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RATES OF RETURN TO OPTION WRITERS ON DOW JONES INDUSTRIAL STOCKS, 1961-1971

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I. Introduction

AN EXCHANGE MARKET FOR SECURITIES OPTIONS has been developed by the Chicago Board of Trade and trading in these securities began on April 26, 1973.[1] The literature to date is contradictory on the nature and usefulness of these instruments.[2] This paper presents data on the rates of return to option writers on the 30 Dow Jones Industrial stocks, showing how much gain or loss an option writer might have realized on these 30 well known stocks over a ten year period of rising and falling prices.

We consider here the simple strategies of buying a Dow Jones stock and simultaneously selling a call, a put, or a straddle on the stock for a continuous ten year period. These simple strategies are potential primal elements of an investor's portfolio just as individual securities are potential primal elements. This paper is concerned with the characteristics of these isolated simple strategies and specifically with their *ex post* rates of return. Further research will be required to determine "optimal" portfolios consisting of these and more complex option-oriented strategies with other securities.

Note: Tables 1–6 are on pages 276 to 285.

II. The Data

The universe of stocks for this study consisted of the 30 Dow Jones Industrials for the time period February 1, 1961 to February 1, 1971. Closing prices for every February 1st and August 1st (or the first trading day thereafter if the Exchange was closed) for these years were used as the data base.

In addition to the assumed premiums, Table 1 shows the average six-month return on each stock, the standard deviation of this return, and the expected or actuarial value of the call.[3]

The following results are calculated on a portfolio-to-portfolio basis, i.e., the investor starts and ends an investment period holding the same stock. All transaction costs, based on the round lot rates that prevailed during this period, were accounted for, as were all cash dividends. (When a cash dividend is declared, the striking price of the option is reduced by the amount of the dividend.) If at the end of an option period, the stock price exceeded the striking price by more than 1%, it was assumed that calls were exercised; if the stock price was more than 1% below the striking price, it was assumed that puts were exercised.

The assumed premiums that the writer received for each of the 30 stocks under study, as a fraction of the starting stock price, were estimated by examining the Securities and Exchange Commission's Weekly Reports from the Put and Call Brokers and Dealers Association and from advertised option price in the *New York Times*. It was assumed that this percentage remained constant during the entire period. The option market is often "thin" and the writer cannot always sell options on the stock he wishes to for the premium that he wants. In practice, if strong demand existed at any time period for these options, the option writer could probably have received premiums greater than assumed here; in periods of little demand, he would have received less, if indeed, he was able to sell options at all. From personal experience and discussion with various practitioners, the estimated premiums used in this study (see Table 1) were judged "reasonable" in that, if demand for these options existed at the start of each period,

these premiums, on average, would have been received by a writer. In its first six months of activity, the Chicago Board Options Exchange has exhibited a premium structure that far exceeds those assumed here.

The investment of a call writer was assumed to be the cash price of the stock plus transaction costs *less* the premium received. Thus if stock can be purchased for a total cost of $10,000 and a premium for writing a call on the stock amounts to $1,000, the call writer's investment is $9,000. Actually, the writer could have used varying amounts of margin during this period and, of course, his investment results would have been different from those reported here. The amount of margin used is part of the portfolio problem, since varying amounts of debt imply an investment with varying characteristics. No portfolio considerations are made in this paper—only "cash" investors are considered.

The investment for the writer of a put is calculated in a similar manner. However, it was assumed that the put writer neither bought stock nor sold stock short; he simply put up cash as collateral equal to the initial market value of the stock under option. His net investment was this amount less the premium received. The cash collateral was assumed to earn interest at the rate of 4% per annum for the option period. Again, by using margin, the put writer could have reduced the size of his investment (to a minimum of 25% of the striking price of the optional stock less the premium received).

Under certain circumstances, the writer of a put who receives interest on the premium plus the cash collateral should experience the same rate of return as the writer of a call who purchases the underlying stock.[4] These conditions require that the difference between the put and call premiums be equal to the interest on a riskless asset (say Treasury bills) and that transaction costs be zero. In this paper, the riskless return was assumed a constant 4% per annum, and the difference between the put and call premium averaged about 5% for six months, reflecting the fact that conversion costs usually exceed the riskless rate of interest. This difference, plus the inclusion of transaction costs, leads these two strategies to have different outcomes.

The investment for a writer of a straddle (i.e., a put *and* a call with the same striking price) was assumed to be the total cost of the stock under call less the premium received for the straddle. The straddle writer was also assumed to have purchased the stock under call.

III. The Results

Assume an investor owned 100 shares of Aluminum Company of America on February 1, 1961, when the price was $75 per share. If he then wrote a 6-month call on that date for a 10% premium ($750 per 100 shares) and subsequently wrote a new 6-month call at the end of every 6-month period for the next 10 years, receiving a premium of 10% of the market price each time and repurchasing stock when it was called away from him, he would have had the experience detailed in Table 2. If he reinvested all dividends and income earned from expired options (assuming transaction costs at the round lot rate), the value of his holdings on February 1, 1971 became 2.3921 times his starting value. If he withdrew all dividends and income as they were earned, his ending value became .4165 times his starting value. Table 2 details the period-by-period progress of a call writer versus the experience of the common stockholder. The *stockholder* who withdrew his dividends earned 2.2% per annum, on average, as income. The *writer* who withdrew all earnings, earned 16.9% per annum, on average, as income.[5] (These last two statistics do not include capital changes.)

These statistics, using the assumed premiums of Table 1, were calculated for each of the 30 Dow Industrial stocks. The "average" of these stocks is detailed in Table 3 where it was assumed that an equal dollar amount was invested in each security at the start of *every* period. (The statistics were also calculated by assuming an equal dollar amount was invested in each of the stocks only at the start of the 10 year period and the investments were then allowed to accumulate. The difference between this latter calculation and Table 3 was negligible. For example, the option writer who reinvested all income each period, ended the 10 year period with a price relative of 2.8140 as opposed to the 2.8166 of Table 3.)

For this "average" Dow Industrial stock, the premium received was 10% per period, the average six month return on the stock was 3.2%, the standard deviation was 9.5%, and the expected call value was 7.6%. (Note that the standard deviation of return on this "average" stock is *not* the average of the individual standard deviations of Table 1.) The average annual income on this stock was 3.77% and the average annual income for the writer on this stock who withdrew income as it was earned, was 14.3%, exclusive of capital changes.

Table 4 is a matrix of annualized returns for an option writer who reinvested all income on the "average" Dow Industrial stock for all starting and ending periods. The returns in parentheses are the annualized rates for the stockholder of the "average" Dow stock who reinvested all income. (The annualized rate of return was calculated as $(1+r)^{1/N}-1$, where r is the return experienced in a particular period and N is the number of years of that period.)

No consideration was made for income taxes in any of the results reported here. It may be noted that the capital gains tax paid by the writer would approximate the tax paid by the investor who owned the stock throughout and sold it at the end of the 10 year period. And, of course, the cumulative performance of the writer who reinvested all his income, if he were subject to income tax, would have been less than that indicated here (as it would have been for the owner of the stock who reinvested dividends).

Tables 5 and 6 are matrices of total rates of return for writers of puts and straddles, respectively, on the average Dow Industrial stock, assuming reinvestment of all income during this period.

IV. Conclusions

One of the striking results is that in the ten year period under study the average premium received by the seller of calls exceeded the actuarial value of the call in 24 of the 30 stocks. Thus, on the criterion of expected value, his better alternative was almost always the purchase of the common stock. The option buyer, on

average, experienced a negative return on these options over this time period.

This does not imply irrationality on the part of the option buyer, nor does it necessarily imply a fondness for risk. The option buyer may well have been a risk-averter, since the option may have had a substantial negative covariance with the other components in his portfolio. (For example, the owner of a call may simultaneously be short the stock.) Whatever the motivations and risk-attitudes, premiums paid on these high quality stocks were high relative to expected values.

This premium structure had favorable implications for the seller of calls: Table 4 indicates that in the preponderant number of cases the call writer who simultaneously purchased stock would have earned more than the investor who only purchased stock. The most notable exception was for the period starting near the stock market low of August 1962 and ending before August 1966. For any other period of two years or more (necessarily starting prior to April 1969), the call writer's return exceeded that of the investor who merely bought and held the "average" stock.

The put writer did not do as well as the call writer or the buyer of the stock. Table 5 shows that for the preponderant number of time periods the buyer of the stock outperformed the writer of puts.

The straddle writer (who simultaneously purchased common stock) outperformed the call writer, the put writer, and the buyer of the common stock in the great majority of cases. In only 15 out of the possible 210 investment periods (corresponding to the cells in the matrix of Table 6) did buying stock prove superior to writing straddles. The premium assumed for the straddle writer was calculated on the basis of 5% conversion costs; e.g., if the premium for the call was y% of the striking price, the premium for the put was (y-5)%. This differs slightly from the assumed put premium used to calculate returns for the put writer. See Table 1, Columns 1, 2, and 3.

The rates of return calculated in Tables 4, 5, and 6 are compound annualized rates. To judge performance on the ranking of

these rates implies a logarithmic utility function.[6] Table 7 presents the statistics for investors with quadratic utility functions interested in the mean and standard deviation of each of these strategies.

TABLE 7 - ANNUAL RATES OF RETURN FOR VARIOUS STRATEGIES

Strategy	Compound Rate	Average Rate	Standard Deviation
Buy and Hold DJI	7.5	8.3	12.6
Buy DJI Sell calls	10.9	11.1	7.1
Buy DJI Sell straddles	11.0	12.2	15.6
Sell puts	4.3	4.6	7.6

The highest average rate of return was achieved with the straddle strategy, which also had the highest standard deviation of return. For only a small reduction in average return, a dramatic fall in standard deviation was achieved by the call strategy. In fact, regardless of an investor's utility function in mean-variance space, the call strategy dominated the buy and hold strategy; it had *higher* average return and *lower* standard deviation.

If the decade under study is representative, and if the premium structure used in this study persists, it seems clear that the use of options will prove advantageous to many investors. In particular, those portfolios constrained to hold quality blue chip stocks similar to the Dow Jones Industrials (e.g., institutional funds subject to "prudent man" considerations)[7], will almost certainly improve their investment performance by the simultaneous sale of calls on

a portion of their portfolio. And, with the advent of the new option exchange, their ability to execute transactions should be greatly facilitated.

1. See Joseph W. Sullivan, "Are Put and Call Options a Valid Investment Medium?" *The Wall Street Transcript*, XXXII, No. 12 (June 21, 1971): 24 and 543-545.

2. For example, Richard J. Kruizenga, "Introduction to the Option Contract" and "Profit Returns From Puts and Calls," in Paul H. Cootner, ed., *The Random Character of Stock Market Prices*, Chapters 17 and 18 (Cambridge: MIT Press, 1964) found option *buying* mildly profitable for a changing universe of stocks during the period of 1948-1956. On the other hand, A. James Boness, "Some Evidence of the Profitability of Trading in Put and Call Options," *ibid.*, Chapter 20, for a different set of stocks and a different period (1958-1960) found option buying extremely unfavorable. Burton G. Malkiel and Richard F. Quandt, *Strategies and Rational Decisions in the Securities Options Market* (Cambridge: MIT Press, 1969), found that option buying and selling maximized various utility functions. They assume almost exclusively the LaPlace Criterion, i.e., a rectangular distribution of future stock price.

3. The expected value of an option is determined by the underlying stock's future probability distribution. For example, if there is a fifty-fifty chance that the stock will be either 10% higher or 10% lower six months from now, then there is a fifty-fifty chance that the option will be worth 10% of the present price of the common or zero, yielding an expected value for the option of 5%. Unfortunately, the future distribution for a stock is not known with certainty. In this paper we use the past distribution of prices as a proxy for future distribution. It should be noted that the expected value of an option is not necessarily the price that would prevail even if all investors were agreed as to the future distribution. An investor who purchased (or sold) an option at its expected value repeatedly would in the long run experience neither a gain or loss. But the repeated purchaser of the common might experience an average gain. If all investors were risk neutral, guided only by expected gain, the equilibrium price, or "fair falue," for an option would have to be discounted by the expected gain in the stock. Thus if the common is expected to return 5% in six months, the fair value of an option would be its expected value divided by 1.05.

4. Compare this with Hans R. Stoll, "The Relationship Between Put and Call Option Prices," *Journal of Finance*, XXIV, No. 5 (December, 1969), p. 806, equation (6).

5. When an option expires unexercised, the premium that the writer re-

ceives is treated as ordinary income, not as capital gain, by the Internal Revenue Service.

6. See, e.g., Paul A. Samuelson, "Lifetime Portfolio Selection by Dynamic Stochastic Programming," *Review of Economics and Statistics,* (August, 1969), pp. 239-246.

7. For an excellent discussion of these possibilities see Walter C. Barton, *Writing Puts and Calls As An Investment for Trusts,* unpublished manuscript, The National Graduate Trust School, Northwestern University, Evanston, Illinois, August 1971. For a superb theoretical analysis see "The Theory of Rational Option Pricing," by R. L. Merton, *The Bell Journal of Economics and Management Science,* Spring 1973; this article might well have been subtitled "The Limits of Rationality." The references cited are extensive.

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