conversion cost. Assume that the conversion cost is $150. The dealer now knows that he will probably receive $1000 from buyers for two calls, and that with conversion costs and minimum mark-ups included, he can pay a maximum premium of $750 to writers. Since the dealer tries to maximize his markup, he may enter a bid for XYZ straddles on his sheet

for perhaps $650. If a writer were willing to accept $650 for supplying a straddle, the dealer will gladly pay it. More likely however, the dealer may have to negotiate with writers and eventually pay anywhere up to $750 for the XYZ straddle.

The above example illustrates the fact that quotes on Thomas, Haab & Botts' bid sheets are not realistic estimates of the actual premiums that writers receive. In most instances the premiums appearing on the sheets underestimate the premiums actually transacted. Hence, an adjustment process is necessary to compensate for the underestimate.

Phase 1: Adjusting Straddle Bids

The adjustment of the 190-day straddle bids into prices more in line with actual transactions was carried out in a two-fold process. First, estimates of the differential between bid sheet premiums and actual premiums paid to writers was made by Mike Pincus,[1] a veteran option trader with Thomas, Haab & Botts.

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[1]Interview with Mike Pincus, Professional Option Trader, Thomas, Haab & Botts, members of the Put and Call Brokers and Dealers Association, New York, March 3,...,7, and March 27, 1969. Mr. Pincus' estimates were verified by three other traders at the firm as well as by two senior partners, Lawrence G. Botts and Phillip D. Haab.

Second, using Pincus' estimates, adjusted bids were compared to similar options that had appeared in Saul Lerner's records of actual transactions.[1] The Lerner records sufficiently substantiated Pincus' estimates.

The straddle bids on Thomas, Haab & Botts' bid sheets were adjusted upward on the average of 5.9 per cent of the bid appearing on the sheet,[2] although the adjustment varied from stock to stock, depending upon the investment characteristics of the issue and the absolute size of the premium bid. Competition is keener among writers in high investment quality stocks (eg., American Telephone or General Motors) as opposed to more speculative issues. Therefore, dealers cannot afford to make bids on top quality stocks that are relatively as low as those on the more speculative variety. If his bids on high grade issues are too low, a dealer will immediately price himself out of the market. Thus, on investment quality stocks which comprised most of the Low

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[1]Examination of the actual records of the Miami branch office of Saul Lerner Co., Inc., was made with the cooperation of David Lerner, Branch Manager, and Jack C. Farbman, Professional Option Trader, July 5, 6, 7, 1966.

[2]A sample of twenty bids and their adjusted premiums was taken from the 210 stocks used in this study. The total bids on the twenty stocks amounted to $19,000, while the adjusted premiums totaled $21,072. Thus, the average markup from bid to actual on the sample of twenty stocks was 5.9 per cent, with a range from 3.1 per cent to 12.4 per cent.

Volatility Class issues, the upward adjustment of the bid sheet quotes was relatively less than the adjustment on the lower quality issues which in turn appeared mostly in the Medium or High Volatility classes.

Phase 2: Estimating Average Annual 190-Day Straddle Premiums

The second phase of the premium estimating process consisted of determining the average 190-day actual straddle premium to sellers as a per cent of striking price for the year in which a stock was included in the sample. The yearly average premium as a per cent of striking price was a more expedient premium estimate than trying to find a separate premium bid on each date that a hypothetical option contract was transacted. In fact, the latter method would have been impossible given the data that was available; however, the nature of the stocks sampled is such that it is still realistic to assume that a writer or buyer could have made monthly transactions.

In calculating the average annual straddle premium as a per cent of the striking price, the bid sheets were searched for broadly-spaced bids on each stock over the year. When several bids were found on a stock (usually made at various stock price levels), the adjusted bids as a per cent of striking price were averaged. The average

straddle premium as a per cent of striking price was thus deemed to be typical of the premium that a writer could have expected had he written straddles either continuously or randomly during the year in question.

Phase 3: Estimating Twelve Option Premium Types

Step Two of the methodology has so far been concerned only with estimating the average yearly 190-day straddle premium as a per cent of striking price to writers. However, eleven other premiums per stock had to be estimated. Table 2-2 shows all twelve categories of option premiums which were eventually estimated on the basis of average yearly premium as a per cent of striking price.

Table 2-2

TWELVE TYPES OF PREMIUMS USED IN THE STUDY

Premium Type*	Abbreviation
1. 190-day straddles to writers	6-S-W
2. 190-day calls to writers	6-C-W
3. 190-day puts to writers	6-P-W
4. 95-day straddles to writers	3-S-W
5. 95-day calls to writers	3-C-W
6. 95-day puts to writers	3-P-W
7. 190-day straddles to buyers	6-S-B
8. 190-day calls to buyers	6-C-B
9. 190-day puts to buyers	6-P-B
10. 95-day straddles to buyers	3-S-B
11. 95-day calls to buyers	3-C-B
12. 95-day puts to buyers	3-P-B

*all premiums above are expressed as premium as a per cent of striking price.

Premiums to Writers

In estimating the remaining eleven premiums, the procedure was to first estimate those premiums paid to writers for option types 2,...,6, above. Three sources were utilized to aid in estimating these sell-side premiums. First, the bid sheets of Thomas, Haab & Botts were scrutinized. For every 190-day straddle bid to writers made on the sheets there also appeared either a 190-day put bid or a 190-day call bid. In many cases, particularly from 1965 through 1968, both put and call bids were present with every straddle bid. All put and call bids on 190-day options that corresponded to a straddle bid used in the 210 stock sample were then transcribed for further examination.

Next, the bid sheets were inspected for 95-day bids on puts, calls, and straddles during the year in which each stock appeared in the sample. The 95-day bids were also copied for further study.

With the estimated average 190-day straddle premiums to writers and with bid sheet quotes on other option types to writers in hand, Dadekian's "Evaluation of Option Bids"[1] was consulted. Dadekian's "Evaluation of Option Bids" appears

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[1]Zaven A. Dadekian, The Strategy of Puts and Calls-Selling Stock Options for Maximum Profit with Minimum Risk, (New York: Corinthian Editions, 1968), 98-103.

in Table D-1 of Appendix D, where the range of his dollar premiums has been converted into premiums as a per cent of striking price.

By using both the Thomas, Haab & Botts bid sheet data and Table D-1, the five remaining option types to writers, expressed in the form of premiums as a per cent of striking price, were estimated. As a final check on the above estimates, Tables 29, 30, and 31 of the S.E.C. Report[1] were consulted. The three tables are reproduced as Tables D-2, D-3, and D-4 of Appendix D, and all are concerned with the interrelationship of put, call, and straddle premiums to writers on three-month (or 95-day) and six-month (or 190-day) options. The final estimates of premiums to writers, relative to the average premium as a per cent of striking price on 190-day straddles, were then made.

Premiums to Buyers

The last procedure in the premium estimating process was to find realistic premiums that buyers would have paid for options on the sampled stocks. Given the estimated premiums to writers, premiums to buyers can be calculated

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[1]Securities and Exchange Commission, op. cit., 84, 86-87.

by adding the option dealer's markup[1] to the writer's premium.

Option dealers' markups were estimated from the data supplied by the Securities and Exchange Commission.[2] The S.E.C. data is the most extensive and the most reliable information on markups that is publically available. Appendix E presents a reproduction of the S.E.C. findings.

Premiums to buyers were calculated by adding the markups found by the S.E.C. to the premiums received by writers. Buyer's premiums were then converted from dollar figures into premiums as a per cent of striking price.

Step 3. Hypothetical Option Transactions: In order to test the results of 54 option strategies it is assumed that 18 option treatments are transacted monthly per sampled stock. Since the sample is stratified into three volatility classes, 54 total option strategies develop (three

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[1]Commissions to the buyer's stockbroker (usually $6.25 per option) and endorsing fees to the writer's stockbroker (also usually $6.25 per option) have been eliminated here from the gross markup (the difference between that sum which the writer actually receives and that sum which the buyer actually pays). Allowance for these fees has been made in Step 3 of The Methodology under the heading "Commissions."

[2]Securities and Exchange Commission, op. cit., Table 32, p. 90; Table 33, p. 92; and Table 34, p. 93. The S.E.C. data is reproduced in Appendix E as Tables E-1, E-2, and E-3.

classes times 18 option treatments per class). There are also three control strategies.

Types of Option Strategies

Table 2-3 enumerates the 57 possible strategies used in the study. The column, "Treatment," shows the abbreviation that is used for each option or control type. The other three columns include the numerical notation which corresponds to a given strategy. Strategies emerge when treatments are combined with volatility classes.

Should one wish to distinguish in abbreviated form, Strategy 1 from Strategy 20, the following would be used:

Strategy 1 = L-3-CL-W Strategy 20 = M-3-CL-W

The Strategy 1 abbreviation refers to Low Volatility Class (L); 95-day duration (3);[1] calls backed against a long stock position (C-L); to writers (W). Strategy 20 refers to the same option treatment except that the Volatility Class is Medium (M).

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[1]Three-month and 95-day options are used interchangeably in the study. The same is true for six-month and 190-day options. In the earlier years of the study the former durations appeared frequently. In the past few years, however, the latter duration periods are used almost exclusively as opposed to the three-month or six-month durations.

Table 2-3

FIFTY-SEVEN OPTION AND CONTROL STRATEGIES USED IN THE STUDY

Treatment	Volatility Classes		
	Low (L)	Medium (M)	High (H)
3-CL-W	1*	20	39
3-CN-W	2	21	40
3-PS-W	3	22	41
3-PN-W	4	23	42
3-SL-W	5	24	43
3-SN-W	6	25	44
6-CL-W	7	26	45
6-CN-W	8	27	46
6-PS-W	9	28	47
6-PN-W	10	29	48
6-SL-W	11	30	49
6-SN-W	12	31	50
3-C-B	13	32	51
3-P-B	14	33	52
3-S-B	15	34	53
6-C-B	16	35	54
6-P-B	17	36	55
6-S-B	18	37	56
Control	19	38	57

where:

3 = three-month or 95-day durations
6 = six-month or 190-day durations
C = call option
P = put option
S = straddle option
L = long stock position to back up a written option
N = naked position to back up a written option
S (where S follows P) = short position to back up a written put
W = option to writer
B = option to buyer
L (where L precedes option type) = Low Volatility Class
M (where M precedes option type) = Medium Volatility Class
H (where H precedes option type) = High Volatility Class
Control = annualized rate of return on investment from purchasing and holding a given stock during the period it is included in the study.

*refers to the numerical notation for each strategy.

Dates of Hypothetical Transactions

It is assumed that each of the 18 option treatments is transacted monthly in all sampled stocks. The last trading day of each month is used as the date on which an option contract is negotiated. Twelve options per stock of each type of treatment are initiated annually beginning in July of the year in which a stock has been drawn and continuing through June of the following year.

The hypothetical transactions commence in July, 1961, and continue for a seven-year period ending in June, 1968.

The control strategy consists of purchasing every stock in July of the year in which a stock is sampled, and holding it for eighteen months to the end of the following December. December is used as the sale date of the stock because all six-month options bought in June are affected by price movements through the end of December. Hence, the control strategy gives one an idea of the returns that could have been generated by purchasing and holding stocks during each eighteen-month period of option investing.

Striking Prices and Holding Periods

All options are assumed to have been transacted at striking prices which are equal to the month-end closing

price of the stock.[1] It is further assumed that the buyer in all option transactions exercises his option (if profitable to do so) only at the month-end stock price three months after a 95-day option has been purchased, and six months after a 190-day option has been bought. If an option lapses, it is assumed that the writer terminates his position which backed up the option. The termination is appropriately completed either three months or six months after the contract originated.

The following quotations from the S.E.C. Report justify the holding periods assumed above:

> ...There is a decided tendency for option holders to refrain from exercising their options until they are about to expire, regardless of market movements...
>
> For all calls as a group which were exercised, regardless of the length of the option, it is estimated that approximately 75 per cent were exercised on their expiration date or less than a week before expiration; an additional 10 per cent were exercised from one week to 30 days before expiration; and only about 15 per cent were exercised more than 30 days before expiration.[2]

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[1]Stock price data was obtained from Investment Statistics Laboratory, Inc., ISL Daily Stock Price Index - American Stock Exchange (also New York Stock Exchange), (Palo Alto, California, 1962-1968); and Barron's (Chicopee, Mass., 1961). All stock prices were rounded to the nearest whole dollar per share with the exception of those under $15. The latter were rounded to the nearest one-half dollar per share.

[2]Securities and Exchange Commission, op. cit., p. 51.

> Many put and call brokers advise their customers to delay the exercise of their profitable options and take advantage of the market movement by trading against the option.[1]

Options were assumed to be exercised only if the commission expense involved in doing so could be recovered. Only one side of the straddle options which were bought was assumed to have been exercised. The call portion of the straddle was exercised when the terminal price of the stock was greater than the striking price (including the commission allowance), while the put side was allowed to lapse. The put was exercised and the call allowed to lapse when the terminal price was lower than the striking price. Occassionally both sides of straddle options were allowed to expire unexercised in cases where commission expenses could not be recovered by exercising either the put portion or the call portion of the contract.

Brokerage Commissions

To accurately reflect the profit returns from investments in options, it is necessary to estimate commission expenses that are incurred. Rather than to laboriously use the exact commission scale of the New York Stock Exchange, it was more expedient to use the abbreviated schedule in

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[1] Ibid., footnote 34.

Table 2-4. This schedule also includes brokerage fees on option purchases as well as endorsing fees to writers.[1]

Table 2-4

COMMISSION SCHEDULE

Stock Price*	Roundtrip Commission Per 100 Shares
Under $20	$50
$20 to $39	$75
$40 to $149	$100
$150 and above	$150

*The stock price is based upon the average of the twelve striking prices used on each stock.

One roundtrip brokerage commission was applied to every put or call, or put or call portion of a straddle that was exercised in any strategy involving option buyers. No commission was charged to buyers when options lapsed.

Commissions were charged to writers as shown in Table 2-5.

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[1] Brokerage and endorsing fees on options are typically $6.25 per option. If options are purchased directly from an option dealer, the fee may be avoided. If an account is large enough and if the stockbroker (who is also the endorser) is agreeable, no endorsing fee is charged to the writer. The S.E.C. notes; "Some endorsers charge only their small inactive customers and other firms make no charge at all." Ibid., p. 60.

Table 2-5

BROKERAGE COMMISSION SETS
APPLIED TO OPTION WRITERS*

Option Type	Stock Up	Stock Down	Stock No Change
Call-Long Position.	1	1	1
Call-Naked.	1	0	0
Put-Short Position.	1	1	1
Put-Naked	0	1	0
Straddle-Long Position.	1	2	1
Straddle-Naked.	1	1	0

*One set equals one buy and one sell commission each (a roundtrip).

The following example shows how the above schedules work. Suppose a writer sells a call (either for 90 days or for 190 days) and backs it up with a long stock position. Assume a striking price of $50 per share and a terminal price of $60 per share. The writer will be called, and it is assumed that he delivers the long position in order to fulfill his contractual obligation. Hence, the writer must pay brokerage commissions to both buy and sell 100 shares of stock (a roundtrip).[1] Table 2-5 shows that one roundtrip

[1]The writer pays a buy commission when he originally purchases the stock at the striking price. He also pays a sell commission when he liquidates the stock at $60 a share by delivering it to the option holder. The two commissions combined make up a set or a roundtrip commission.

commission set is applied to the writer, while Table 2-4 indicates that the one commission set costs $100 (assuming the average of all striking prices was in the $40 to $149 range).

Had the terminal stock price fallen to $40, the option would not have been exercised. In this case, it is assumed that the writer liquidates his long position in the market, again paying one roundtrip set of brokerage commissions.[1]

Dividends and Stock Splits

Whenever a stock goes ex-dividend during the life of an option contract, the striking price is reduced by the amount of the dividend. Should a stock be split or should a firm declare a stock dividend, the striking price is reduced by means of the following formula:

$$\text{New Striking Price} = \frac{\text{Old Striking Price}}{1 + \text{number of new shares per each old share}}$$

After a stock split the striking price is not only reduced, but the number of shares on option is increased in proportion to the split. For example, suppose a call is sold on XYZ with a striking price at $50 per share. One

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[1]One buy commission (at a stock price of $50 per share) plus one sell commission (at $40 per share) equals one roundtrip set of commissions.

month later the company announces a two-for-one split. The new striking price is then equal to $50 /1+1 = $25.

Since the number of new shares is twice the number of old shares, the call on XYZ will cover 200 shares, each with a striking price of $25.

All option strategies used in this study have been adjusted for both dividends and for stock splits. The three control strategies have also been adjusted in a manner consistent with holding a long position.

It should be noted here that when a writer sells a call against a long position he in effect gives up any dividends received during the life of the option, provided that the call is exercised. If the option fails to be exercised, the writer keeps any dividends accumulated during the life of the contract. Dividends thus represent an opportunity cost to the writer in the event that he is called. However, dividends reduce the risk of writing calls (when backed by a long position) by giving the writer a cushion when the stock declines.

Put option purchasers find their striking price to be less advantageous after a dividend, while call option buyers benefit from a reduced striking price. Writers of naked puts find the reduction in the striking price after a

dividend works to their advantage, since the likelihood of their being put is reduced.

Investment Bases

In all hypothetical option transactions there must be an assumption of how many dollars are invested per transaction. The investment assumed for option buyers is simply that 100 per cent of the cost of each option purchased is deposited with a broker since this is the amount brokers require.

The assumed investment required for writers is far more complex. The major problem in determining the writer's investment base for each option contract is that there are a variety of ways to finance the position against which a contract is written. The current minimum margin requirement, as stipulated in Regulation T of the Board of Governors,[1] is that 80 per cent of the long or short position taken in a stock must initially be deposited. Since July, 1961, when this study began, the initial margin requirement has varied between 50 per cent to 80 per cent, although it remained at 70 per cent during the bulk of the past seven years.

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[1]Board of Governors of the Federal Reserve System, Regulation T, (as amended effective June 8, 1968).

Should an option writer wish to use margin in order to increase his leverage, he may do so; however, he must pay interest to his broker on the amount borrowed. If margin were used as part of the assumptions of this study, the resulting interest costs would be quite significant and would also make calculations of returns on investment more complex. Furthermore, it is probably best to analyze investment opportunities from a standpoint of risk and return first, and introduce the financing decision only after the investment has been accepted as appropriate. Hence, it is assumed that no funds will be borrowed on any investments, a procedure which avoids complex interest calculations, but which still enables adjustment of risks and returns later for the effects of any given leverage strategy desired.[1]

Stock Positions to Cover Options

Since no funds will be borrowed by writers in this study, all long positions that back up calls or calls as a part of straddles and all short positions held against puts will initially be financed with 100 per cent margin. However, since premiums are received when the contracts are

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[1]The return-risk ratios developed later in this study are unaffected when leverage is used if it is assumed that borrowing costs are zero. When interest is charged on margin borrowing, the return-risk ratios are adversely affected.

initiated, the amount of funds which must be deposited by the writer in covering a long or short position is the striking price per 100 shares minus the premium received. For example, if a 95-day call on General Motors were sold against a long position at $80 a share for a premium of $500, the required investment by the writer would be $80 x 100 shares - $500 = $7500. In essence, a writer would have to appropriate $7500 in his brokerage account to finance the call contract without having to resort to margin borrowing. The $500 premium covers the remaining requirements to keep the account debt-free. The premium is not considered part of the investment since the writer did not have it until he wrote the contract, and since it is not considered earned until the contractual obligation has been completed (ie., when the option is either called or when it lapses).

Naked Options

A second margin requirement established by the New York Stock Exchange[1] pertains to required margins on option contracts which are written against cash (naked) positions. The minimum initial margin requirements are 30 per cent cash

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[1] New York Stock Exchange Constitution and Rules, (Chicago: Commerce Clearing House, Inc., November 16, 1964), Rule 431, p. 3751.

(of the striking price per 100 shares) for calls, and 25 per cent cash for puts. Since stock has neither been bought nor sold when naked contracts are written, no money has been borrowed from the broker; thus, no interest expense need be incurred. The initial margin requirements on the cash positions are requested in order that the option writer have funds available with which to discharge his obligations in the event he is either put or called. It must be noted here that the exchange's requirements are the absolute initial minimum; however, there is nothing to prevent an individual brokerage house from requiring an even greater initial cash position.

In addition to an initial margin requirement on cash positions, all accounts are "marked to the market" as follows:

Suppose a 95-day put is sold on General Motors at $80 per share for a premium of $400, and the writer wishes to back up his contract with the minimum permissible amount of cash. The initial margin requirement is 25 per cent of $8000 = $2000. Since the writer receives a $400 premium, he need deposit only $1600 initially. If GM subsequently declines to say $70 per share, the writer's account is marked to the market. The maintenance margin becomes 25 per cent of $70 x 100 shares = $1750; <u>plus</u> the difference in adverse

price movement to the writer. Since the stock has dropped $10 per share on a 100 share obligation, the adverse movement requires $1000 in addition to the $1750 for a total maintenance requirement of $2750. Since only $2000 was originally placed in equity, an additional $750 must be deposited by the writer.

Should GM happen to rise to say $90 per share, the account is marked as follows: 25 per cent x $9000 less ($9000 - $8000) = $1250. Because $2000 originally appeared as equity in the account, the difference of $750 is released to the writer.

From the above examples one can readily see that a writer runs a great risk in backing contracts with the minimum cash requirements. Should the market go against his position, he will be called for more margin. Should the writer become "undermargined," disaster could strike. Furthermore, as noted earlier, brokerage houses that endorse option contracts can and frequently do require higher than the minimum margin.

Because of the conservatism of many option endorsers and because of the extremely high risk of using the minimum cash requirements, the following assumptions have been made regarding option writers' initial investment.

Naked Calls

For cash positions that cover a call option, the investment will be assumed to be the striking price per 100 shares, less the premium received. In the GM example the premium on the call was $500 and the striking price per 100 shares was $8000. Thus the writer's investment is assumed to be $7500, giving the account a 100 per cent initial margin. This initial margin is far above the minimum requirement of 30 per cent, and for good reason; namely, there is no theoretical limit as to how high a stock can climb during an option period, and over that time the writer is under full obligation to sell 100 shares at $80 upon request of the option buyer. Should the stock go to say $200 per share at which point the writer is called, he is obligated to tender 100 shares for delivery at $80, even though he must first purchase the stock in the market at $200 a share. Fulfillment of his contractual obligation would result in a $12,000 loss, less the $500 premium. Obviously, even a 100 per cent initial margin would not suffice to finance the above loss, let alone a paltry 30 per cent deposit. However, the former margin is sufficient in most cases and is probably a more reasonable initial investment than the minimum margin requirement of 30 per cent.

The assumption is also made that all initial cash or stock positions which back a written option are maintained by the writer until his contractual obligation is discharged (eg., the writer who sells a naked call maintains a naked position against his contract throughout its life, never purchasing the stock no matter how high its price may rise). The assumption dictates that a more conservative initial margin than the required minimum of 30 per cent be deposited.

It should be kept in mind that the writer of naked calls can find himself in a precarious position if the stock price were to rise sharply. Should he refuse to buy in the stock, the writer's potential loss can conceivably be infinite. Should he relent and finally buy the stock, the writer must put up at least 80 per cent of the market price (not the striking price) in order to hold the stock long. However, if the writer had initially employed excessive leverage and had become undermargined, he would not have sufficient equity to purchase the stock.

Furthermore, if the writer were able to belatedly establish a long position, he would still be exposed to risk since the stock could react and decline in price. A downward reaction in the stock price would then add to the writer's losses. But if he then decides to sell his long

position, he runs the risk of the stock turning around and rising once again; an event which is tantamount to the writer being whipsawed.

Selling a naked call places a writer in a much more vulnerable position than even selling a stock short (where no option is involved). At least on a short sale a speculator can buy back the stock and cover the short; thereby discharging his obligation to the broker by delivering the stock that was previously borrowed and sold. But the option writer's obligation is not discharged -- even if he buys in the stock -- until the written contract lapses or until the buyer calls the writer. The above possibilities are precisely why many option dealers and stock brokers advise their clients never to sell a naked call. In fact, several endorsing firms refuse to endorse any call option that is not backed by a long position.[1]

Naked Puts

For cash positions that cover the sale of a put contract, the assumed investment will be one-half of the striking price per 100 shares. In the GM example, a naked put was sold for a $400 premium at a striking price of $80

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[1]Securities and Exchange Commission, op. cit., p. 59.

per share. Assuming that the writer covers his position with a cash deposit, his investment will be considered as 50 per cent x $8000 = $4000. Thus, the writer must allocate $4000 plus the $400 in a margin account to cover the sale of the put contract. The total cash allocation amounts in this case to 55 per cent of the striking price per 100 shares ($4400/$8000). Should GM advance in price, no additional margin is required. In fact, when the account is marked to the market, funds will be released. However, should GM decline, the writer will be faced with the possibility of depositing more cash in the account although the stock would have to fall to under $48 a share before this eventuality occurs. When the account is marked to the market at the time the stock hits $48, the required margin is (25 per cent x $4800) + ($8000 - $4800) = $4400. Since the original deposit was exactly $4400, no additional funds are required unless the stock falls below $48. Thus, when an investment of 50 per cent of the striking price per 100 shares is added to the premium, there is enough margin to guard against a 40% decline in the price of the stock. While put premiums in this study will vary, they will rarely be less than 5 per cent of the striking price per 100 shares. If 5 per cent is considered a rough minimum guide, then when

combined with a cash deposit of 50 per cent of the striking price per 100 shares, the initial margin becomes 55 per cent, or enough to cover a 40 per cent market decline. This downside coverage is reasonably but yet not excessively adequate. Writers who try to get by with the minimum initial requirement of 25 per cent margin often find problems when faced with demands for more margin. On the other hand, an initial cash position of say 75 per cent or 100 per cent is probably too conservative and would unnecessarily reduce the rate of return on investment. The initial margin recommendation of roughly 55 per cent (of which 50 per cent is investment) can be altered by the reader to his own satisfaction should he desire to learn what would have been the rates of return on investment if some other margin figure were used.

Straddles - Long

For straddles sold against a long position the investment base is assumed to be 140 per cent of the striking price per 100 shares. For example, suppose a 190-day straddle is sold on ABC for a $2000 premium with the striking price set at $100 a share. The allocated investment would be 140 per cent x $10,000 = $14,000. The arbitrary 140 per cent figure is actually a combination of the previously mentioned assumptions regarding calls sold against long

positions, plus puts sold against naked positions. If the assumption were made that roughly half of the straddle premium is allocated to each the put and the call sides respectively, then the required investment is derived thusly:

Call coverage = striking price per 100 shares-
(50 per cent x straddle premium)

= $10,000 - $1000 = $9000

Put coverage = 50 per cent x striking price per 100 shares

= $5000

Straddle coverage = $9000 + $5000 = $14,000

The straddle coverage of $14,000 is 140 per cent of the striking price per 100 shares. Note, that since the premium as a per cent of the striking price will vary, the actual initial margin will be higher as the premium is greater and vice versa. Option writers often deposit less than the assumed 140 per cent figure when backing straddles against a long (plus cash) position. However, they do so only with greater exposure to the risk of a decline in the stock price. If the stock price falls, the writer will be put, thereby suffering a loss on 200 shares (100 which is put and 100 which is long). If his margin were thin, the writer's percentage loss would be greater than the loss incurred against relatively high initial margins because of

the effects of greater leverage.

Naked Straddles

On straddle contracts that are written against only a naked position, the same assumption of 140 per cent of the striking price per 100 shares applies as the investment base. The 140 per cent figure is derived by combining the assumed positions of the call coverage against cash, plus the put coverage against cash.

Summary of Investment Bases

Table 2-6 shows the assumed investments for all six combinations of options and writer positions.

Table 2-6

INVESTMENT BASES

Position	Assumed Investment Base
Call vs. Long Position	S.P.* - Premium
Call vs. Naked Position	S.P. - Premium
Put vs. Short Position	S.P. - Premium
Put vs. Naked Position	.5(S.P.)
Straddle vs. Long Position	1.4(S.P.)
Straddle vs. Naked Position	1.4(S.P.)

*where S.P. is the striking price per 100 shares.

Step 4. Rate of Return per Stock for Each Strategy: Each sampled stock has been used in 19 strategies during the year in which it has been included in the study (with three classes of stocks there are 57 strategies in total). In Step 4, the rates of return on investment in the twelve option writing, six option buying, and one control strategy per stock are found on each of the 210 stocks studied. All the calculations in this step and in most of the subsequent steps were performed by a Control Data 3600 computer.[1]

Each of the different option strategies were transacted monthly on every stock for a one-year period. A control strategy was initiated on each stock once per year. The annual rate of return on investment was then found for all strategies on each of the 210 stocks.

Step 5. Mean and Standard Deviation of Return:

Mean Returns

The 210 stocks studied have been stratified into three volatility classes. Stocks in each volatility class have been subjected to 19 different treatments each. Since the price movement characteristics of each volatility class

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[1]Computer programming, key punching, and computer time were arranged by Ward Herring, Applications Programming Department, Michigan State University Computer Laboratory.

are significantly different,[1] it is reasonable to assume that a given type of treatment in one volatility class can be classified as a distinct strategy from the same treatment in another volatility class. Given 19 different types of treatments and three types of volatility classes, it is possible to generate 57 option and control strategies.

Ten stocks are included yearly in each strategy and 70 stocks are included in each strategy over the entire seven-year period. Given the rates of return on investment per strategy on each stock as found in Step 4, the mean rate of return on investment for the ten stocks used in each strategy per year is calculated. The mean yearly rate of return on investment per strategy is denoted by r_{nj}; where: n = the year (1,...,7) and j = the strategy (1,...,57).

For example, r_{1-1} = the mean rate of return on investment in 1961-62 for Strategy 1; where Strategy 1 relates to writing 95-day calls against a long position on Low Volatility Class stock.[2]

In addition to calculating the yearly r_{nj} with its sample size of 10, the seven-year mean rate of return on investment per strategy (R_j) is also found, where R_j is

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[1]See Appendix B.

[2]See Table 2-2.

based on a sample size of 70. Both the yearly means and the seven-year means are arithmetic averages. They are calculated in order to show the average rates of return on investment during a given period.

Standard Deviation of Return

The standard deviation of the seven-year rate of return on investment (S_j) is calculated for each strategy, where S = the standard deviation of sample size 70, and j = the strategy (1,...,57). The standard deviation is used as a proxy for the amount of risk that is inherent in each strategy. While subject to limitations, the standard deviation is used as a risk measure partly because of its mathematical expediency. It is also assumed that variance (S_j^2) is an undesirable aspect of return and that the investor considers its presence a risky factor. Rational investors (excluding gamblers) will accept greater expected variance only when accompanied with greater expected returns. This is so because when variance is great, one is less certain of receiving the expected future return than when variance is low.

There are at least two important limitations in using the standard deviation as a risk measure. First, the standard deviation is less reliable as a risk measure when

the distribution of future expected returns does not approximate normality. For example, suppose that the probability distribution of expected returns were; + 20 per cent return (p = .9) and - 80 per cent return (p = .1). The mean expected return is + 10 per cent and the standard deviation is approximately 27 per cent.

One way in which the standard deviation of 27 per cent could be interpreted would be that the probability of a return being more than three standard deviations to the left of the mean (ie., a return of less than - 71 per cent) is .00135. Since the actual expectation of the return being worse than -71 per cent is .1 (ie., the probability of a return of -80 per cent), this interpretation of the standard deviation can be quite misleading. It is doubtful that the returns on the strategies in the study are distributed as those in the above example. In fact, there is no reason to believe that the distribution of the returns in the study will deviate so much from normality that the use of the standard deviation as a risk measure would produce severely misleading interpretations when based on a sample size of 70.

A second limitation of the standard deviation as a risk measure is that many investors are not concerned with the variance of returns which are positive, but are only

concerned with the risk of losing money. None-the-less, the standard deviation can still be useful to the above investor because when returns are expected to be approximately normally distributed, the statistic can be used to estimate the probability of a given loss while the variance of positive returns may be ignored.

It should be noted that the standard deviation is based upon a seven-year sample of size 70 as opposed to using several yearly standard deviations of sample size 10. The former method is preferred because the extreme price behavior of any one stock is less likely to distort a yearly risk measure since the sample size is seven times that of the latter method. Furthermore, it is not mathematically appropriate to use seven separate standard deviations when one is attempting to measure the average risk for the entire period taken as a whole. This is so because the arithmetic average of seven individual standard deviations of size 10 does not equal the seven-year standard deviation of size 70.[1]

Step 6. Return-Risk Ratio per Yearly Strategy: The development of return-risk ratios enables one to make reasonable comparisons between strategies, where the

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[1]Note, individual variances and likewise individual standard deviations are not additive. See: J. L. Hodges and E. L. Lehmann, Basic Concepts of Probability and Statistics (San Francisco: Holden-Day, Inc., 1966), p. 145.

comparisons are based upon a common measure that includes allowances for both return and for risk. Too often investment opportunities are fallaciously measured against one another solely on the basis of expected return or of past returns. When risk is ignored in the comparison of investment opportunities, less than optimal choices may occur. If investment Strategy A has an expected return of 15 per cent, it is not necessarily superior to investment Strategy B which has an expected return of only 10 per cent.

On the other hand, if it were believed that Strategy A involved two units of risk as compared to only one unit of risk for Strategy B, there would not necessarily be grounds to select B as the superior investment. Some might be expected to choose B over A on the basis that B produces 10 units of return per unit of risk (10 per cent/1 unit of risk); while A produces only 7½ units of return per unit of risk (15 per cent/2 units of risk). However, this may not be a valid analysis because no allowance has been made for the risk-free rate of return.

A better means of comparison would be to measure both strategies in terms of the incremental return expected from undertaking a risky investment, per unit of risk that is taken. Thus, if the risk-free rate of return were 6

per cent, the incremental return generated from undertaking risky investments is 9 per cent for A (15 per cent - 6 per cent) and 4 per cent for B (10 per cent - 6 per cent). In terms of the incremental return for risk-taking, per unit of risk taken, Strategy A returns a 4.5 ratio (9 per cent / 2 units of risk) verses Strategy B's 4.0 ratio (4 per cent / 1 unit of risk). In terms of the latter method of comparison, A is the superior investment.

Introducing the Risk-Free Rate of Return

The risk-free rate of return (r*) is defined as the average annual yield on ninety-day treasury bills for each year during the study as shown in Table 2-7.

Incremental Return

To find the incremental return that is produced by taking on risk, subtract r_n* from r_{nj}. For example, suppose that r_{nj} = 10 per cent; where n = 1 (1961) and j = 16 (strategy 16). The incremental return produced by risk-taking is equal to: 10 per cent - 2.4 per cent = 7.6 per cent.

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[1]Assuming that the investor has only a one-stock or one-investment portfolio. For the present, ignore the problem of covariance between different investments within a portfolio.

Table 2-7

RISK-FREE RATE OF RETURN[1]

Year	r*
1961	2.4 per cent
1962	2.8
1963	3.2
1964	3.5
1965	4.0
1966	4.9
1967	4.3
average for 7 years	3.59

r* refers to r_n*, where n = 1,...,7, (note that 1 refers to 1961, etc.).

The above procedure was repeated for all 57 strategies during each of the seven years of study.

Return-Risk Ratio[2]

Given the incremental return for risk-taking (call it, r-r*), each r-r* for all 399 r_{nj}'s is divided by the number of units of risk that were undertaken to produce the

[1]The risk-free rate of return (r*) is the average annual yield on ninety-day treasury bills. Source: Board of Governors of the Federal Reserve System, Federal Reserve Bulletin, Washington, D.C.: 1961-1967.

[2]The return-risk ratios developed here are similar to those presented by Lintner, in developing his portfolio model. See: John Lintner, "Security Prices, Risk, and Maximal Gains from Diversification," Journal of Finance, Vol. XX, No. 4 (December, 1965), 587-615.

returns. The latter figure is S_j, the seven-year standard deviation of return (for simplicity, call it S).

Thus, 399 return-risk ratios are developed for each yearly strategy by the formula:

$$\text{Return-Risk Ratio (call it, rr)} = \frac{r - r^*}{S}$$

where: $r = r_{nj}$ = the mean yearly return for the n^{th} year on the j^{th} strategy.

$r^* = r_n^*$ = the risk-free rate of return for the n^{th} year.

$S = S_j$ = the standard deviation of return or amount of risk undertaken to produce the return during the seven-year period on the j^{th} strategy.

$rr = rr_{nj}$ = the return-risk ratio for the n^{th} year on the j^{th} strategy. The ratio enables one to make comparisons between strategies which are more likely to result in optimal choices than by comparing rates of return alone.

Step 7: Seven-Year Return-Risk Ratios per Strategy: Each of the 57 strategies has been measured by seven (one for each year) return-risk ratios (rr). Step 7 involves finding the mean of the seven yearly rr ratios for each of the strategies. Call the seven-year mean for each strategy, RR_j; where: $j = 1,\ldots,57$.

Since each of the seven rr_j's which are used in

computing RR_j consists of a sample of ten stocks, the sample size for each $RR_j = 70$.

The mean return-risk ratios are computed by the following formula:

$$RR_j = \frac{\sum_{n=1}^{7} rr_{nj}}{7}$$

where: RR_j = the mean return-risk ratio for seven years of the j^{th} strategy.

rr_{nj} = the return-risk ratio for the n^{th} year on the j^{th} strategy; where $n = 1,\ldots,7$ (for years 1961-2,..., 1967-8); and $j = 1,\ldots,57$.

The standard deviation of each seven-year return-risk ratio is also computed. This statistic will be used later in performing statistical tests.

Step 8. Testing the Null Hypothesis: Given a predetermined level of significance (α) equal to .05, the null hypothesis (H_o) is:

$$H_o: RR_1=RR_2=\ldots=RR_{57}$$

The alternative hypothesis (H_1) is

$$H_1: RR_1\neq RR_2\neq\ldots\neq RR_{57}$$

In testing the null hypothesis, a Treatment by Levels Analysis of Variance[1] is used. If the interaction

[1]See: E. F. Lindquist, Design and Analysis of Experiments in Psychology and Education (Boston: Houghton Mifflin Co., 1956), Chapter 5, 121-155.

effect of the TxL Analysis of Variance is significantly different (at $\alpha = .05$) from the test statistic, F, then H_o is rejected and the alternative hypothesis H_1 is accepted.

Should H_o be rejected and H_1 be accepted, then post hoc comparisons of the 57 RR_j's will be made by testing for significant differences between pairs of means with a t Test.[1] This last procedure (used only if H_o is rejected) could possibly lead to conclusions as to which strategy or strategies are significantly better than others.

In making inferences about past option investing performance, it must be kept in mind that the observations studied here represent only a sample of a sample of the total option population of the past. The 210 stocks observed here for option investing represent an unbiased sample of the option activity as represented on Thomas, Haab & Botts' bid sheets. The bid sheets in turn represent only a sample of total past option activity of all dealers.

At the least, significant findings as verified by proper statistical testing can be used as inferences about the option population only when the population is limited to activity arising from the Thomas, Haab & Botts bid sheets. Only to the extent to which the bid sheets are an unbiased

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[1] Hays, op. cit., 316-322.

sample of the total option population can one accept the significant findings of this research as being applicable to the entire past option population. It is believed that the bid sheets are a reasonably unbiased sample of the total option population, therefore if the findings of the sample are found to be significant, it will be inferred that the conclusions hold for the entire option population.

It will also be assumed that the significant findings based upon past observations are valid estimates of future expectations. Therefore, when some aspect of option investing has been found to be significant in the past, it is inferred that the same will hold true in the long-run of the future, providing that the assumptions used in the calculations remain reasonable for future option markets.

Step 9. Tax Considerations: Up to this point the investor has been considered to be tax-exempt. In order to obtain a better picture of real world option investing results, it is necessary to examine at least the most critical of the Federal tax rulings that are applicable in option investing situations.

The major concern of tax rulings is the extent to which they might affect the option strategies which have been presented here.

Step 10. Implications of the Findings: Implications of the findings in the study will be discussed in terms of which type or types of investors might benefit from investing in certain option strategies.

The limiting effects of the assumptions used in the research will also be analyzed. Included in this analysis will be the possible effects on the strategies developed here in the event that the proposal to develop an auction market in options by The Board of Trade of The City of Chicago becomes a reality.

Suggestions for additional further studies relevant to this research will then be offered.

CHAPTER 3

ANALYSIS OF RESULTS

On 84 dates during the 1961 to 1968 period, 54 option strategies were initiated on groups of 10 stocks each, resulting in 45,360 observations of hypothetical option activity. In addition, the 210 sampled stocks were hypothetically purchased in order to produce control strategies. This chapter analyzes the results of these 45,570 option and stock transactions in terms of risk and return, and draws implications regarding the relative merits of the strategies studied.

1. Percentage of Options Exercised

Eighteen option strategies were investigated on each stock, where all the option strategies involved either calls, puts, or both calls and puts (in the case of straddles). Ten stocks per year were included in each of three volatility classes, and each stock was involved in option transactions on 12 dates during the year of its inclusion in the study. Nine of the option strategies per stock had duration periods of 95 days, while the other nine strategies

consisted of 190-day options. Thus, each volatility class was linked with strategies initiated at 120 points (12 each for 10 stocks) for both 95-day and 190-day duration periods. Over the seven-year period of study each class had options originating at 840 points for both time durations. Therefore, any strategy including put options which were either bought or sold in some manner was originated at 840 different points throughout the seven years. Likewise, any strategy involving call options also was originated at 840 points during the entire study period.

All types of strategies involving puts of a given duration period within a given volatility class are based upon similar origination and terminal stock prices. Hence, the number of put options exercised for one type of put option strategy is the same for any other put option strategy within the same volatility class and for the same duration period. The above statement applies similarly for call options. In calculating the number of options exercised, it was necessary to review 120 points of origination and termination per year for each duration period in every volatility class or 840 points during the seven years.

Table 3-1 shows the percentage of both put and call options exercised during the period of study. If the

Table 3-1

PERCENTAGE OF OPTIONS EXERCISED

Year	95-Day Options Exercised*			190-Day Options Exercised		
	Calls	Puts	None**	Calls	Puts	None
Low***						
1961-62	29.2	68.3	02.5	25.8	70.0	04.2
1962-63	74.1	18.4	07.5	82.5	10.8	06.7
1963-64	64.2	30.8	05.0	68.3	25.0	06.7
1964-65	56.6	31.7	11.7	69.2	26.6	04.2
1965-66	35.8	59.2	05.0	25.8	71.7	02.5
1966-67	64.2	30.8	05.0	63.4	33.3	03.3
1967-68	43.4	50.8	05.8	46.6	44.2	09.2
Total	52.5	41.4	06.1	54.5	40.2	05.3
Medium***						
1961-62	33.3	46.7	10.0	25.8	68.4	05.8
1962-63	60.8	30.0	09.2	62.5	28.3	09.2
1963-64	45.8	36.7	17.5	55.0	39.2	05.8
1964-65	55.8	34.2	10.0	69.2	23.3	07.5
1965-66	63.3	34.2	02.5	57.5	41.7	08.3
1966-67	68.3	25.0	06.7	84.1	11.7	04.2
1967-68	45.8	50.0	04.2	52.5	42.5	05.0
Total	53.3	38.1	08.6	58.1	36.4	05.5
High***						
1961-62	41.7	50.0	08.3	35.0	59.2	05.8
1962-63	45.8	42.5	11.7	42.5	49.2	08.3
1963-64	36.7	52.5	10.8	45.8	52.5	01.7
1964-65	59.1	34.2	06.7	74.2	20.0	05.8
1965-66	63.3	35.0	01.7	55.0	44.2	08.0
1966-67	64.2	28.3	07.5	69.1	29.2	01.7
1967-68	40.0	54.2	05.8	41.7	52.5	05.8
Total	50.2	42.4	07.4	51.9	43.8	04.3

*Expressed as a per cent of all options of a given type that were purchased. For each option duration period per volatility class there are 840 options during the seven-year study.

**None, refers to the per cent of cases in which neither a put nor a call which might have been purchased were exercised. Thus, the subsequent price movement after the purchase date was insufficient to provide for exercise of any type of option.

***Volatility Class.

termination price differed by more than a roundtrip commission expense from the origination price, an option was exercised. The call was exercised when the terminal price was greater than the original price, and the put was exercised when the reverse was true. The column headed "None" shows the percentage of instances in which neither puts nor calls were exercised. Options of one type or the other were not exercised in cases where the commission expense of exercising was greater than the amount that could have been recovered by such an act.

Table 3-1 depicts the fact that calls were more likely to be exercised in the Medium Volatility Class for both 95-day and 190-day duration periods than in the other volatility classes. The Medium Class also had the greatest total of unexercised options for both duration periods.

As might be expected, the percentage of calls exercised dropped significantly during the market break of 1962. All three classes experienced a sharp drop in the number of calls exercised during the 1961-62 year which ended in June, 1962, or about the same time that the market reached its lowest ebb.

One would probably expect similar results during the 1966 market break, but curiously, only the Low Volatility

Class was affected adversely when measured by the percentage of calls exercised during 1965-66. In that year only 35.8 per cent of 95-day calls and 25.8 per cent of 190-day calls were exercised. However, the Medium Class experienced a total of 63.3 per cent of 95-day and 57.5 per cent of 190-day calls which were exercised, and the High Class had figures of 63.3 per cent and 55.0 per cent respectively for the two duration types.

The most plausible explanation for the above phenomenon is that the blue chip type stocks, of which the Low Volatility Class is mostly comprised, tended to peak much earlier than the more speculative issues. Such stocks as General Motors, American Telephone, duPont, and the major steels made their bull market highs in 1964 or 1965. On the other hand, the more speculative issues of the time, such as the color television and airline stocks, generally made their highs in the spring or summer of 1966.

While blue chip type issues tended to peak earlier than most stocks in the mid-sixties, they also tended to lead the bull market that began in 1962. Note that 95-day calls showed a 74.1 per cent exercise ratio in 1962-63 for the Low Volatility Class. But the more speculative and lesser quality stocks took longer to pick up the tempo

of the new bull market. For calls of 95 days in 1962-63, 60.8 per cent in the Medium Class and only 45.8 per cent in the High Class were exercised.

In 1963-64, when the market was still in the earlier portions of its upswing, the Low Volatility Class of high grade stocks was continuing to show the greatest percentage of calls exercised. Only in the latter phase of the mid-sixties bull market did a greater proportion of the more speculative stocks begin to move up relative to the blue chips.

The evidence of stock price movements presented in Table 3-1 helps to support the stratification technique that is used here. Apparently, it is more prudent to segregate stocks into somewhat homogeneous groups when one is drawing generalizations about future possibilities which are based upon past observations.

2. Price Movements of Stocks in the Sample

While Table 3-1 presents a picture of the direction of price movements of the sample stocks, Tables 3-2, 3-3 and 3-4 depict the magnitude of price swings.

Table 3-2 shows the frequency of price movements of various magnitudes during three-month and six-month periods for stocks in each of the three volatility classes. Table 3-3 shows the same price movements but is measured in

Table 3-2

FREQUENCY DISTRIBUTIONS OF PERCENTAGE CHANGE IN PRICES OF THE STOCKS USED IN OPTION TRANSACTIONS

Percentage Movement Away From Striking Price	Number of Transactions					
	3 Mo. Low	3 Mo. Medium	3 Mo. High	6 Mo. Low	6 Mo. Medium	6 Mo. High
-50 to -70	0	0	4	0	2	22
-40 to -49	0	2	13	2	11	37
-30 to -39	5	18	33	17	36	64
-20 to -29	19	46	97	52	64	93
-10 to -19	89	99	130	106	78	97
0 to -9	288	225	142	207	158	91
1 to 9	266	147	75	179	113	52
10 to 19	129	132	104	171	116	69
20 to 29	28	80	63	66	75	48
30 to 39	11	34	44	22	65	43
40 to 49	4	26	33	9	40	26
50 to 59	0	10	23	4	26	26
60 to 69	1	8	19	1	15	29
70 to 79	0	7	16	2	8	28
80 to 89	0	1	8	0	6	26
90 to 99	0	3	8	2	7	9
100 to 149	0	2	21	0	14	45
150 to 199	0	0	7	0	6	17
200 to 400	0	0	0	0	0	18
Total Transactions	840	840	840	840	840	840

Table 3-3

FREQUENCY DISTRIBUTIONS OF PERCENTAGE CHANGE IN PRICES OF THE STOCKS USED IN OPTION TRANSACTIONS EXPRESSED AS A PER CENT OF TOTAL TRANSACTIONS WITHIN EACH CLASSIFICATION

Percentage Movement Away From Striking Price	Frequencies as a Per Cent of Total Transactions					
	3 Mo. Low	3 Mo. Medium	3 Mo. High	6 Mo. Low	6 Mo. Medium	6 Mo. High
-50 to -70	00.0	00.0	00.5	00.0	00.2	02.6
-40 to -49	00.0	00.2	01.5	00.2	01.3	04.4
-30 to -39	00.6	02.2	03.9	02.0	04.3	07.6
-20 to -29	02.3	05.5	11.6	06.2	07.6	11.1
-10 to -19	10.6	11.8	15.5	12.6	09.3	11.6
0 to -9	34.3	26.8	16.9	24.7	18.8	10.8
1 to 9	31.7	17.5	08.9	21.3	13.5	06.2
10 to 19	15.3	15.7	12.4	20.4	13.8	08.2
20 to 29	03.3	09.5	07.5	07.9	08.9	05.7
30 to 39	01.3	04.0	05.2	02.6	07.7	05.1
40 to 49	00.5	03.1	03.9	01.1	04.8	03.1
50 to 59	00.0	01.2	02.7	00.5	03.1	03.1
60 to 69	00.1	01.0	02.3	00.1	01.8	03.5
70 to 79	00.0	00.8	01.9	00.2	01.0	03.3
80 to 89	00.0	00.1	01.0	00.0	00.7	03.1
90 to 99	00.0	00.4	01.0	00.2	00.8	01.1
100 to 149	00.0	00.2	02.5	00.0	01.7	05.4
150 to 199	00.0	00.0	00.8	00.0	00.7	02.0
200 to 400	00.0	00.0	00.0	00.0	00.0	02.1
Total Frequencies	100.0	100.0	100.0	100.0	100.0	100.0

Table 3-4

CUMULATIVE FREQUENCY DISTRIBUTIONS OF PERCENTAGE CHANGE IN PRICES OF THE STOCKS USED IN OPTION TRANSACTIONS

Percentage Movement Away From Striking Price	Cumulative Frequencies					
	3 Mo. Low	3 Mo. Medium	3 Mo. High	6 Mo. Low	6 Mo. Medium	6 Mo. High
-50 to -70	.000	.000	.005	.000	.002	.026
-40 to -49	.000	.002	.020	.002	.015	.070
-30 to -39	.006	.024	.059	.022	.058	.146
-20 to -29	.029	.079	.175	.084	.134	.257
-10 to -19	.135	.197	.330	.210	.227	.373
0 to -9	.478	.465	.499	.457	.415	.481
1 to 9	.795	.640	.588	.670	.550	.543
10 to 19	.948	.797	.712	.874	.688	.625
20 to 29	.981	.892	.787	.953	.777	.682
30 to 39	.994	.932	.839	.979	.854	.733
40 to 49	.999	.963	.878	.990	.902	.764
50 to 59	.999	.975	.905	.995	.933	.795
60 to 69	1.000	.985	.928	.996	.951	.830
70 to 79	1.000	.993	.947	.998	.961	.863
80 to 89	1.000	.994	.957	.998	.968	.894
90 to 99	1.000	.998	.967	1.000	.976	.905
100 to 149	1.000	1.000	.992	1.000	.993	.959
150 to 199	1.000	1.000	1.000	1.000	1.000	.979
200 to 400	1.000	1.000	1.000	1.000	1.000	1.000
Total	1.000	1.000	1.000	1.000	1.000	1.000

percentages of all movements per classification, rather than in absolute totals. Upon examining Table 3-3 closely, one can detect that the magnitude of price movements becomes greater as the volatility class increases from Low, to Medium, to High for both types of duration periods. Thus, as the classes increase in their volatility, the range of the frequency distributions of price movements becomes broader, inferring that the variance of price movements increases directly with the volatility class. The inference is verified by the F Ratio Tests performed in Appendix B.

It may also be seen in Table 3-3 that the range of the frequency distributions for each volatility class increases as the duration period expands from 95 days to 190 days. The distributions likewise become less peaked in each class as the duration period is increased. The implication is as one would probably expect -- that price movements of stocks are likely to be of greater magnitude over periods of six months as opposed to periods of only three months. Hence, it appears that option premiums carry a greater actuarial value as the duration period increases.

Table 3-4 shows the cumulative frequency distributions of magnitudes of price movements by classes and durations. It is interesting that stocks in the High Volatility

Class declined in 49.9 per cent of the three-month periods and in 48.1 per cent of the six-month duration periods, or a greater proportion than experienced in the other two classes. If one acknowledges that one aspect of risk is the likelihood of a stock declining, then it can be implied that the High Volatility Class is comprised of riskier issues than either the Medium or Low Classes.

On the other hand, stocks in the High Volatility Class increased in price by 50 per cent or more in 12.2 per cent of three-month duration periods and in 23.6 per cent of the six-month spans. This compares to 50 per cent or more price increases in only 0.1 per cent of three-month periods in the Low Class, and in 3.7 per cent of three-month periods in the Medium Class. Six-month periods showed price increases of 50 per cent or more only 1.0 per cent of the time in the Low Class and only 9.8 per cent of the time in the Medium Class.

The most extreme price swings experienced by stocks in the study occurred in the following situations:

Syntex had the greatest price increase in a six-month period when it rose 363 per cent in value between June and December, 1963. The greatest upward move in a three-month period occurred in National Video, as it climbed 190

per cent between August and November, 1965.

General Plywood had the dubious distinction of exhibiting the greatest decline in both three-month and six-month periods. The stock fell 67 per cent between February and August, 1964, and by 60 per cent between February and May of the same year.

3. Returns to Writers on Three-Month Strategies

Table 3-5 shows the rate of return on investment and the return-risk ratios for the 18 strategies involving writers of three-month (or 95-day) options. The far right column of Table 3-5 shows the seven-year average rate of return on investment (R_j), and the seven-year average return-risk ratio (RR_j).[1] Assuming that the option writer is on a tax-free basis, not one of the 18 R_j's is positive, and correspondingly all 18 RR_j's are negative. The evidence presented in Table 3-5 implies that option writing for three-month periods, irrespective of the 18 variations reviewed, apparently is an inferior investment when considered apart from other investments in a portfolio.

As measured by the return-risk ratio (RR_j), the

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[1] There is no theoretical limit of the range in which the RR_j figures can vary. It is seen in Table 3-12 that the range for the seven-year return-risk ratios is .48 to -1.36.

Table 3-5

RATE OF RETURN ON INVESTMENT AND RETURN-RISK RATIOS TO WRITERS ON THREE-MONTH STRATEGIES

Treatment	Strategy*	Ret.**	61-62	62-63	63-64	64-65	65-66	66-67	67-68	7 Year Average
1	1: L3-CL-W	R	-17.00	10.60	5.40	5.10	-8.40	2.70	0.00	-0.23
		RR	-1.60	.64	.18	.13	-1.02	-.18	-.36	-.32
	20: M3-CL-W	R	-25.90	7.90	-0.30	4.90	2.80	10.90	-5.30	-0.71
		RR	-1.49	.27	-.18	.07	-.06	.31	-.50	-.23
	39: H3-CL-W	R	-6.50	-1.80	-13.90	1.30	1.80	8.90	-17.90	-4.01
		RR	-.32	-.17	-.62	-.08	-.08	.14	-.80	-.28
2	2: L3-CN-W	R	8.80	-16.10	-7.30	-9.80	-2.50	-10.50	-0.60	-5.43
		RR	.40	-1.19	-.66	-.84	-.41	-.97	-.31	-.57
	21: M3-CN-W	R	8.90	-10.70	-14.40	-10.40	-37.50	-42.90	-8.50	-16.50
		RR	.18	-.38	-.50	-.39	-1.17	-1.34	-.36	-.57
	40: H3-CN-W	R	-7.00	-15.10	-28.20	-40.60	-66.60	-48.80	-7.80	-30.59
		RR	-.16	-.30	-.53	-.75	-1.19	-.91	-.20	-.58
3	3: L3-PS-W	R	-3.00	-24.50	-16.40	-19.60	-13.30	-20.80	-12.50	-15.73
		RR	-.38	-1.92	-1.38	-1.63	-1.22	-1.81	-1.18	-1.36
	22: M3-PS-W	R	-9.20	-24.60	-30.90	-25.80	-51.20	-56.20	-25.50	-31.91
		RR	-.35	-.83	-1.04	-.89	-1.68	-1.86	-.91	-1.08
	41: H3-PS-W	R	-30.90	-39.40	-52.50	-53.80	-81.90	-64.70	-28.40	-50.23
		RR	-.64	-.81	-1.07	-1.10	-1.65	-1.33	-.63	-1.03
4	4: L3-PN-W	R	-40.90	19.00	7.10	7.80	-23.20	-0.90	-7.30	-5.49
		RR	-1.68	.63	.15	.17	-1.06	-.23	-.45	-.35
	23: M3-PN-W	R	-55.40	8.40	-5.10	0.50	-5.30	10.00	-23.90	-10.11
		RR	-1.57	.15	-.23	-.08	-.25	.14	-.76	-.37
	42: H3-PN-W	R	-54.40	-19.40	-38.90	-8.60	-15.10	5.90	-49.70	-25.74
		RR	-1.08	-.42	-.80	-.23	-.36	.02	-1.03	-.56
5	5: L3-SL-W	R	-25.90	13.80	5.40	6.00	-14.30	1.40	-3.00	-2.33
		RR	-1.63	.64	.13	.14	-1.06	-.20	-.42	-.34
	24: M3-SL-W	R	-36.30	8.20	-2.10	3.20	-2.50	10.80	-12.10	-4.40
		RR	-1.50	.21	-.21	-.01	-.25	.23	-.64	-.31
	43: H3-SL-W	R	-33.00	-7.70	-20.30	-2.70	-4.40	6.70	-23.00	-12.06
		RR	-1.03	-.31	-.68	-.18	-.24	.05	-.79	-.45
6	6: L3-SN-W	R	-8.80	-4.30	-3.00	-4.20	-10.30	-7.80	-3.30	-5.96
		RR	-1.35	-.86	-.75	-.93	-1.72	-1.53	-.92	-1.15
	25: M3-SN-W	R	-13.80	-4.00	-11.40	-7.30	-29.20	-24.40	-14.10	-14.94
		RR	-.85	-.36	-.76	-.56	-1.73	-1.55	-.98	-.97
	44: H3-SN-W	R	-23.80	-16.90	-31.60	-29.30	-47.80	-29.80	-22.60	-28.97
		RR	-.91	-.69	-1.21	-1.13	-1.80	-1.21	-.94	-1.13

*See Table 1-1 for codes to strategies.

**R = seven-year average rate of return on investment. Rates of return on investment for individual years are symbolically defined as "r". R and r are expressed in percentages (e.g., 5.00 = 5.00 per cent).

RR = seven-year average return-risk ratio. Yearly return-risk ratios are symbolically defined as "rr". RR and rr are expressed as the number of units of return per unit of risk.

worst three-month writing strategy was that of selling puts against a short position on Low Volatility Class stocks (Strategy 3). The strategy produced an RR of -1.36. Selling puts against a short position also produced very poor RR's in the Medium and the High Volatility Classes of -1.08 and -1.03 respectively.

The technique of writing puts against a short position is designed to be employed when a writer is bearish, but the strategy failed to produce positive results in any year for all volatility classes, even in the substantial bear market years of 1961-62 and 1965-66.

Writing naked straddles is another technique which appears to be extremely undesirable. The Low, Medium and High Classes had RR's of -1.15, -.97, and -1.13 respectively. Selling naked straddles is usually employed when the writer believes that a stock will not fluctuate too greatly in price over the duration period. If the stock should move significantly in one direction, the writer will either be put or called, and since neither a long nor a short stock position has been maintained, the writer must absorb the entire amount of the price movement away from the striking price. The remark often attributed to Bernard Baruch that, "The market will fluctuate," apparently has enough validity

on a three-month basis to render the selling of naked straddles unsatisfactory.

The best of the 95-day writing strategies were the three involving the conventional selling of calls against a long position. This strategy produced RR's of -.32 for the Low Volatility Class, -.23 for the Medium Class, and -.28 for the High Class. During bull market years the selling of calls against a long position often produced positive rates of return on investment, although the return was not always greater than the risk-free rate of return for each year. However, even bull markets do not guarantee success with the strategy as is evidenced by the rate of return on investment -13.90 per cent in 1963-64 for Strategy 39.

When bear markets occur, the option premiums that writers receive for selling calls are often insufficient to cover portfolio losses on stocks held to back up the calls. Note that the rates of return on investment in 1961-62 of -17.00 per cent for Strategy 1, and of -25.90 per cent for Strategy 20 are quite poor.

On the other hand, it might be argued that although the returns to writers on calls covered by long positions are poor in bear market periods, the returns are still superior to those that would have been made by simply

holding the stock outright. At least the writer can claim the option premium to help offset losses, while the normal investor does not enjoy the cushion of the premiums. As long as the market fails to make a significant rally, the call writer with a long position will fare better than the regular stockholder. However, in the long-run the market tends to fluctuate and even though a given period of time might be generally bearish, there could be enough upward movements to produce greater returns to the stockholder than to the call writer with a long position. This is precisely what happened in 1961-62. It is seen later in Table 3-8 that the rate of return on investment in stock positions was not as negative as the return on writing three-month calls against long positions in the bear market period of 1961-62. Of course, it is doubtful that the rate of return on stock investing was superior to call writing during the first half of 1962 when the market was practically void of significant rallies. But during the second half of 1962 the stockholder was getting the full benefit of the rallies that eventually came, while the call writer with the long position was limited to the premiums since his stock was called away after strong rallies.

The best yearly rate of return on investment for

any three-month strategy to writers occurred in 1962-63, when selling naked puts on Low Volatile stocks (Strategy 4) generated an r of 19.00 per cent. Selling naked puts, however, is a dangerous strategy in bear markets as is seen by the r's of -40.90 per cent in 1961-62 and -23.20 per cent in 1965-66 for Strategy 4.

The best return-risk ratios on a yearly basis for three-month options to writers were the rr's of .64 for both Strategy 1 and for Strategy 5 in 1961-62.

The worst yearly rate of return on investment was -81.90 per cent for Strategy 41 in 1965-66, while the lowest return-risk ratio was -1.92 for Strategy 3 in 1962-63. Both strategies involve the selling of puts against short positions. Interestingly, the dismal performance of Strategy 41 in 1965-66 occurred in a bear market, which on the surface should have been a good period for a strategy with a bearish stance. Evidently there were enough substantial price upswings during the period which far outweighed the put premiums accruing to the writer.

4. Returns to Writers on Six-Month Strategies

Four of 18 six-month option writing strategies produced positive rates of return on investment (R_j), but only one of the four had a positive return-risk ratio (RR_j) over

the seven-year period. As is seen in Table 3-6, selling calls against a long position on Low Volatility Class stocks (Strategy 7) showed an R of 2.51 per cent; while selling straddles against a long position in stocks of the same class (Strategy 11) bought in an R of 1.39 per cent, and against Medium Class stocks (Strategy 30) produced an R of 2.61 per cent. In all three of the above cases however, the rate of return on investment was less than the seven-year average risk-free rate of return of 3.59 per cent; hence, the return-risk ratios were negative for all three strategies.

Strategy 26, the selling of calls against a long position on Medium Volatility Class issues, was the only strategy of 36 involving option writing which was positive when measured by a return-risk ratio. The RR for the strategy was only .08, since the rate of return on investment of 4.89 per cent exceeded the pure rate of interest by only 1.30 percentage points.

Writing calls against a long position was the best technique of the six-month variety. Only in the case of the High Volatility Class was the method negative, and then it lost only 0.16 per cent on investment. The second best technique of six-month option writing was the selling of

Table 3-6

RATE OF RETURN ON INVESTMENT AND RETURN-RISK RATIOS TO WRITERS
ON SIX-MONTH STRATEGIES

Treatment	Strategy*	Ret.**	61-62	62-63	63-64	64-65	65-66	66-67	67-68	7 Year Average
7	7: L6-CL-W	R	-15.80	11.10	7.20	8.40	-8.10	7.50	7.30	2.51
		RR	-1.60	.73	.35	.43	-1.07	.23	.26	-.10
	26: M6-CL-W	R	-20.30	13.20	4.10	11.50	3.10	18.50	4.10	4.89
		RR	-1.30	.60	.05	.46	-.05	.78	-.01	.08
	45: H6-CL-W	R	-18.10	4.90	-9.70	12.60	2.80	12.80	-6.40	-0.16
		RR	-.81	.08	-.51	.36	-.05	.31	-.42	-.15
8	8: L6-CN-W	R	10.30	-16.80	-7.40	-16.30	1.80	-8.20	0.30	-5.19
		RR	.46	-1.15	-.62	-1.16	-.13	-.77	-.23	-.51
	27: M6-CN-W	R	11.40	-6.40	-13.80	-21.60	-31.40	-41.20	-5.60	-15.51
		RR	.24	-.25	-.46	-.68	-.96	-1.25	-.27	-.52
	46: H6-CN-W	R	5.00	-37.80	-19.70	-58.30	-41.30	-53.30	-4.40	-29.97
		RR	.04	-.57	-.32	-.87	-.64	-.82	-.12	-.47
9	9: L6-PS-W	R	1.20	-22.30	-13.30	-22.60	-5.50	-14.40	-7.30	-12.03
		RR	-.08	-1.62	-1.06	-1.68	-.61	-1.24	-.75	-1.01
	28: M6-PS-W	R	-1.40	-16.50	-24.70	-30.80	-36.50	-48.00	-15.20	-24.73
		RR	-.11	-.57	-.83	-1.02	-1.20	-1.57	-.58	-.84
	47: H6-PS-W	R	-10.60	-53.30	-35.60	-70.00	-52.20	-61.70	-17.10	-42.93
		RR	-.20	-.86	-.60	-1.13	-.86	-1.02	-.33	-.71
10	10: L6-PN-W	R	-38.70	17.60	9.30	10.80	-22.40	8.60	7.50	-1.04
		RR	-1.78	.64	.26	.32	-1.15	.16	.14	-.20
	29: M6-PN-W	R	-46.80	14.60	-2.30	11.80	-5.10	25.70	-1.10	-0.46
		RR	-1.52	.36	-.17	.26	-.28	.64	-.17	-.13
	48: H6-PN-W	R	-44.40	-6.10	-32.70	7.10	-12.70	13.00	-21.90	-13.96
		RR	-1.02	-.19	-.78	.08	-.36	.18	-.57	-.38
11	11: L6-SL-W	R	-24.10	13.70	8.20	9.70	-13.40	8.00	7.60	1.39
		RR	-1.68	.69	.32	.39	-1.11	.20	.21	-.14
	30: M6-SL-W	R	-29.70	13.20	1.90	11.80	-1.90	20.80	2.20	2.61
		RR	-1.38	.45	-.06	.36	-.25	.68	-0.9	-.04
	49: H6-SL-W	R	-26.90	0.90	-15.90	12.90	-2.90	12.70	-12.30	-4.50
		RR	-.93	-.06	-.61	.30	-.22	.25	-.53	-.26
12	12: L6-SN-W	R	-7.10	-4.80	-1.80	-6.50	-6.80	-2.30	2.90	-3.37
		RR	-1.09	-.87	-.57	-1.15	-1.24	-.83	-.16	-.84
	31: M6-SN-W	R	-9.50	0.70	-9.40	-9.50	-22.70	-17.00	-4.20	-10.23
		RR	-.60	-.11	-.64	-.66	-1.35	-1.11	-.43	-.71
	50: H6-SN-W	R	-12.80	-26.20	-23.40	-30.60	-28.80	-28.00	-11.10	-22.99
		RR	-.43	-.82	-.75	-.96	-.92	-.93	-.43	-.75

*See Table 1-1 for codes to strategies.
**See footnote, Table 3-5 for explanation of R and RR.

straddles against a long position, as two of the three volatility classes produced positive rates of return on investment.

The worst six-month strategy was Strategy 9, the writing of puts against a short position on stocks in the Low Volatility Class. The strategy had a return-risk ratio of -1.01. The same technique applied to Medium and High Volatility Classes also generated poor RR's of -.84 and -.71 respectively. It can be seen in Table 3-6 that selling naked straddles was another inferior technique on all types of stocks.

The best single year performance was in 1966-67 by Strategy 26. In that year the selling of calls against a long position produced a return-risk ratio of .78. There were other yearly strategies that had greater rates of return on investment, but only at the expense of greater relative risk.

The worst rr in a single year was made by selling naked puts on Low Volatile stocks in 1961-62. During that bear market period the strategy had an rr of -1.78. The poor performance was the result of put premiums being inadequate compensation for losses accruing on stocks which were put to the writer.

5. Returns to Option Buyers

The results of option buying were far more favorable than the results of option writing as five of the 18 buying strategies produced positive return-risk ratios. Table 3-7 reveals that purchasing calls and straddles on High Volatile stocks produced positive results for both 95-day and for 190-day periods. The remaining positive strategy is that of purchasing calls on stocks in the Medium Volatility Class on a six-month basis (Strategy 35).

The two best buying strategies are those involving the purchase of calls (Strategy 54) and of straddles (Strategy 56) for six months on stocks in the High Volatility Class. The former strategy had a return-risk ratio of .27, and the latter a ratio .24. Note that buying calls in Strategy 54 produced a rate of return on investment of a gigantic 105.03 per cent, compared to a still very high rate of return on investment of 47.64 per cent for the straddles in Strategy 56. While the return on buying the calls was more than twice that on purchasing the straddles, the risk was also considerably greater; thus, the return-risk ratios on the two strategies were very similar.

In studying the yearly returns on the two most profitable strategies, it can be seen why the risk is so

Table 3-7

RATES OF RETURN ON INVESTMENT AND RETURN-RISK RATIOS TO BUYERS ON THREE-MONTH AND SIX-MONTH STRATEGIES

Treatment	Strategy*	Ret.**	61-62	62-63	63-64	64-65	65-66	66-67	67-68	7 Year Average
13	13: L3-C-B	R	-228.50	10.00	-79.00	-65.30	-126.40	-51.40	-167.30	-101.13
		RR	-1.12	.03	-.40	-.33	-.63	-.27	-.83	-.51
	32: M3-C-B	R	-248.50	-67.20	-58.00	-125.80	194.20	277.10	-76.90	-15.01
		RR	-.73	-.20	-.18	-.38	.56	.80	-.24	-.05
	51: H3-C-B	R	-96.80	-0.60	44.00	83.10	373.10	234.90	-69.10	81.23
		RR	-.23	-.01	.10	.19	.87	.54	-.17	.18
14	14: L3-P-B	R	288.20	-366.70	-266.60	-307.00	-8.40	-195.20	-190.70	-149.49
		RR	1.02	-1.32	-.96	-1.13	-.04	-.72	-.70	-.55
	33: M3-P-B	R	171.20	-244.20	-188.60	-177.50	-145.20	-226.50	-26.30	-119.59
		RR	.70	-1.02	-.79	-.75	-.62	-.95	-.13	-.51
	52: H3-P-B	R	100.10	-139.10	-7.30	-141.90	-17.30	-178.30	-11.10	-56.49
		RR	.41	-.60	-.04	-.61	-.09	-.77	-.06	-.25
15	15: L3-S-B	R	-10.40	-149.70	-160.50	-170.60	-74.30	-109.50	-179.60	-122.09
		RR	-.10	-1.20	-1.28	-1.36	-.61	-.90	-1.44	-.98
	34: M3-S-B	R	-76.30	-130.80	-112.40	-112.90	62.00	70.50	-59.40	-51.33
		RR	-.44	-.75	-.65	-.65	.32	.37	-.36	-.31
	53: H3-S-B	R	-15.10	-60.30	-0.80	8.60	181.70	55.10	-4.30	21.10
		R	-.08	-.30	-.02	.02	.84	.24	-.04	.09
16	16: L6-C-B	R	-143.70	96.60	13.80	83.10	-75.60	3.70	-74.00	-13.73
		RR	-.89	.57	.06	.49	-.49	-.01	-.48	-.10
	35: M6-C-B	R	-100.70	-25.00	7.00	93.30	139.20	227.40	-32.90	44.04
		RR	-.42	-.11	.02	.37	.55	.91	-.15	.17
	54: H6-C-B	R	-92.00	186.10	30.80	223.40	186.80	225.40	-25.30	105.03
		RR	-.26	.50	.07	.60	.49	.60	-.08	.27
17	17: L6-P-B	R	191.60	-194.80	-139.20	-170.50	90.40	-146.40	-135.20	-72.01
		RR	1.07	-1.12	-.81	-.99	.49	-.86	-.79	-.43
	36: M6-P-B	R	126.30	-161.00	-77.80	-136.50	-43.00	-183.10	-63.10	-76.89
		RR	.78	-1.04	-.51	-.89	-.30	-1.19	-.43	-.51
	55: H6-P-B	R	84.30	-73.30	13.70	-129.40	13.80	-95.10	13.00	-24.71
		RR	.52	-.48	.07	-.84	.06	-.63	.05	-.18
18	18: L6-S-B	R	4.70	-26.50	-51.00	-21.80	-7.60	-62.40	-100.10	-37.81
		RR	.03	-.34	-.63	-.30	-.14	-.79	-1.22	-.48
	37: M6-S-B	R	-8.80	-77.70	-26.10	2.20	68.10	55.40	-40.90	-3.97
		RR	-.09	-.61	-.22	-.01	.49	.38	-.34	-.00
	56: H6-S-B	R	-13.70	74.90	24.00	70.40	100.00	86.40	-8.50	47.64
		RR	-.09	.39	.11	.36	.52	.44	.07	.24

*See Table 1-1 for codes to strategies.

**See Table 3-5 for explanation of R and RR.

much greater in purchasing calls. In poor market periods for High Volatility Class type stocks, the returns on call option buying are highly negative as is evidenced by the r for Strategy 54 of -92.00 per cent in 1961-62 and of -25.30 per cent in 1967-68. Yet in the same two years the rate of return on investment in straddles showed losses of only -13.70 per cent and -8.50 per cent respectively. The advantage of straddles over calls is that in down markets the put portions of straddles may be exercised in order to recover some of the investment and to reduce the rate of loss, or perhaps to even earn a profit. The disadvantage is that the straddle premiums are significantly more expensive than those on calls.

The worst returns to option buyers over the seven-year period generally occurred in strategies involving the Low Volatility Class stocks. The worst return-risk ratio was -.98 for Strategy 15, the buying of three-month straddles; and the lowest rate of return on investment was -149.49 per cent in Strategy 14, the purchasing of three-month puts. The statistics presented in Table 3-7 imply that price movements in Low Volatility Class stocks are of insufficient magnitude to justify the relatively low premiums that buyers pay for options on these types of stocks. A warning message

for option purchasers thus develops: It may not be a wise policy to always hunt for the lowest option premiums relative to striking prices. In fact, it might even be profitable to search for the relatively high premiums; the appearance of which often indicates that the probability of price swings of large magnitudes is favorable, relative to the amount buyers must pay in option premiums. Of course, if an investor were convinced that a given stock is adequately volatile, it would be imprudent for him to not shop around for the lowest premium possible.

In viewing Table 3-7, one will notice that many of the rates of return on investment are greater absolutely than -100.00 per cent. This is so because of the method used to calculate the returns. For example, in the case of six-month options it is possible to lose 200 per cent of the amount which was originally invested. If an option buyer were to completely lose his entire investment in six-month options during the first six months of a year, but he were presumed to be investing for an entire year, then he would have to add to his original investment in order to remain in the market for the year's second half. If the investment for the second half of the year were assumed to be equal in dollars to that of the first half, and if it

were also totally lost, then the entire year's loss is equal to twice that originally invested at the first of the year or a rate of return on investment of -200.00 per cent. Using similar logic, it is possible for the three-month option buyer to lose at an annual rate of -400 per cent.[1]

The best performance of a buying strategy during a single year came in 1961-62, when during that bear market period, buying puts for six-months on Low Volatility Class stocks generated a return-risk ratio of 1.07. In five of the subsequent six years, however, the same strategy produced huge losses.

The worst single year return-risk ratio occurred in 1962-63, when buying three-month puts on Low Volatility Class issues produced an rr of -1.32.

6. Returns to Purchasers of Stock

As has been explained, the three control strategies consist of purchasing and holding the sample stocks during the time in which option contracts were transacted in them. Table 3-8 shows the results of the three control strategies.

The most interesting aspect of Table 3-8, and perhaps of the entire study, is that all three control strategies

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[1]The problem of calculating returns is more fully discussed by Boness, op. cit., 478-480.

Table 3-8

RATE OF RETURN ON INVESTMENT AND RETURN-RISK RATIOS
FOR CONTROL STRATEGIES

Treat-ment	Strategy*	Ret.**	61-62	62-63	63-64	64-65	65-66	66-67	67-68	7 Year Average
19	19: L-Cont.	R	-9.60	23.00	11.70	28.20	2.30	8.70	10.60	10.70
		RR	-.53	.90	.38	1.10	-.08	.17	.28	.32
	38: M-Cont.	R	-15.70	13.00	13.00	44.80	56.10	46.30	11.50	24.14
		RR	-.42	.24	.23	.96	1.21	.96	.17	.48
	57: H-Cont.	R	-4.60	58.40	21.30	108.10	85.40	61.20	3.90	47.67
		RR	-.07	.55	.18	1.03	.80	.56	-.01	.43

*See Table 1-1 for codes to strategies.

**See Table 3-5 for explanations of R and RR.

outperformed every one of the 54 option strategies. Purchasing and holding stocks produced return-risk ratios of .32 for the Low Volatility Class, .48 for the Medium Class, and .43 for the High Class. The annual rate of return on investment was 10.70 per cent for the Low Class, 24.14 per cent for the Medium Class, and 47.67 for the High Class.

The rate of return on investment appears unusually large for stocks in the High Volatility Class but there is a plausible explanation. Stocks were selected for the class only when 190-day straddle premiums were extremely high relative to all straddle premiums. Premiums become very high-priced only when the stock involved has shown recent signs of great volatility. Such volatility usually is found in cases where stocks have made dramatic upward or downward movements. When each highly volatile stock is given equal weight in a portfolio, the upward movements usually outweigh the downward movements because stocks rarely fall by more than 60 to 80 per cent in a year, but will occasionally rise by several hundred per cent. An equal number of heavy winners and heavy losers, all of which are extremely volatile, will likely produce large returns. For example, if five stocks in a portfolio fall by 50 per cent each and the other five increase by 150 per cent, the return on the whole

portfolio is 50 per cent on investment when all ten stocks are equally weighted.

7. Results of a Treatment by Levels Analysis of Variance

Evidence has thus far been presented indicating that an investor generally would have done better by purchasing options as opposed to selling them during the past seven years; but that returns were superior when the investor simply purchased stocks outright. In order to determine whether those results can be accepted as significant (i.e., not due to chance variations), it is desirable to apply a statistical test to the data. The test selected is a Treatment by Levels Analysis of Variance which is a type of Two-Way Analysis of Variance.

Table 3-9 shows the effects (measured by return-risk ratios) of 19 treatments, the effects of three control levels or volatility classes, and the effects of the 19 treatments interacting with the three control levels. The figures within the cells in Table 3-9 are the mean return-risk ratios for seven years of each of the 57 strategies. The same figures appear in the far right columns of Tables 3-5 to 3-8.

The row means in Table 3-9 show the effects of 19 treatments holding the control levels constant. The column

Table 3-9

RETURN-RISK RATIOS ON 19 TREATMENTS
BY THREE LEVELS FOR SEVEN YEARS

Treatment	Strategy	Low Vol. Class	Medium Vol. Class	High Vol. Class	Row Means
3-CL-W	(1, 20, 39)	-.32	-.23	-.28	-.272
3-CN-W	(2, 21, 40)	-.57	-.57	-.58	-.570
3-PS-W	(3, 22, 41)	-1.36	-1.08	-.103	-1.158
3-PN-W	(4, 23, 42)	-.35	-.37	-.56	-.427
3-SL-W	(5, 24, 43)	-.34	-.31	-.45	-.369
3-SN-W	(6, 25, 44)	-1.15	-.97	-1.13	-1.082
6-CL-W	(7, 26, 45)	-.10	.08	-.15	-.056
6-CN-W	(8, 27, 46)	-.51	-.52	-.47	-.501
6-PS-W	(9, 28, 47)	-1.01	-.84	-.71	-.853
6-PN-W	(10, 29, 48)	-.20	-.13	-.38	-.236
6-SL-W	(11, 30, 49)	-.14	-.04	-.26	-.146
6-SN-W	(12, 31, 50)	-.84	-.70	-.75	-.764
3-C-B	(13, 32, 51)	-.51	-.05	.18	-.125
3-P-B	(14, 33, 52)	-.55	-.51	-.25	-.437
3-S-B	(15, 34, 53)	-.98	-.31	.09	-.400
6-C-B	(16, 35, 54)	-.10	.17	.27	.111
6-P-B	(17, 36, 55)	-.43	-.51	-.18	-.373
6-S-B	(18, 37, 56)	-.48	-.06	.24	-.101
Control	(19, 38, 57)	.32	.48	.43	.410
Column Means		-.507	-.340	-.313	-.387

means indicate the effects of the control levels holding the treatments constant.

Table 3-10 presents a summary of the Treatment by Levels Analysis of Variance. Using a predetermined level of significance (α) equal to .05, it is seen in Table 3-10 that the treatment effect, holding the control levels constant, is significant at the 0.0005 level. Since the probability of the F Statistic for the treatments is below .05, it may be concluded that the treatment or row means in Table 3-9 are significantly different from one another, or that the differences among the row means are probably not due to chance variations.

The F Statistic for the control levels is found to be 0.008 in Table 3-10. Since this statistic is also below .05, it may be reasonable to expect that the differences among the column means in Table 3-9 are likewise not attributable to chance variations.

The interaction effect of the treatments taken by levels produced an F Statistic of 0.853 in Table 3-10. Since the statistic is greater than .05, it cannot be concluded that the effect of interaction of taking the treatments by levels is significant at the predetermined α level.

Since both the treatments and levels effects

Table 3-10

SUMMARY TABLE OF TREATMENT BY LEVELS ANALYSIS OF VARIANCE

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Square	F Statistic	Approximate Significance of Probability of F Statistic
Treatments (Rows)	57.230	18	3.179	10.645	< 0.0005
Levels (Columns)	2.942	2	1.471	4.924	0.008
Treatment X Levels	8.059	36	0.224	0.750	0.853
Remaining Error	102.151	342	0.299		
Total	170.381	398			

apparently are due to something more than just chance variations, it might be worthwhile to further examine the row and column means in order to determine which treatment effects are significantly better than others, or which levels effects are significantly better than other levels effects. The additional examination of treatment and levels effects may be undertaken with the use of t Tests.

8. t Test for Determining Significance Among Level Effects

In Table 3-9 it is seen that the levels effects produced column means of -.507, -.340, and -.313 for the three volatility classes. It has also been determined in Table 3-10 that the differences among the three means are due to something more than just chance variations. Hence, the -.313 mean for the High Volatility Class (the best of the three means) infers that the return-risk ratio for that class, taken independently of treatments, is significantly better than the mean of -.507 for the Low Volatility Class (the worst of the three means, and also taken independently of treatments).

But the question arises as to whether the return-risk ratio for the High Volatility Class is significantly better than that of the Medium Volatility Class when treatments are not considered. The question may be answered by

employing a t Test for Differences Between Means, where:

$H_o: \bar{X}_H = \bar{X}_M$ $\qquad$ $H_1: \bar{X}_H \neq \bar{X}_M$

$\alpha = .05$ (two-tail)

Degrees of Freedom = 264

Significant t Statistic = 1.960

$$t = \frac{\bar{X}_H - \bar{X}_M}{\sqrt{\left(\frac{SS_H + SS_M}{Df_H + Df_M}\right)\left(\frac{1}{n_H} + \frac{1}{n_M}\right)}}$$

where: SS = sum of squares, and Df = degrees of freedom

Then: $\bar{X}_H = -.313$ $\qquad$ $n_H = 133$

$\bar{X}_M = -.340$ $\qquad$ $n_M = 133$

$SS_H = 53.56$ $\qquad$ $Df_H = 132$

$SS_M = 71.51$ $\qquad$ $Df_M = 132$

Thus, $t = 0.308 < 1.96$; therefore the difference between the mean return-risk ratios of the High and Medium Volatility Classes, taken independently of treatments, is not significant and hence might be due to chance variations. Therefore, the most that can be inferred of levels taken independently of treatments is that given an α of .05, the Low Volatility Class appears inferior to the High Class, but that no significant distinction can be made between the Medium and High Volatility Classes.

9. t Test for Determining Significance Among Treatment Effects

It has been previously determined that something more than chance has accounted for the differences among the treatment effects in Table 3-9. It is possible that individual differences between specific pairs of row means might generate insight as to which one or several of the treatments employed is significantly better than the others. Such inferences may be developed by employing t Tests for Differences Between Means, as was done in the last section.

In Table 3-9 the highest return-risk ratios among the treatments (holding levels constant) are the control treatment of .410 and the six-month calls to buyers of .111. For simplicity, call the former, Treatment 19 and the latter, Treatment 16. If the difference between these two row means were found to be significant, it would be inferred that the control treatment is significantly better than all the other 18 treatments. If the difference between the two means were not significant, then another t test can be run pairing the control mean to the third best mean, and so on, until some difference between pairs of means is found to be significant. When significance of the difference between the control mean (the highest ranking mean) and some other mean is finally encountered, it may then be implied that the optimal

treatment (holding levels constant) comes from the treatment or treatments which do not have significantly different row means from the control mean.

First, a t Test for differences between Treatment 19 and 16 is run, where:

$H_o: \bar{X}_{19} = \bar{X}_{16}$ $\quad$ $H_1: \bar{X}_{19} \neq \bar{X}_{16}$

$\alpha = .05$ (two-tail)

Degrees of Freedom = 40

Significant t Statistic = 2.021

Then: $\bar{X}_{19} = .410$ $\quad$ $n_{19} = 21$

$\bar{X}_{16} = .111$ $\quad$ $n_{16} = 21$

$SS_{19} = 8.54$ $\quad$ $Df_{19} = 20$

$SS_{16} = 4.60$ $\quad$ $Df_{16} = 20$

Using the same formula for t as in the last section, $t = 1.69 < 2.021$; therefore the difference between the control treatment and the buying of six-month calls is not significant. Hence, it cannot be inferred that one of the two treatments is significantly superior to the other.

Next, another t test is taken to account for the difference between the control strategy return-risk ratio and the return-risk ratio of the third best treatment -- selling calls against long positions for six months (Treatment 7).

Then: $H_o: \bar{X}_{19} = \bar{X}_7$ $\quad$ $H_1: \bar{X}_{19} \neq \bar{X}_7$

$\alpha = .05$ (two-tail)

Degrees of Freedom = 40

Significant t Statistic = 2.021

$\bar{X}_{19} = .410$ $\quad$ $n_{19} = 21$

$\bar{X}_7 = -.056$ $\quad$ $n_7 = 21$

$SS_{19} = 8.54$ $\quad$ $Df_{19} = 20$

$SS_7 = 8.87$ $\quad$ $Df_7 = 20$

Again using the same formula for t, it is found that $t = 2.30 > 2.021$; hence the difference between the return-risk ratios for the control treatment and for selling six-month calls against a cash position probably is not due to chance variations, but rather because of some significant difference between the two treatments.

Since $\bar{X}_{19}$ is significantly greater than the third best treatment, $\bar{X}_7$, it is also significantly greater than the remaining sixteen treatments. Hence, it is inferred that differences between the control treatment and the buying of six-month calls might be due to chance, but that the other seventeen treatments are significantly inferior to the control treatment. Thus, in searching for optimal treatments taken independently of levels, only Treatments 19 and 16 need be considered.

10. Possible Superior Strategies

Since it was found in the Treatment by Levels Analysis of Variance that the interaction effect was not significant, no t tests can be made which would compare the cell means. The cell means represent the return-risk ratios for a seven-year period for each of 57 strategies, where each strategy takes into account both treatment and levels. But while no direct statistical comparison between cell means can be made in lieu of a significant interaction effect, some inference can be made as to which strategies are probably superior.

It was found in comparing column means that the Low Volatility Class level was inferior to the other two classes. Hence, without a significant interaction effect, no strategy involving the Low Volatility Class can be classified as significantly better than any other strategy outside the Low Volatility Class.

Furthermore, since the comparison of row means found seventeen treatments to be significantly inferior to Treatment 19, no strategy involving any of the seventeen other treatments can be said to be better than any strategy not using one of those seventeen treatments. Hence, for any strategy to be considered the best out of all 57 strategies,

it must involve either Treatments 19 or 16, and must fall in either the Medium or High Volatility Class. Only the four strategies shown in Table 11 meet the above constraints.

Table 3-11

POSSIBLE SUPERIOR STRATEGIES

Strategy	Return-Risk Ratio	Rank
35: Buy Calls for 190 Days on Medium Volatility Class Stocks	.17	7
54: Buy Calls for 190 Days on High Volatility Class Stocks	.27	4
38: Buy Stocks in Medium Volatility Class	.48	1
57: Buy Stocks in High Volatility Class	.43	2

In Table 3-12 it is seen that when the 57 strategies are ranked in order by their respective return-risk ratios, the four strategies in Table 3-11 do not all rank in the top four. In fact, Strategy 35 ranks only seventh among all 57 strategies. None-the-less, the strategies ranked third, fifth, and sixth cannot be considered significantly better than Strategy 35 because of the results of the previous statistical tests. Thus, in selecting an optimal strategy,

Table 3-12

OPTION AND CONTROL STRATEGIES RANKED
IN ORDER OF RETURN-RISK RATIOS

Rank	Strat-egy	RR Ratio	Rank	Strat-egy	RR Ratio	Rank	Strat-egy	RR Ratio
1:	38	.48	20:	10	-.20	39:	27	-.52
2:	57	.43	21:	20	-.23	40:	14	-.55
3:	19	.32	22:	52	-.25	41:	42	-.56
4:	54	.27	23:	49	-.26	42:	21	-.57
5:	56	.24	24:	54	-.27	43:	2	-.57
6:	51	.18	25:	39	-.28	44:	40	-.58
7:	35	.17	26:	24	-.31	45:	31	-.70
8:	53	.09	27:	1	-.32	46:	47	-.71
9:	26	.08	28:	5	-.34	47:	50	-.75
10:	30	-.04	29:	4	-.35	48:	28	-.84
11:	32	-.05	30:	23	-.37	49:	12	-.84
12:	37	-.06	31:	48	-.38	50:	25	-.97
13:	26	-.08	32:	17	-.43	51:	15	-.98
14:	7	-.10	33:	43	-.45	52:	9	-1.01
15:	16	-.10	34:	18	-.48	53:	41	-1.03
16:	29	-.13	35:	13	-.51	54:	22	-1.08
17:	11	-.14	36:	33	-.51	55:	44	-1.13
18:	45	-.15	37:	17	-.51	56:	6	-1.15
19:	35	-.17	38:	8	-.51	57:	3	-1.36

only the four appearing in Table 3-11 can be considered. However, since there was no significant interaction effect, no one strategy of the four can be considered as significantly best.

11. Summary

Of 57 strategies tested only nine returned an amount greater than the risk-free rate of return. The three top ranking strategies all involved outright purchases of stocks while all the 54 option buying and option selling strategies had lower rankings.

No one strategy could be deemed significantly superior to the rest, but it was determined that the best strategy probably is one of a group of four. The four in order of their return-risk ratios are the purchase of stocks in the Medium Volatility Class, the purchase of stocks in the High Volatility Class, the purchase of 190-day call options on High Volatility Class stocks, and the purchase of 190-day call options on Medium Volatility Class stocks.

A Treatment by Levels Analysis of Variance found that both the treatments and the volatility classes which were used produced significant effects on return-risk ratios; however, when treatments were taken in combination with volatility classes, no significant interaction effect

developed at the .05 confidence level.

In every case involving option strategies over the seven-year period, the six-month strategy either equaled or outperformed the equivalent three-month strategy as measured by return-risk ratios.

CHAPTER 4

TAX CONSIDERATIONS OF OPTION STRATEGIES

The risks and returns to option investors discussed in Chapter 3 are based upon the assumption of a tax-free world. In actuality, the assumption is valid only for those investors and institutions which are tax-exempt. Since most investors in options operate on a taxable basis, it is appropriate that the major tax implications which confront option investors be discussed.[1]

Buyers of Puts and Calls

The discussion here will center on call options, but the tax implications apply similarly for put options. There are three possible outcomes that can occur when one purchases a call: the call may lapse (fail to be exercised); the call may be sold; or the call may be exercised.

1. Call option lapses:[2] Should the stock on which a

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[1]Information presented here on tax rulings of option transactions may be found in; 1954 Internal Revenue Code: Section 1234; and in John D. Cunnion, How to Get Maximum Leverage from Puts and Calls (Larchmont, N.Y.: Business Reports, Inc., 1966).

[2]For the sake of simplicity, brokerage commissions will be ignored in the following tax discussion.

call has been purchased decline in price, the option will normally be allowed to lapse. If such is the case, the premium paid for the call is treated as a capital loss, established on the date that the option expires. If the expiration date is more than six months after the date on which the call was purchased, the loss is treated as a long-term loss. When the period between purchase and expiration is six months or less, the loss is treated as a short-term loss.

2. Call option is sold: The sale of an option contract (usually to a third party who is often a put and call broker or dealer) creates either a capital gain or loss. If the option had been held more than six months, the gain or loss is treated as long-term. If the contract had been held six months or less and subsequently sold, the gain or loss is treated as short-term.

3. Call option exercised: If the price of the stock subsequently rises above the striking price and the call option is exercised, the cost of the option is added to the cost of purchasing the 100 shares of stock at the striking price. This total cost becomes the cost base for tax purposes of the 100 shares of stock which the investor is long. The holding period for the long position commences on the

date of exercise, not on the date that the call was purchased.

The gain or loss which subsequently develops when the long position is sold is treated as long-term only if the stock is held for more than six months after the date of exercise. If the stock were held for six months or less after the date of exercise, the gain or loss is treated as short-term.

In the case of a call option which is exercised, the period of time the option was held prior to exercise (even if it exceeds six months) is irrelevant for tax purposes.

In most cases the investor who exercises a call option will immediately sell the long position which he purchases from the writer at the striking price. When this is done the holding period is reduced to less than one day, and as such, any capital gain or loss developing from the exercise and sale is treated as short-term.

When a put option is exercised, the premium is subtracted from the proceeds of the sale of the 100 shares of stock to the writer. The exerciser of the put now has a short position in the stock. When the short position is eventually covered, the resulting gain or loss is always treated as short-term, regardless of how long a time the stock is held short. Hence, no long-term capital gains can

result in instances where a put option is exercised.

Implications of Tax Rules to Put and Call Buyers

Assuming that a put or call purchaser is in a taxable bracket and that during the course of a year he generates short-term gains or losses from capital transactions, he may take advantage of the above tax rulings to improve his after-tax return-risk ratios relative to those presented in Chapter 3. Below are some pertinent examples of how results may be improved:

Example A: A six-month and ten-day call is purchased on XYZ for $1000 on January 1, at a striking price of $100 per share. On July 1, the stock is selling for $120. Should the holder exercise the call and immediately sell the stock at any time during the following ten days, the gain would be short-term and therefore taxable at higher rates than if the gain were long-term. However, if the holder waits one more day, he can sell the call to a third party and thereby establish a long-term capital gain since the option is a capital asset held for over six months. As a service to their customers, put and call brokers will purchase options for the full amount at which the options are in the money (in this case $2000) less a roundtrip commission. Ignoring the commissions, the long-term gain would be $1000.

For an investor in the 50 per cent tax bracket, the after-tax profit is $750 as opposed to only $500 if the call were exercised.

Example B: Suppose that on July 1, XYZ were selling for $80 per share. If the holder allows another ten days to pass, the option will presumably lapse (barring a very strong rally) and a long-term loss would develop. In the event that the holder has short-term gains from other transactions, he might instead wish to establish a short-term loss against which he can offset his gains. He can establish a short-term loss by selling his call for $1 to an option broker on July 1. If he waits one more day to sell the call, he will establish a less desirable long-term loss.

Thus, the taxable investor who purchases calls with durations of over six months can establish long-term capital gains if successful, but he can also take short-term losses if it is desirable from a tax standpoint. No such tax advantages develop on options with less than six month's duration.

Example C: A six-month and ten-day put is purchased on XYZ for $1000 on January 1, at a striking price of $100 per share. On July 1, the stock is selling for $80. If the put were exercised, the gain is of the less desirable short-

term variety. However, by waiting another day or more and selling the put to a third party, a long-term capital gain may be established. Had the stock been shorted on January 1, no long-term gain could ever have been taken, regardless of how long the short position were held. Thus, buying a put is a means of accruing advantageous long-term capital gains in a declining stock.

Buyers of Straddles

Effective January 25, 1965, the Internal Revenue Service held that writers of straddles must allocate the proceeds of straddle premiums among the put and call components.[1] It later stated that an allocation of the premium of 55 per cent to the call side and of 45 per cent to the put side would be appropriate. While no release came forth on the effect of the tax ruling to straddle buyers, it is believed that a similar allocation of the premium may be made by them.[2]

As in the case of puts and calls to buyers described above, three outcomes of straddle purchases are possible. One or both of the straddle components may lapse; may be sold; or may be exercised. The tax treatment for the three

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[1]Internal Revenue Service Ruling 65-31 (4739.751), January 22, 1965.

[2]Cunnion, op. cit., p. 94.

contingencies is similar to those discussed for puts and calls, bearing in mind that the cost of the straddle premium is allocated on a 55 per cent - 45 per cent basis between the put and call components.

Implcations of Tax Rules to Straddle Buyers

Example D: On January 1, a six-month and ten-day straddle is purchased on XYZ for $2000 at a striking price of $100 per share. On July 1, XYZ is selling for $130. Since the call portion is valuable because the stock is selling for more than the striking price, the call must either be exercised or sold in order to recover its value. The put portion is presumed now to be worthless.

First, the straddle premium is allocated among its two components. The tax cost of the call is $1100 and the cost of the put is $900.

If the call were exercised and the stock immediately sold, a short-term capital gain of $1900 develops on the call portion. However, by waiting one or more days and by selling the call portion to a third party, a long-term capital gain of $1900 is taken (assuming no significant fluctuations in the market price of the stock).

The holder can thus accrue advantageous long-term gains on the successful call portion of the straddle, but

what about the unsuccessful put? If the put were allowed to lapse, the cost of the put ($900) would be treated as a long-term capital loss. Assuming that the holder has other short-term gains in his portfolio, it might be advantageous for him to establish a short-term loss on the put portion. This he can do by selling his put on July 1 for $1 to an option dealer. If he waits until July 2 or later to sell his put, the holding period becomes greater than six-months and the loss becomes long-term.

It is seen that buying 190-day straddles, which was previously found to be profitable on High Volatility Class stocks, can become even more desirable when weighed against risks; especially for those investors in high tax brackets who have substantial short-term capital gains among their other assets. For any successful straddle, the long-term capital gain which develops can be taxed only at a maximum rate of 25 per cent (ignoring any tax surcharge which might be in existence). Conversely, for any unsuccessful straddle or portion thereof, the loss can be established as short-term and offset against short-term gains, which would otherwise be taxed at rates at least twice those applying to long-term gains. For one in a 50 per cent tax bracket, the purchase of 190-day straddles affords the opportunity to establish

after-tax profits of 75 per cent of the gross gain, but to suffer after-tax losses of only 50 per cent of gross losses. Hence, the return-risk factor increases relative to those presented in the last chapter, where gains and losses are given equal weights. As long as the straddle purchaser generates short-term gains on other assets, the Federal Government stands to bear a greater proportion of straddle losses than it will receive in gains. Since the reverse is true for the investor, the purchase of 190-day straddles offers a potentially good investment opportunity because of the tax advantages.

Writers of Puts and Calls

From the writer's standpoint there are two possible outcomes on puts or calls which he sells; the option may lapse, or the option may be exercised (either by the original buyer or by a third party).

1. Option lapses: In the case of any put or call which is not sold as a part of a straddle, the premium received is treated as ordinary income when the option expires without having been exercised. The income is recognized on the date on which the option expires. Premiums are not recognized as earned income until either the point of exercise or expiration. The above rules hold even when the writer has suffered

a capital loss on a stock position which backed up the option which he wrote. The gains or losses on the stock position (either long or short) against which the option is written are treated for tax purposes in the same manner in which any ordinary gains or losses on stock transactions are handled. The tax treatment of the lapsed option premium is thus viewed independently of the gains or losses on the stock which covered the option.

2. Option is exercised: In the case of a put option which is exercised, 100 shares of stock are tendered to the writer for acceptance at the striking price. The writer may then deduct the put premium from the cost of the 100 shares. Since the holding period on the stock which is put to him begins on the day of exercise, any gains or losses on the stock are treated as long-term only if the writer proceeds to hold the shares for more than six months after being put. If the writer immediately disposes of the shares which are put to him, the gain or loss which results is treated as short-term since the holding period of the capital asset is for less than six-months.

If the put option writer maintained a short position to back up the option, the gain or loss on the position is always treated as short-term since no capital asset was held.

This rule is consistent with the Internal Revenue Service rulings on ordinary short sales.

In the case of call options which are exercised, the premium is added to the sales price of the shares which the writer delivers to the buyer upon being called. If the shares delivered were held for more than six months by the writer, the gain or loss which results is treated as long-term. When the shares delivered to the exerciser have been held by the writer for six months or less, the resulting gains or losses are treated as short-term. Note, the shares which the writer delivers on an exercised option do not necessarily have to be the same shares which the writer may have originally purchased to back his contract.

Implication of Tax Rules to Put and Call Writers

Example E: On January 1, a writer sells a six-month and ten-day call on XYZ for $1000 at a striking price of $100 per share. On the same day the writer purchases 100 shares of the stock at $100 per share in order to back up the contract which he has written. On July 1, XYZ is selling for $80. The option will be presumed to lapse unexercised on July 10.

The call premium of $1000 must be treated as ordinary income by the writer despite the fact that he has a capital loss on the stock, as yet unrecognized. If the writer has

other short-term gains from earlier transactions, he could elect to sell his long position on July 1 in order to establish a short-term loss of $2000 against which he can offset his short-term gains. If on the other hand the writer thinks it desirable from his tax standpoint to elect to take a long-term loss, he may do so by waiting at least one day longer to sell his long position.

Should the writer not want to establish a capital loss of any type, he can simply hold on to his long position. In this event he may elect to wait until the following year to establish his loss, assuming that the stock fails to rally. Or, he might elect to sell another call against his already established long position.

The unexercised call (or put) places the option writer at a tax disadvantage. If the premium were allowed to be offset against the capital loss, the total loss would be $1000 for tax purposes, which in turn could be used to offset other capital gains. If no capital gains were available to be offset and assuming that the writer has already used up the allowable $1000 deduction from ordinary income with other capital losses, the loss could be carried over to another year and no tax need be paid in the current year.

However, since the premium is treated as ordinary

income, taxes must be currently paid on it, whereas the $2000 capital loss can be carried forward. If the writer were in the 50 per cent tax bracket, he would have to pay taxes of $500, despite an economic net loss of $1000 on the transaction.

Hence, it is undesirable for persons in higher tax brackets to write options which they feel will go unexercised. This implies that such strategies as selling naked puts and naked calls are in an unfavorable position taxwise relative to other strategies. Furthermore, writers who sell calls against long positions or puts against short positions will also be at a tax disadvantage when the stock price moves in an adverse direction (down in price for calls and up for puts).

Example F: Assume that a writer sells a call under the same conditions as in Example E, except that on July 1 the stock is selling for $120 per share. Since the current market price is substantially above the striking price, the writer knows that he will soon be called.

Suppose that the writer waits to get called and that on July 10, the last day of the contract, the option is exercised. Suppose also that the market price is still $120. If the writer delivers the 100 shares of XYZ which he purchased on January 1, the writer will have established a

long-term capital gain of $1000. This is so because the premium of $1000 is added to the proceeds of the stock sale, which occurred at the striking price of $100 per share. Since the stock was purchased at $100 per share, the gain is $1000 when the premium is considered.

The writer has another alternative, however, that might be more profitable from a tax standpoint. Upon being called at $100 a share on July 10, the writer purchases a second lot of 100 shares in the market and delivers them to the option holder. At the same time he sells the original 100 shares in the market to establish a long-term capital gain of $2000.

On the second 100 shares which the writer delivers he must pay a price of $120 per share and sell them to the exerciser for $100 per share. The call premium of $1000 will then be added to the sales price making the gross proceeds of the sale equal to $110 per share. On a 100 share lot the loss amounts to $1000. Since the stock position was held for less than one day, the loss is considered short-term. Thus, by purchasing for delivery a second lot of stock, the writer has established a tax advantageous $2000 long-term capital gain, and a $1000 short-term capital loss which can be used to offset other short-term capital gains.

Writers of Straddles

As noted earlier, the Internal Revenue Service has ruled that option writers must split their premiums into put and call components for tax purposes. The I.R.S. also suggested that a 55 per cent - 45 per cent allocation between calls and puts is acceptable.

After the premium has been allocated among the put and call components, the premium on the side or sides which eventually become exercised is treated in the same manner as premiums on individual puts or calls are handled. The portion or portions of the straddle contract which are allowed to lapse are treated as short-term capital gains; a treatment which is quite different to that accorded to individual puts or calls which lapse.[1] Short-term capital gains thus result from any lapsed portion of a straddle contract, regardless of how long the contract was in effect and regardless of whether or not the overall returns were profitable

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[1]The 1965 change in the tax laws on straddles made the tax treatment on straddles more consistent with the economic results on those contracts. The I.R.S. or Congress never got around to also making the tax laws similarly consistent on individual puts and calls, perhaps because lobbyists brought their biggest pressure to bear on the straddle contract (which many writers prefer to sell). As it stands currently, there is definitely an inconsistency in the tax treatment for straddles as opposed to individual puts and calls.

to the writer. It also makes no difference as to how the lapsed portion of the contract was covered by the writer (eg., by a stock or naked position).

Implications of Tax Rules to Straddle Writers

Because of the recent rulings on straddle contracts by the Internal Revenue Service, the tax implications to straddle writers are generally more favorable than those to put or call option writers. This is so because the straddle writer has little occasion to be forced into accepting ordinary income.[1]

Example G: On January 1, a writer sells a straddle on XYZ for $2000 at a striking price of $100 per share. He simultaneously purchases 100 shares of the stock to cover his contract. On July 1, XYZ is selling for $130 a share. Further assume that the writer is in the 50 per cent tax bracket and that he has previously generated short-term capital gains on other transactions.

Knowing that he will soon be called and aware that the put option will soon expire, the writer may elect to employ a technique similar to that in Example F. Suppose that

[1]Straddle writers might possibly generate ordinary income from dividends received on long positions which are held to back up their contracts, and which are not called away. But lapsed premiums are not considered ordinary income.

on July 10, the stock is called away and that the market price is still $130. The writer purchases a second lot of 100 shares at $130 per share and delivers these to the exerciser. The allocation of the call portion of the straddle premium is $1100. The $1100 is added to the proceeds of the sale to the option holder which total $11,100 (100 shares at the striking price at $100 per share plus the $1100 call premium). Since the stock was purchased for $13,000 (100 shares at $130 apiece), a short-term capital loss of $1900 is established. The loss is short-term because the stock position was held for less than one day.

The lapsed put portion of the straddle contract is allocated at $900 and is treated as a short-term capital gain. This gain may be used to partially offset the $1900 short-term loss.

The 100 shares of XYZ which were originally purchased on January 1 at $100 are sold on July 10 for $130 a share, thus establishing a long-term capital gain of $3000.

By using the remaining $1000 short-term loss to offset other short-term gains in his portfolio, the writer's net tax bill on the straddle transaction amounts to only 25 per cent of the long-term $3000 gain or $750.

Had separate puts and calls been sold on January 1

for $900 and $1100 respectively, the writer would have been worse off taxwise. He could have employed the technique used in Example F on the successful call option, but the put premium of $900 would accrue to him as ordinary income which could not be offset against capital losses of any type.

Summary of Tax Implications to Option Investors

Option purchasers, particularly straddle option purchasers, generally operate in a superior tax environment relative to option writers. In fact, option buyers can often achieve better tax results than buyers or short sellers of stocks. Option buyers in high tax brackets can often conceivably effect a more advantageous expected return- risk ratio than those presented in Chapter 3.

Option writers operate in a handicapped atmosphere when they are on a taxable basis. This is often true because the Internal Revenue Service rules on option writing are not always consistent with the economic outcome of option transactions. In particular, writers of individual puts and calls are often at a tax disadvantage, therefore in certain cases the expected return-risk ratios for option writers are more negative than those appearing in the last chapter.

Straddle writers, thanks to recent revisions of the 1954 Internal Revenue Code, are now in a superior tax position relative to put option or call option writers.

CHAPTER 5

SUMMARY, QUALIFICATIONS AND IMPLICATIONS

1. Summary

Purpose of the Study

Put and call option investing has been studied based on three objectives: First, to improve upon the methodology of past studies in the option investment area which exhibited conflicting findings. Second, to incorporate risk as well as return in measuring and analyzing option investment performance in order that meaningful comparisons of different option and stock strategies can be made. Third, to offer guidance to option practitioners in planning their investments.

Methodology

A stratified random sample of 210 stocks or 30 per year, which at the time of their inclusion had significant option activity, was drawn over a seven-year period between 1961 to 1968. Stratification of the sampled stocks was made on the basis of the stocks' expected price volatility.

High, Medium and Low Volatility Classes were defined and 70 stocks were represented in each of the three classes. Eighteen option strategies and one stock purchasing strategy

were applied to every stock within each of the three volatility classes, resulting in a total of 57 different option and stock strategies.

Thirty-six option writing strategies were generated by varying the stock volatility class, the duration period of the option (95 days or 190 days), the type of option written (puts, calls or straddles), and the position taken by the writer to back up the option contract (long or short stock positions or cash positions). By varying volatility classes, duration periods and the option type, eighteen option buying strategies were also developed.

Based upon 45,570 hypothetical transactions over a seven-year period, calculations were made of the rate of return and the risk associated with the return on all 57 option and stock strategies. The strategies were then independently measured and ranked by return-risk ratios, where the ratios were based upon the incremental return per unit of risk above the risk-free rate of return. Risk on each strategy was measured by its seven-year standard deviation of return.

A Treatment by Levels Analysis of Variance and several t Tests for Differences Between Means were made in order to determine significant differences in the performance of

of the strategies.

Findings

The major finding of the study is that tax-free investors had superior performance investing in stocks as opposed to either buying or selling options. Purchasing 190-day calls on Medium and on High Volatility Class stocks were the only two option strategies which were not found significantly inferior to the two best stock buying strategies, but even these two had lower return-risk ratios than some other option strategies and all three stock strategies.

Selling 190-day calls against long positions on stocks in the Medium Volatility Class was the only one of thirty-six option writing strategies which had a positive return-risk ratio, but the rate of return on investment barely exceeded the risk-free rate of return. Five of eighteen option buying strategies, all involving the purchase of calls or straddles in the Medium or High Volatility Classes, produced positive return-risk ratios.

In every instance, 190-day options of all varieties to both buyers and to writers either equaled or outperformed the corresponding 95-day option strategy. When taxes were taken into consideration, the longer duration options were even better in their relative performance.

The nine strategies with positive return-risk ratios were as follows:

Strategy	Return-Risk Ratio	Rate of Return on Investment
Buy Stock- Med. Volatility	.48	24.14
Buy Stock- High Volatility	.43	47.67
Buy Stock- Low Volatility	.32	10.70
Buy 190-day Calls - High Volatility	.27	105.03
Buy 190-day Strad.- High Volatility	.24	47.64
Buy 95-day Calls- High Volatility	.18	81.23
Buy 190-day Calls- Med. Volatility	.17	44.04
Buy 95-day Strad.- High Volatility	.09	21.10
Sell 190-day Calls vs. Long Position- Med. Volatility	.08	4.89

While most option strategies had poor performance, it is still possible that the inclusion of options might increase the return per unit of risk in a Lintner-type investment portfolio. In addition, the nature of tax laws regarding options, particularly for buyers, makes it possible to increase the return-risk ratios found in the study. For taxable investors, option buying has definite tax advantages over both option writing and stock purchasing.

If The Chicago Board of Trade should establish an auction-type market in options as planned, there is a possibility that both option buyers and writers could increase their investment performance.

2. Limiting Factors of the Study

The findings of this study cannot be accepted *prima facie*. It is important that one who might wish to apply the results found here to real world situations be familiar with the limiting assumptions applied to the analysis, as well as to some extraneous factors which threaten to alter the current market for put and call options.

Some Limiting Assumptions and Qualifications

1. As with most historical studies of securities markets, a major limitation is that past observations may not necessarily render valid generalizations about future results. The limitation has been at least partially overcome by observing a reasonably long past period which included two major bear markets (1962 and 1966) as well as strong bull markets. The study would fail to generate reasonable future expectations if a repeat of something on the order of the 1929-1932 bear market should reoccur or if an unprecedented bull market develops. Even these eventualities can be accounted for by expanding the duration of the 1962 or 1966 bear markets or the bull markets which occurred during the seven-year period.

2. The practice of stratifying stocks according to their volatility characteristics is valid only if straddle

option bids provide a reasonable estimate of future volatility. In the long-run a stock's volatility could change with changes in its investment or speculative prospects. This eventuality has been considered by taking a new volatility rating for all stocks once each year and subsequently drawing a new random sample of issues. Furthermore, the F Ratio Tests shown in Appendix B lend supporting evidence to the stratifying techniques which were used.

3. Stock prices have been rounded to the nearest whole dollar per share and a simplified estimate of the commission schedule has been established. The purpose of these moves has been to facilitate the ease of computation. It is doubtful that rounding would cause any significant errors in measurement since rounding several thousand prices tends to balance off very small deviations against one another.

4. Option premiums were estimated as a constant per cent of the striking price for a one-year period whereas in actual practice the premium as a per cent of the striking price will vary. Premiums have also been estimated from bid sheets and not from actual past transactions. However, it is believed that the premiums for any given year will be quite close to what might actually have been expected.

5. The assumptions that all option contracts are

not exercised until the final week of duration (if exercised at all) and that investment bases have been arbitrarily established are necessary in order to make profit and risk estimates. Another researcher could vary the assumptions to his satisfaction.

6. The commission expense has been somewhat overstated in at least two cases. First, assume that a writer continuously sells options on the same stock. Suppose the writer sold a call backed by a long position and that the stock declined without the option having been exercised. If the writer were to sell another call against the stock, there would be no necessity to undertake another set of commissions because the writer already has possession of the stock.

Second, assume that a writer sold calls on stocks held in his portfolio which had been originally purchased as normal stock investments. The writer's commission expense would be lower than that previously estimated since his marginal commission cost is zero.

7. With the exception of volatility measurement, the problem of security analysis has been avoided in the selection of stocks. Real world results could be improved or worsened depending upon the skill of the investor at analyzing securities. However if the Random Walk Hypothesis

were accepted, there would be no justification for security analysis, at least not for short-run periods such as three or six months.

8. Samples have been used to predict what might actually happen to samples of option contracts transacted in the future. Any estimates of risk and return are therefore subject to the constraints of sample sizes, both in the research here and in the practitioner's portfolio.

9. The use of standard deviations as measurements of risk has its limitations. Perhaps the most objectionable feature of the standard deviation is that it could lead to false impressions about the potential risk of a strategy when expected returns are not normally distributed. Another limitation is that some investors are not interested in the total distribution of expected returns, but rather in the probability of certain types of adverse returns.

Despite its limitations, the standard deviation is a convenient mathematical measure of risk; furthermore, investors generally consider variance (the square of the standard deviation) as an undesirable aspect of return.

10. A taxless environment has been assumed. The assumption is valid for certain types of institutional investors but not for most individuals and institutions.

However, if it were assumed that all capital gains and losses and all ordinary income involving option investing were treated equally for tax purposes, the return-risk ratios developed here remain unaffected, although the rates of return on investment would be lower.

Of course, not all gains and losses or ordinary income are treated equally under the Federal tax laws; therefore, it is necessary to adjust the risk and returns to compensate for tax brackets and for the type of income or capital generated.

11. The return-risk ratios which are used in the comparison of strategies are subject to at least two important limitations. First, in ranking various strategies, it is assumed that the return-risk ratios provide a valid means for screening out certain strategies, while at the same time suggesting which strategies are favorable for investment purposes. However, the return-risk ratios produce only <u>independent</u> observations of each strategy. No effort has been made to examine the covariance among any combination of pairs of strategies. It is possible that some strategies which appear unfavorable when ranked by return-risk ratios may indeed be valuable additions to a portfolio, providing the additions can increase the overall return relative to

the risk of the entire portfolio. It should be noted here that the return-risk ratios are in such form that they could be included in a Lintner-type portfolio model.[1] With the aid of a computer it would then be possible to select that combination of option or stock strategies which will produce the maximum expected return per unit of risk taken on the whole portfolio.

Second, the return-risk ratios can validly compare independent alternatives only when one makes the assumption that an investor can either borrow or invest at the pure rate of interest. Investing at the pure rate of interest is no problem assuming that Treasury bills are considered risk-free, however borrowing at that rate is usually impossible. Furthermore, borrowing at any rate of interest is sometimes impossible because of Federal Reserve Board or brokerage house margin regulations.

Even if it were assumed that one cannot borrow at all on his option investments, the return-risk ratios can still provide fair comparisons when it is assumed that one can invest at the pure rate of interest. For example, suppose Strategy A has an expected rate of return on investment of 25 per cent and a standard deviation (risk measure) of .20;

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[1]Lintner, op. cit., 587-615.

while Strategy B has an expected return of 20 per cent and a standard deviation of .10. Assuming that the pure rate of interest is 5 per cent, the return-risk ratios for A and B are 1.0 and 1.5 respectively.[1] If the portfolio problem were eliminated from consideration and only the best of the two strategies were selected, B is the preferred alternative even though the rate of return on investment for A is greater.

Suppose that the investor has just $1000 to invest and that he puts it all into Strategy B. His total expected return would be $200 and his risk would be one unit.[2] Alternatively, the investor could adapt Strategy A and reduce his risk to one unit by investing some of his funds at the risk-free rate of return. By investing only $500 in Strategy A and by purchasing another $500 worth of Treasury bills (at a 5 per cent yield), the risk of investing the entire $1000 is reduced to one unit, however the return is cut to $150 (.25 x $500 + .05 x $500 = $150).[3]

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[1] $RR_A = \frac{.25 - .05}{.20} = 1.0$; and $RR_B = \frac{.20 - .05}{.10} = 1.5$.

[2] where one unit of risk = .10 standard deviations.

[3] The risk is reduced to one unit (or .10 standard deviations) because half of the portfolio is riskless. The weighted average of risk on the portfolio is (.20 std. dev. x .5) + (0 std. dev. x .5) = .10 std. dev. or one unit of risk on the entire portfolio.

Thus when the two Strategies are equated for risk, Strategy B provides the greater return. If one could borrow at the pure rate of interest, the same equating could be accomplished by leveraging Strategy B instead of reverse-leveraging Strategy A.

Some Extraneous Factors Which Could Affect Future Usefulness of the Findings

A. Institutional Activity: The Securities and Exchange Commission found that on June 1, 1959, only 1.20 per cent of all outstanding put and call options had been written by institutional investors.[1] During the entire month of June, 1959, the S.E.C. also found that only two institutions participated on the buy side of the option market.[2]

In the ensuing ten years institutional activity in options has increased although there are no accurate records available to verify the magnitude of the increase. However, a recent survey undertaken by Sarin[3] gives some indication

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[1]Securities and Exchange Commission, op. cit., p. 55.

[2]Ibid., p. 75. Both institutional investors were banks.

[3]Interview with Donald C. Sarin, Option Specialist and Branch Manager, E. F. Hutton & Co., Inc., Southfield, Mich., June 13, 1969. Sarin recently completed a survey of option dealers, mutual funds, and brokerage houses, in which institutional activity in options was the major inquiry. The results will be presented to the Investment Banking Seminar at the Wharton School of Finance and Commerce under the title, "Put and Call Options and the Institutional Investor," 1969.

of the current scope of institutional put and call option interest.

According to Sarin, put and call option dealers estimate that about 15 to 20 per cent of their recent option business has been with institutional accounts. These accounts, representing virtually all types of institutions, participate about equally on both the buy and the sell sides. However, only a very small portion of all financial institutions engage in the option business, and of those which do, only a fraction of their portfolios is invested in options.

Two major hurdles must be overcome in order to attract more institutional business. The first is the difficulty of obtaining large block transactions of options which institutions require in order to make investing worthwhile. Second, is the need for more education of institutional investors about options. Many institutions are hesitant to participate in ventures about which their knowledge is very limited.

Sarin also found that 19 per cent of the brokerage houses which he surveyed (103 member firms of the New York Stock Exchange responded to his questionnaire) stated that they currently handle some option business for institutional accounts. The brokers estimated that of those institutions

which were approached for option business, some 27 per cent had already either bought or sold options in the past.

Of the 81 mutual funds that Sarin sampled, 14 per cent stated that they had at least one in-house fund which dealt in puts and calls.

It is probably accurate to conclude that institutional activity in puts and calls has grown rapidly in the past ten years, and that it currently accounts for a much greater proportion of total option activity than the S.E.C. found in 1959. If institutional activity in options were to continue to grow rapidly in the future, the nature of the current put and call market could change significantly: volume executions would become more prevalent, perhaps premiums would increase or decrease, or perhaps the characteristics of the stocks on which options are traded would differ markedly from those in the past few years.

If any such changes were brought about in the option market, the conclusions concerning risk and profitability in option investing found in this study might fail to provide reasonable future estimates.

B. The Chicago Board of Trade: At the present time The Board of Trade of The City of Chicago is undertaking a feasibility study to determine the desirability of entering

the put and call business by establishing an exchange-type market in options.[1] If The Board were to enter the business, it would operate the only auction market in puts and calls in the United States.

One of the major aims of The Board of Trade in establishing an option exchange would be to attract institutional business. The Board believes that institutions could be attracted by offering a market place where large volume blocks of options could be transacted. It also feels that the current spread which option dealers take on each transaction could be lowered, and the savings passed along in the form of lower premiums to option buyers.

To make the market more attractive to option writers (particularly of the institutional variety), The Board is considering letting the seller keep all dividends that accrue on a stock against which a call option has been sold, even when the stock is later called away. Current practice insures that the buyer of a call is entitled to any dividends paid during the life of the call, providing that the option is exercised. The current practice lowers the rate of return

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[1]Interviews with Joseph W. Sullivan, Assistant to the President; Henry H. Wilson, President; and Edward O'Connor, Vice-Chairman, Board of Directors, Board of Trade of The City of Chicago, Chicago, April 18, 1969.

on investment for writers who sell calls on dividend paying issues. By letting the seller keep all dividends, The Board believes that many institutions would begin to participate in the market as writers, especially in higher quality stocks.

Institutions which currently might be interested in writing calls or puts on top quality stocks are often priced out of the market by foreigners. Since foreign investors are often not subject to taxes or to the margin requirements that prevail in the United States, they can afford to write options for lower premiums. Foreign writers, by supplying a large portion of options on quality issues, provide competition which is keen enough to keep many potential institutional writers out of the option market.[1]

If The Board of Trade were to maintain an option market in which writers could keep all dividends, the returns to writers might become potentially great enough to attract institutions. Of course if the writer becomes the one who is entitled to the dividends, the demand function for calls could shift to the left and the supply functions for calls

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[1]Interview with Mike Pincus, op. cit., March 4, 1969. Pincus estimates that the bulk of options supplied on top quality stocks are written by Europeans, with about half of the European supply originating in Geneva, Switzerland. The S.E.C. found that on June 1, 1959, 14.8 per cent of all outstanding option contracts were written by foreigners, Securities and Exchange Commission, op. cit., p. 55.

could shift to the right. Both shifts, ceteris paribus, would tend to lower premiums, making future projections of this study less useful. Furthermore, even if dividends were to accrue to the writer in the future, institutions might still be priced out of the market by foreigners. Foreigners too would receive the benefits of the dividends and therefore might be able to maintain their current competitive advantage. However, it is possible that The Board of Trade would attract considerable foreign activity on the supply side, taking away a source of supply from the members of the Put and Call Brokers and Dealers Association.

It is interesting to note that not one of the eight put and call dealers which Sarin surveyed believes that The Board of Trade will be successful in establishing an auction market in options.[1] On the other hand, the option dealers almost all added that if The Board were successful, option volume would probably increase and premiums would probably fall.

Not only would the establishment of an auction market in options by The Board of Trade have an effect on option prices and volume, it would also radically affect the nature of the present option contract. While several methods of

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[1]Sarin, loc. cit.

option trading are being considered by The Board of Trade, it will probably adopt a plan which will restrict striking prices to a set figure and limit the number of expiration dates to about four per year. The result would make option contracts more homogeneous than they are now and thereby help to encourage a secondary market in options. Because option contracts currently have varying striking prices and expiration dates, their heterogeneous nature makes secondary market trading quite cumbersome, thereby severely restricting the size of that market.

But if a large secondary market were developed by The Board of Trade, there could well be an impact on the primary market, thus creating differences in volume and price from what one might expect in the current market. If such changes were to take place, the results of this study might not be useful in estimating future expected risks and returns on option investing.

Assuming that The Board of Trade does fix striking prices, another radical departure from current practice would result. With fixed striking prices, the market price of a stock and the striking price of a potential option contract would usually be different. The market would compensate for the difference in the two prices by adjusting the option

premiums up or down, depending on whether the striking price is below or above the market price of the stock. Option premiums would then reflect the magnitude to which an option is in or out of the money. Since this study has not examined "in the money" or "out of the money" option contracts, the results found would probably be inadequate in describing future expected risks and returns.

Another change which The Board of Trade would bring, would be a significant reduction in the number of options actually exercised. Successful options (those on which the buyer could get back at least some of his investment) would usually be settled by transferring cash between writers and buyers, with The Board of Trade's Clearing House acting as middleman.

If options were rarely exercised, the tax implications to both buyers and sellers would be affected. Both parties would generally receive more beneficial tax treatment than that which usually accrues currently (see Chapter 4).

Furthermore, if options were rarely exercised, there would be considerably less commission expense to both buyers and writers than they normally undertake today. This is so because there would be fewer actual transfers of stock and thus the brokerage commissions assumed in this study would

be excessive. Since much commission expense could be eliminated in the future by option investors, the rate of return on investment to both buyers and sellers could be greater than estimated here.

C. Market Monitor Data, Inc.: In 1968 the firm of Market Monitor Data, Inc. began operations.[1] The firm supplies securities dealers with a computerized network or teleprocessing system which furnishes bids and offers on puts and calls. The major purpose of the firm's system is to enable brokerage houses and option dealers to receive more accurate information on the size and structure of the option market at any point in time.

The firm's system could enhance the ease with which options are traded and hence increase the volume of option activity, possibly at prices which are not similar to those of prior years. To the extent that Market Monitor's operation changes the price structure, volume, or nature of the parties engaged in option investing (the system is designed to attract more institutional activity), the results of this study might be inaccurate in describing future expected risks and returns in option dealings.

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[1]Baerwald & Deboer, Prospectus: Market Monitor Data, Inc. (55 Liberty Street, New York: July 18, 1968), p. 3.

D. Interest Rates: At the moment (June, 1969), U. S. Treasury bills are yielding close to seven per cent, or almost double the average risk-free rate of return for the seven-year study of 3.59 per cent. If the risk-free rate of return were to remain considerably higher than during the past seven or eight years, option investors would have to receive a higher rate of return on investment in order to accumulate an incremental return for risk-taking equal to that found in this study. To the extent that the risk-free rate of return remains relatively high and that other factors remain unchanged, the option strategies in the study as measured by return-risk ratios would become even less attractive.

The current prime rate of interest is also at a record high of 8.50 per cent. Since option converters usually charge 1.5 to 2.0 percentage points greater than the prime rate for conversions, the conversion expenses today are considerably greater than during the period of study. The implication of higher conversion costs is that writers would receive smaller premiums for puts or straddles than they would have received during the period studied. Or perhaps call option purchasers would have to pay greater prices for calls than during the period of study. Either the buyer or

writer or both parties must be adversely affected by greater conversion costs; thus, the returns accruing to one or both of the parties will be lower than those projected in the study.

E. Taxes: Taxes were not considered in developing the risk and return measures although the tax implications to option investors were discussed in Chapter 4. But even if one were willing to make the assumption that an investor can operate on a tax-free basis (eg., a charitable trust), a change in the Federal tax laws could affect the tax-free investor's returns in the option market. For example, if some of the inequities in the current laws were amended (eg., the accretion of ordinary income to the writer who suffers an economic loss on an option transaction), the premiums demanded by writers who do pay taxes might be smaller than at present. Or perhaps the tax laws might become even more stringent (eg., an increase in the capital gains tax rate) and thereby cause writers to demand higher premiums.

If changes in the tax laws were to cause changes in option prices, then even tax-free option investors would be affected. Thus, the indications of expected risks and returns to tax-free option investors presented here might not accurately reflect conditions holding under a new tax environment.

F. Government Regulations: At the present time

certain institutions are prohibited from either buying and/or selling options because of legal restrictions in some states.[1] These restrictions often apply because regulatory agencies view puts and calls as something akin to gambling. If the views of the regulatory agencies change (as could happen if The Chicago Board of Trade were to create a fresher atmosphere for option trading), new forces of supply and demand could enter the put and call market and alter the implications of the results presented in the study.

Other governmental agencies such as the Securities and Exchange Commission (which has the power, heretofore virtually unused, to regulate the put and call industry) could enact changes in rulings which would greatly alter the nature of the option business, thereby affecting the degree to which the findings of the study could be projected.

3. Implications

The major finding of the study is that option investing was not as worthy an investment for tax-free investors as simply purchasing stocks outright. All but two of the 54 option investing strategies analyzed were found to be significantly inferior to the two best stock purchasing

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[1]Sarin, loc. cit.

strategies. The two option strategies which were found not to be significantly inferior were none-the-less ranked below the top two stock strategies in terms of return-risk ratios.

The findings, however, do not rule out option investing completely as a means for improving portfolio performance. It is still possible that the inclusion of one or of several option strategies in an investor's portfolio might increase the return per unit of risk on the portfolio as a whole.

Furthermore, options might provide better returns per unit of risk if some of the extraneous factors discussed here become a reality. For example, suppose that The Chicago Board of Trade introduces an auction market in options. It might then be possible for an institutional investor to perform considerably better than this study indicates. First, in The Board of Trade market a call option writer would be able to keep all dividends on stocks that are called away, a factor which could increase returns by two to three percentage points per year.

Second, since institutions customarily purchase and sell stocks in large blocks, it is possible for them to achieve significant commission savings over those assumed in this study.

Third, the Chicago market would eliminate the necessity

of transferring stock every time an option was successful, thereby producing further commission savings. In addition, since options would rarely ever be exercised in The Board of Trade market, investors there (particularly writers) would receive more favorable tax treatment than they do currently.

Even without a Chicago market, an important change in the return-risk ratios found here could be achieved by a taxable investor. As noted in Chapter 4, there are several means of risking short-term losses against the prospect of producing long-term gains. There also exists methods of converting ordinary income into capital gains through the use of options. Thus, it is possible for the taxable investor to employ option strategies for which the return-risk ratio is considerably greater than those presented in this study, although the rate of return on investment will necessarily be lower.

In general, it is probably fair to conclude that most investors probably would not benefit from investing in options under the conditions set forth in the study. However, investors in high tax brackets might find option investing (particularly on the buy side) worthwhile. In addition, institutions which are sophisticated enough to employ new portfolio models might find that options could increase

their performance (ie., increase their portfolio's return per unit of risk). Furthermore, the advent of a Chicago Board of Trade market in options could conceivably make option investing more worthwhile for all investors.

4. The Need for Additional Research

This study does not analyze every aspect of potential risk and return on option investing. There are several areas of the option business which offer fruitful grounds for further research.

1. A study would be warranted on the effects created by an auction-type exchange in options such as that proposed by The Chicago Board of Trade.

2. A study on the potential of option investing to the institutional investor and of the impact of increased institutional activity in options would be timely.

3. An examination of the tax laws surrounding put and call investing should be made. The major purpose of the study would be to provide impetus for needed tax reform, or at the least, tax rule clarification for option investors.

4. The Securities and Exchange Commission, which has the power to regulate the option business, has not made a detailed study of the industry in the past ten years. This body should give consideration to another investigatory

effort similar to the one in 1959. The study should be directed squarely at the members of the Put and Call Brokers and Dealers Association in order to determine whether dealer's markups are unreasonably high or whether the members of the Association engage in price collusion.

5. It would be worthwhile to study the effects on optimal portfolios of combining options with more conventional investments such as common stocks. Using a computer, a Markowitz or Lintner-type portfolio model could be applied to the problem. The results of such a study could prove very useful particularly for the institutional investor.

5. Contributions of the Study

This research effort will help to fill a gap in the literature about put and call options. So little actual research has been done on options because of the inaccessibility of option data and because of a general lack of interest in the topic by most academicians.

Secondly, this study provides a guide to risk and return possibilities encountered in option investing. The knowledge could aid theorists in formulating hypotheses about put and call option valuation, as well as aiding option investors in determining optimal strategies of buying and selling puts and calls.

APPENDIX A

OPTION ACTIVITY FROM 1961 TO 1968

Table A-1

WEEKLY AVERAGE NUMBER OF STOCKS ON WHICH PUT AND CALL OPTION CONTRACTS WERE WRITTEN DURING 1961 TO 1968

Year	Average Weekly Number of Stocks with Option Activity
1961	317.77
1962	238.56
1963	233.13
1964	259.06
1965	321.29
1966	346.13
1967	504.85
1968*	580.59
Average	345.44

Source: Unpublished data supplied by the Division of Trading and Markets of the Securities and Exchange Commission, Washington, D. C. The S. E. C. collects the data from the Put and Call Brokers and Dealers Association, New York City.

*Data available only through November 1, 1968.

Table A-2

YEARLY VOLUME OF SHARES ON WHICH PUTS AND CALLS WERE WRITTEN 1961 TO 1968

Year	Total Shares Optioned	Total Puts Written	Total Calls Written	Ratio of Puts to Calls	Ratio of Option Volume to N.Y.S.E. Volume
1961	13,324.3*	4,774.9*	8,549.4*	.559	1.30
1962	7,840.5	2,681.5	5,159.0	.520	.82
1963	9,633.9	3,153.4	6,480.5	.487	.84
1964	11,231.7	3,496.8	7,734.9	.452	.90
1965	15,255.0	4,872.1	10,382.9	.470	.98
1966	15,188.3	4,736.4	10,451.9	.453	.80
1967	23,809.0	7,221.1	16,587.9	.436	.94
1968	30,284.1	8,181.3	22,102.8	.370	1.05

Source: Unpublished data supplied by the Division of Trading and Markets of the Securities and Exchange Commission, Washington, D.C.

*Number of shares in thousands.

APPENDIX B

F RATIO TESTS FOR SIGNIFICANCE OF DIFFERENCES IN VARIANCE OF THREE-MONTH AND OF SIX-MONTH PRICE MOVEMENTS AMONG VOLATILITY CLASSES

Table B-1

F RATIO TEST FOR SIGNIFICANCE OF DIFFERENCES IN VARIANCE OF THREE-MONTH PRICE MOVEMENTS AMONG VOLATILITY CLASSES*

Volatility Class	Mean**	Variance (S^2)	Standard Deviation
Low (L)	1.39	145.90	12.08
Medium (M)	5.72	478.47	21.08
High (H)	10.22	1480.82	38.48

Given Variance (S^2) as a proxy variable for volatility:

H_o: $S_L^2 = S_M^2 = S_H^2$ $\qquad$ H_1: $S_L^2 \neq S_M^2 \neq S_H^2$

where: N = 840 for all three classes
α = .05 (2-tail)
Degrees of Freedom = N_L-1 = N_M-1 = N_H-1 = 839
Significant F = 1.00

F Ratio $\frac{S_H^2}{S_L^2}$ = 10.17 > 1.00 $\therefore$ S_H^2 sig.> S_L^2 at α = .05

F Ratio $\frac{S_H^2}{S_M^2}$ = 3.10 > 1.00 $\therefore$ S_H^2 sig.> S_M^2 at α = .05

F Ratio $\frac{S_M^2}{S_L^2}$ = 3.28 > 1.00 $\therefore$ S_M^2 sig.> S_L^2 at α = .05

Hence, Variance (S^2), a proxy variable for Volatility, is significantly greater at the .05 level as the Volatility Class advances from Low, to Medium, to High.

*See Hays, op. cit. 351-355.

**The mean is the arithmetic average of all three-month duration price movements of the stocks within each volatility class over a seven-year period. The price movements are expressed in percentage changes. Thus the mean for the Low Class of 1.39 implies that on the average stocks within the class appreciated 1.39 per cent during 840 periods of three months each.

Table B-2

F RATIO TEST FOR SIGNIFICANCE OF DIFFERENCES IN VARIANCE OF SIX-MONTH PRICE MOVEMENTS AMONG VOLATILITY CLASSES

Volatility Class	Mean*	Variance (S^2)	Standard Deviation
Low (L)	2.76	303.57	17.42
Medium (M)	11.67	1134.70	33.68
High (H)	21.65	4219.73	64.96

Given Variance (S^2) as a proxy variable for volatility:

H_o: $S_L^2 = S_M^2 = S_H^2$ $\qquad$ H_1: $S_L^2 \neq S_M^2 \neq S_H^2$

where: N = 840 for all three classes
α = .05 (2-tail)
Degrees of Freedom = $N_L-1 = N_M-1 = N_H-1 = 839$
Significant F = 1.00

F Ratio $\frac{S_H^2}{S_L^2}$ = 13.91 > 1.00 $\therefore$ S_H^2 sig.> S_L^2 at α = .05

F Ratio $\frac{S_H^2}{S_M^2}$ = 3.72 > 1.00 $\therefore$ S_H^2 sig.> S_M^2 at α = .05

F Ratio $\frac{S_M^2}{S_L^2}$ = 3.74 > 1.00 $\therefore$ S_M^2 sig.> S_L^2 at α = .05

Hence, Variance (S^2), a proxy variable for Volatility, is significantly greater at the .05 level, as the Volatility Class advances from Low, to Medium, to High.

*See footnote in Table B-1. Six-month price changes are used here as opposed to Table B-1's three-month changes.

APPENDIX C

STOCK SAMPLE: 1961-68

Table C-1

STOCK SAMPLE: 1961-62

Stock	190-Day Straddle Premium[a]	Annualized Return[b]
Low Volatility Class:		
Coca-Cola Co.	12.5	-01
Ferro Corp.	14.5	-13
Ford Motor Co.	12.5	04
Inland Steel	13.5	-13
Jones & Laughlin	13.0	-19
Lorillard	14.5	-11
Magma Copper	14.5	17
U. S. Steel	11.5	-33
Westinghouse Electric	14.0	-18
Woolworth	13.5	-09
Average	13.4	-09.6
Medium Volatility Class:		
American Machine & Foundry	17.5	-39
American-South African	21.0	25
Bobbie Brooks	18.0	09
Douglas Aircraft	17.0	-19
General Time Corp.	20.0	-20
Martin-Marietta	16.5	-29
New York Central R. R.	19.0	-12
Pacific Petroleums Ltd.	17.5	-05
Raytheon Co.	16.0	-22
Universal Match	19.0	-45
Average	18.2	-15.7
High Volatility Class:		
Audio Devices	24.0	-50
Electronic Specialty	24.0	00
Gulf American Land	25.0	-05
Hecla Mining	23.5	00
Indiana General	24.0	-17
Lafayette Radio Electronics	23.0	-47
Liberty Fabrics N.Y.	24.0	18
Magnavox	23.0	13
Soss Manufacturing	23.0	69
Studebaker-Packard	24.0	-25
Average	23.8	-04.6

[a]190-day straddle premium to writers expressed as a per cent of the striking price (or cost of 100 shares of stock). The percentage premium reflects an approximate yearly average.

[b]Annualized return refers to the percentage rate of return on investment of having purchased the stock long in July, 1961, and holding it until December, 1962, with the results restated on an annual basis. All commissions, dividends, and stock splits are included in the calculations.

Table C-2

STOCK SAMPLE: 1962-63

Stock	190-Day Straddle Premium[a]	Annualized Return[b]
Low Volatility Class:		
American Telephone	09.5	13
Bethlehem Steel	14.0	-03
Consolidated Cigar	13.5	51
Ford Motor Co.	12.0	14
General Electric	13.0	24
General Motors	12.0	44
Pfizer, Charles & Co.	12.0	15
Royal Dutch Petroleum	10.0	22
Sears, Roebuck & Co.	12.5	34
U. S. Steel	13.0	16
Average	12.3	23.0
Medium Volatility Class:		
Columbia Pictures	18.0	22
Inspiration Consolidated Copper	17.0	-08
Litton Industries	18.0	43
McDonnell Aircraft	15.5	13
Metro-Goldwyn-Mayer	16.5	-10
Minn. Mining & Manufacturing	15.5	20
Polaroid	16.5	44
Sperry Rand	18.0	32
Universal Match	19.5	-17
Universal Oil Products	17.0	-09
Average	17.2	13.0
High Volatility Class:		
Astrex	29.0	-45
Barnes Engineering	24.0	31
Chromalloy	23.0	14
Collins Radio	23.0	-04
General Plywood	34.0	04
Haveg Industries	23.0	84
Molybdenum	23.0	-13
Rowland Products	28.0	-33
Syntex	24.0	586
Transitron Electronic	29.0	-40
Average	26.0	58.4

[a]See Table C-1.

[b]See Table C-1. Investment period is July, 1962 to December, 1963.

Table C-3

STOCK SAMPLE: 1963-64

Stock	190-Day Straddle Premium[a]	Annualized Return[b]
Low Volatility Class:		
American Cyanamid	12.5	16
American Tobacco	13.5	14
duPont (E.I.) de Nemours	10.0	29
Gillette	10.5	-10
International Business Machines	10.0	13
International Tel. & Tel.	12.0	15
Kerr-McGee Oil	13.5	13
Mack Trucks	14.0	00
Reynolds Tobacco	12.0	05
Texaco	09.5	22
Average	11.8	11.7
Medium Volatility Class:		
American Machine & Foundry	16.5	00
Chrysler	15.5	07
Diners Club	17.5	00
Eastern Airlines	17.0	54
Fairchild Camera	18.0	-14
Getty Oil	16.5	08
Rayette	21.0	-18
Stanley Warner	18.0	16
Sunshine Mining	21.5	91
Microwave Associates	20.5	-14
Average	18.2	13.0
High Volatility Class:		
Colorado Fuel & Iron	23.0	11
Data Control Systems	27.0	84
General Plywood	34.0	-50
National Video, A stock	25.0	15
Old Town	24.0	200
Rowland Products	25.0	00
Syntex	33.0	62
Talley Industries	25.0	-42
Technical Operations	25.0	-35
Victoreen Instruments	25.0	-32
Average	26.6	21.3

[a]See Table C-1

[b]See Table C-1. Investment period is July, 1963 to December, 1964.

Table C-4

STOCK SAMPLE: 1964-65

Stock	190-Day Straddle Premium[a]	Annualized Return[b]
Low Volatility Class:		
Aluminum Co. of America	12.5	10
Anaconda	14.0	65
Boeing Co.	13.5	97
El Paso Natural Gas	12.0	00
General Motors	09.5	12
General Tel. & Electronics	10.5	30
Southern Pacific R. R.	13.0	00
U. S. Steel	11.0	-07
Upjohn	11.5	33
Western Union Telegraph	12.5	42
Average	12.1	28.2
Medium Volatility Class:		
Bell & Howell	17.0	59
Certain-Teed Products	19.0	37
Chris-Craft Industries	19.5	37
Gibralter Financial	16.5	17
Metro-Goldwyn-Mayer	17.0	12
National Airlines	17.0	119
Northwest Airlines	16.5	84
Rayette	19.0	-28
Texas Gulf Sulphur	18.5	55
Vornado	17.0	90
Average	17.7	44.8
High Volatility Class:		
Alloys Unlimited	25.0	300
Computer Sciences	23.0	139
Heinicke Instruments	23.0	75
Kin-Ark Oil	25.0	-46
Packard-Bell Electronics	28.0	140
Papercraft	23.0	29
Planning Research	26.0	125
Rollins Broadcasting	23.0	118
Syntex	23.0	131
Technical Operations	23.0	70
Average	24.2	108.1

[a]See Table C-1

[b]See Table C-1. Investment period is July, 1964 to December, 1965.

Table C-5

STOCK SAMPLE: 1965-66

Stock	190-Day Straddle Premium[a]	Annualized Return[b]
Low Volatility Class:		
Aluminum Ltd.[c]	14.5	06
American Telephone	09.0	-10
Bethlehem Steel	12.5	-11
duPont (E. I.) de Nemours	11.0	-28
Eastman Kodak	11.0	36
Ford Motor Co.	12.5	-17
General Electric	10.0	-06
Radio Corp. of America	14.5	21
Royal Dutch Petroleum	11.0	-05
United Aircraft	14.5	37
Average	12.1	02.3
Medium Volatility Class:		
American Broadcasting	16.5	30
Avnet	19.5	31
City Investing	16.5	74
Chrysler	15.0	-19
Delta Airlines	21.0	142
General Instruments	19.0	105
Pennsylvania R. R.	17.5	20
Royal Crown Cola	19.0	05
Sperry Rand	19.5	85
Xtra	21.0	88
Average	18.5	56.1
High Volatility Class:		
Alloys Unlimited	24.5	187
Collins Radio	24.0	61
Conductron	29.5	109
Control Data	23.5	-05
National Video, A stock	32.0	48
Pyle National	23.0	-38
Sangamo Electric	23.5	39
S C M	27.5	172
Solitron Devices	25.0	238
Syntex	26.0	43
Average	25.9	85.4

[a]See Table C-1.

[b]See Table C-1. Investment period is July, 1965 to December, 1966.

[c]Name changed during the period to Alcan Aluminum.

Table C-6

STOCK SAMPLE: 1966-67

Stock	190-Day Straddle Premium[a]	Annualized Return[b]
Low Volatility Class:		
Coca-Cola Co.	13.5	53
General Motors	12.0	05
Homestake Mining	13.5	17
Jones & Laughlin	13.5	05
Monsanto	13.5	-18
Owens-Illinois Glass	10.5	-08
Sinclair Oil	11.0	13
Standard Oil of California	10.5	05
Standard Oil (Indiana)	12.0	11
Union Oil of California	12.0	04
Average	12.2	08.7
Medium Volatility Class:		
Bristol-Myers	15.0	36
Ampex	19.0	33
Calumet & Hecla	20.0	00
Eastern Airlines	18.5	-05
Emery Air Freight	20.5	08
Gulf & Western	19.0	86
Ling-Tempco-Vought	18.5	153
Martin-Marietta	17.0	02
White Consolidated	20.0	75
Xtra	21.0	75
Average	18.9	46.3
High Volatility Class:		
Diversified Metals	26.0	103
E G & G	24.0	219
Electronic Associates	24.0	24
First Charter Financial	24.0	67
Flying Tiger Line	24.0	26
Microwave Associates	24.0	106
Scientific Data Systems	23.0	123
S C M	23.0	-07
Silicon Transitor	26.0	-11
Sunasco	23.0	-38
Average	24.1	61.2

[a] See Table C-1.

[b] See Table C-1. Investment period is July, 1966 to December, 1967.

Table C-7

STOCK SAMPLE: 1967-68

Stock	190-Day Straddle Premium[a]	Annualized Return[b]
Low Volatility Class:		
American Telephone	10.0	06
Ford Motor Co.	12.5	06
General Motors	11.0	00
Homestake Mining	13.5	62
International Nickle	12.5	-02
Republic Steel	12.5	13
Reynolds Tobacco	13.5	08
U. S. Steel	12.0	-02
Western Union Telegraph	14.5	05
Westinghouse Electric	13.5	10
Average	12.6	10.6
Medium Volatility Class:		
Admiral	18.5	-12
American-South African	20.5	33
Avnet	20.0	45
Bobbie Brooks	19.0	18
Chrysler	16.0	15
Flintkote	19.0	16
Grumman Aircraft	16.5	-02
McDonnell Douglas	17.0	-06
K L M Royal Dutch Airlines	16.0	-19
White Consolidated	17.5	27
Average	18.0	11.5
High Volatility Class:		
American Motors	26.0	-08
Conductron	23.5	-22
Data Processing Fin. & Gen.	26.5	25
H & B American	27.0	16
Hydrometals	28.0	-18
Milgo	27.0	87
National Video, A stock	24.5	-40
Scurry-Rainbow Oil Ltd.	24.0	-18
Valley Metallurgical	28.0	-39
Zapata Off-Shore[c]	24.0	56
Average	25.9	03.9

[a] See Table C-1.

[b] See Table C-1. Investment period is July, 1967 to December, 1968.

[c] Name changed during the period to Zapata Norness Inc.

APPENDIX D

SUPPORTING EVIDENCE OF THE RELATIONSHIP AMONG VARIOUS TYPES OF OPTION PREMIUMS TO WRITERS

Chapter 2 contained an explanation of how all option premiums to writers were estimated once the 190-day straddle premium had been determined. Two sources of support for the techniques used in the study are shown in this section.

The first source is that of Dadekian,[1] who has prepared an evaluation of option bids. Dadekian's evaluation consists of rating option bids into percentiles, where the percentiles are a reflection of all option bids reviewed by him over a five-year period. Dadekian's ratings are all based upon premiums expressed in dollar amounts. Table D-1 shows Dadekian's dollar premiums convered into premiums expressed as a per cent of the striking price.[2]

The second source of support is that presented by the Securities and Exchange Commission. Tables D-2, D-3, and D-4 are reproductions of data that were taken from the S.E.C.'s 1961 Report.[3] The data provide evidence on the relationship among one another of various option premiums to writers.

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[1]Dadekian, op. cit., 98-103. Dadekian, an honor graduate of Massachusetts Institute of Technology, based his option evaluations on data collected during his five years of experience as a professional option writer.

[2]"Striking price" is used here as a convenient term for the cost of 100 shares of stock at the striking price. This author has converted Dadekian's dollar premiums.

[3]Securities and Exchange Commission, op. cit., 84, 86-87.

Table D-1

CONVERSION OF DADEKIAN'S EVALUATION OF OPTION BIDS INTO BIDS EXPRESSED AS A PER CENT OF THE STRIKING PRICE

Striking Price	Percentile**	Bids to Option Sellers*					
		190-Day Options			95-Day Options		
		Straddles	Puts	Calls	Straddles	Puts	Calls
10	25	26.0	10.0	16.0	18.0	07.0	11.0
	50	27.0	10.5	17.0	19.5	07.0	12.0
	75	28.0	11.0	18.0	20.5	08.0	12.5
20	25	21.0	08.0	13.0	15.0	05.5	09.5
	50	22.0	08.5	14.0	16.0	06.0	10.0
	75	24.0	09.0	15.0	17.0	06.5	11.0
30	25	17.5	06.5	11.0	13.0	05.0	08.5
	50	19.0	07.5	12.0	14.5	05.5	09.0
	75	21.0	08.0	13.0	16.0	06.0	10.0
40	25	16.0	05.5	10.5	12.5	05.0	08.0
	50	18.0	06.5	11.5	14.0	05.0	08.5
	75	19.5	07.5	12.5	15.0	06.0	09.0
50	25	15.5	06.0	10.0	12.0	05.0	07.5
	50	17.0	07.0	11.0	13.5	05.0	08.0
	75	19.0	07.5	12.0	14.5	05.5	09.0
60	25	15.5	06.0	09.5	12.0	04.5	07.5
	50	17.0	06.5	10.5	13.0	05.0	08.0
	75	19.0	07.5	11.5	14.5	05.5	09.0
70	25	15.5	06.0	09.5	11.5	04.5	07.5
	50	17.0	06.5	10.5	13.0	05.0	08.0
	75	19.0	07.5	11.5	14.5	05.5	08.5

Source: Dadekian, op. cit., 98-103.

*Premium bids to option writers are expressed as a per cent of the cost of 100 shares of stock at the striking price (conveniently the cost of 100 shares at the striking price is referred to here simply as "the striking price.").

**Bids for a stock with a given striking price are shown at three different percentile levels. The percentiles are based upon all the bids reviewed by Dadekian at each of the striking prices above.

Table D-2

RELATIVE SIZE OF AVERAGE PREMIUMS
ON OPTIONS OF VARIOUS DURATION*

Duration of Option	Average Premium on Six-Month Option = 100			
	All Options	Straddles	Puts	Calls
30 Days	49.5	51.0	48.7	46.6
60 Days	55.7	58.0	61.8	49.2
90 Days	68.7	70.4	63.9	68.3
6 Months	100.0	100.0	100.0	100.0
One Year	159.7	154.3	157.9	164.8

Source: Securities and Exchange Commission, op. cit., Table 29, p. 84.

*Average premiums received by writers during June, 1959 on market options on common stocks traded on the New York Stock or American Stock Exchanges. Premiums are expressed as a per cent of the average six-month premiums.

Table D-3

AVERAGE PREMIUMS ON THREE-MONTH AND SIX-MONTH OPTIONS CLASSIFIED BY PRICE OF STOCK OPTIONED*

Price Class	3-Month Options No. of Stocks	3-Month Options Average Premium	6-Month Options No. of Stocks	6-Month Options Average Premium
		a. Straddles		
Less than $10.00	4	$ 402	9	$ 244
$10.00 to $19.99	17	303	50	381
$20.00 to $29.99	36	350	41	514
$30.00 to $39.99	26	475	35	683
$40.00 to $49.99	13	506	22	739
$50.00 to $59.99	14	652	14	1,043
$60.00 to $79.99	13	784	18	1,161
$80.00 to $99.99	6	1,002	3	1,408
$100.00 and over	1	1,650	2	2,017
		b. Puts		
Less than $10.00	2	$ 103	13	$ 126
$10.00 to $19.99	5	138	34	186
$20.00 to $29.99	13	177	23	252
$30.00 to $39.99	9	279	20	329
$40.00 to $49.99	6	242	13	371
$50.00 to $59.99	7	386	5	498
$60.00 to $79.99	4	379	7	548
$80.00 to $99.99	2	325	3	694
$100.00 and over	1	1,053	2	1,167
		c. Calls		
Less than $10.00	0	-	5	$ 142
$10.00 to $19.99	10	$ 202	31	252
$20.00 to $29.99	18	236	30	333
$30.00 to $39.99	19	323	34	442
$40.00 to $49.99	7	357	18	533
$50.00 to $59.99	13	378	13	611
$60.00 to $79.99	9	548	13	791
$80.00 to $99.99	3	658	1	850
$100.00 and over	1	825	3	1,061

Source: Securities and Exchange Commission, op. cit., Table 30, p. 86.

*Average premiums received by writers during June, 1959 on market options on common stocks traded on the New York Stock or American Stock Exchanges.

Table D-4

AVERAGE PREMIUMS ON THREE-MONTH AND SIX-MONTH OPTIONS CLASSIFIED BY PRICE AND VOLATILITY OF STOCK OPTIONED*

Price Class	3-Month Options: Most Volatile Stocks No. of Stocks	3-Month Options: Most Volatile Stocks Average Premium	3-Month Options: Moderately Volatile Stocks No. of Stocks	3-Month Options: Moderately Volatile Stocks Average Premium	3-Month Options: Least Volatile Stocks No. of Stocks	3-Month Options: Least Volatile Stocks Average Premium	6-Month Options: Most Volatile Stocks No. of Stocks	6-Month Options: Most Volatile Stocks Average Premium	6-Month Options: Moderately Volatile Stocks No. of Stocks	6-Month Options: Moderately Volatile Stocks Average Premium	6-Month Options: Least Volatile Stocks No. of Stocks	6-Month Options: Least Volatile Stocks Average Premium
a. Straddles												
Less than $10.00	4	$ 402	0	-	0	-	6	$ 238	3	$ 258	0	-
$10.00 to $19.99	12	304	3	$ 327	2	$ 260	19	409	18	377	13	$ 342
$20.00 to $29.99	20	363	12	357	4	265	16	552	17	498	8	472
$30.00 to $39.99	8	538	7	497	11	415	11	701	12	707	12	643
$40.00 to $49.99	3	611	4	492	6	465	5	960	6	750	11	632
$50.00 to $59.99	7	665	5	648	2	612	7	1,198	3	908	4	872
$60.00 to $79.99	1	883	6	772	6	780	5	1,386	8	943	5	1,283
$80.00 to $99.99	3	1,085	1	1,075	2	842	1	1,850	0	-	2	1,188
$100.00 and over	0	-	0	-	1	1,650	1	2,633	0	-	1	1,400
b. Puts												
Less than $10.00	2	$ 103	0	-	0	-	7	$ 129	5	$ 130	1	$ 88
$10.00 to $19.99	1	150	2	$ 144	2	$ 125	22	203	10	155	2	162
$20.00 to $29.99	9	181	3	179	1	133	12	254	9	255	2	225
$30.00 to $39.99	3	259	5	302	1	225	10	384	5	294	5	253
$40.00 to $49.99	1	150	3	283	2	225	5	416	4	381	4	306
$50.00 to $59.99	3	479	3	338	1	250	3	542	1	515	1	350
$60.00 to $79.99	1	464	2	381	1	291	1	722	4	452	2	656
$80.00 to $99.99	0	-	0	-	2	325	1	850	0	-	2	616
$100.00 and over	1	1,053	0	-	0	-	1	1,500	0	-	1	833
c. Calls												
Less than $10.00	0	-	0	-	0	-	2	$ 167	1	$ 162	2	$ 106
$10.00 to $19.99	7	$ 208	2	$ 175	1	$ 212	16	284	13	229	2	150
$20.00 to $29.99	11	233	6	244	1	225	11	340	13	329	6	330
$30.00 to $39.99	6	323	8	326	5	319	12	478	11	432	11	413
$40.00 to $49.99	2	412	1	400	4	319	5	598	2	503	3	475
$50.00 to $59.99	2	367	6	413	2	306	6	673	2	430	2	400
$60.00 to $79.99	3	654	3	412	3	578	4	876	4	763	5	744
$80.00 to $99.99	2	700	0	-	1	575	0	-	0	-	1	550
$100.00 and over	0	-	0	-	1	825	1	1,320	0	-	2	681

Source: Securities and Exchange Commission, op. cit., Table 31, p. 87.

*Average premiums received by writers during June 1959 on market options on common stocks traded on the New York Stock or American Stock Exchanges.

APPENDIX E

OPTION DEALERS' MARKUPS

Table E-1

DISTRIBUTION OF DOLLAR MARK-UPS AND PREMIUMS RECEIVED BY PUT AND CALL BROKERS AND DEALERS ON CALLS BOUGHT AND SOLD ON SAME DAY*

June 1959

Amount of Mark-up	Amount of Premium**										
	Less than $200	$200 - $299	$300 - $399	$400 - $499	$500 - $599	$600 - $699	$700 - $799	$800 - $899	$900 - $999	$1,000 and over	Total
	[Volume of calls sold (shares)]										
$12.50 or less	11,300	5,100	5,900	2,500	2,100	1,000	600	400	200	700	29,800***
$12.51 to $25.00	4,700	10,600	7,800	5,500	2,100	600	300	400	400	100	32,500
$25.01 to $37.50	5,000	7,300	12,200	6,600	5,000	1,500	400	200	800	400	39,400
$37.51 to $50.00	2,700	6,500	13,400	8,800	5,200	1,000	1,600	600	400	300	40,500
$50.01 to $62.50	800	7,100	8,300	5,800	2,800	1,600	700	1,600	1,400	100	30,200
$62.51 to $75.00	300	3,800	5,000	3,700	3,100	1,600	1,600	0	0	500	19,600
$75.01 to $87.50	0	2,700	3,600	3,000	1,300	1,200	900	1,400	800	1,000	15,900
$87.51 to $100.00	0	1,000	2,700	3,900	1,300	200	1,000	600	700	1,000	12,400
$100.01 to $125.00	0	400	2,200	2,600	800	1,700	2,100	2,200	500	600	13,100
$125.01 to $150.00	0	800	600	1,500	1,600	900	1,300	900	400	1,300	9,300
Over $150.00	0	0	0	1,300	800	1,000	500	800	1,300	1,900	7,600
Total	24,800	45,300	61,700	45,200	26,100	12,300	11,000	9,100	6,900	7,900	250,300

Source: Securities and Exchange Commission, op. cit., Table 32, p. 90.

*Excluding calls sold to other put and call dealers and calls on which profits could not be computed.

**Premiums received by put and call brokers and dealers after payment of taxes but before deducting commissions paid to option buyers' brokers.

***Includes calls for 1,500 shares sold at no profit and calls for 3,400 shares sold at a loss.

Table E-2

PERCENT MARKUP BY PUT AND CALL BROKERS AND DEALERS ON CALLS BOUGHT AND SOLD ON SAME DAY*

June, 1959

Percent Markup	Volume of Calls Sold	
	No. of Shares	Percent of Total
Less than 5.0	28,800**	11.5
5.0 to 9.9	51,400	20.5
10.0 to 14.9	57,300	22.9
15.0 to 19.9	36,300	14.5
20.0 to 24.9	23,600	9.4
25.0 to 29.9	17,300	6.9
30.0 to 34.9	12,100	4.8
35.0 to 39.9	8,500	3.4
40.0 to 44.9	4,900	2.0
45.0 to 49.9	2,400	1.0
50.0 and over	7,700	3.1
Total	250,300	100.0

Source: Securities and Exchange Commission, op. cit., Table 33, p. 92.

*Excluding calls sold to other put and call dealers and calls on which profits could not be computed.

**Includes calls for 1,500 shares sold at no profit and calls for 3,400 shares sold at a loss.

Table E-3

NET PROFIT OF PUT AND CALL BROKERS AND DEALERS
ON OPTIONS BOUGHT AND SOLD ON SAME DAY*

June, 1959

	Put and Call Broker/Dealers	Put and Call Brokers	All Firms
Volume of Options Sold (Shares)	189,800	115,100	304,900
Net Receipts from Sale** of Options	$816,536	$491,374	$1,307,910
Less: Total Cost of Options***	693,694	445,520	1,139,214
Net Profit	$122,842	$ 45,854	$ 168,696
Ratio of Net Profit to Total Cost	17.7%	10.3%	14.8%

Source: Securities and Exchange Commission, op. cit., Table 34, p. 93.

*Excluding 30,700 shares covered by options which were purchased as straddles, strips or straps and entire transaction was not completed the same day or for which profits could not be computed for other reasons.

**After payment of taxes and commissions.

***Excluding taxes.

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