

## **HISTORICAL RETURN DISTRIBUTIONS FOR CALLS, PUTS, AND COVERED CALLS**

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### **Abstract**

Historical return distributions are useful for assessing the risks and potential rewards associated with investing in different financial instruments. While an abundance of such information exists for stocks and bonds, historical return information for common option strategies is limited and often difficult to interpret as presented. This paper attempts to fill this void by providing historical return distributions for calls, puts, and covered calls in an easily interpretable format. The information provided should prove useful to prospective investors as well as in a pedagogical setting.

### **INTRODUCTION**

Historical return distributions provide valuable insights into the rewards and risks associated with financial securities. Information on stocks, bonds, and bills provided by Ibbotson and Sinquefeld [2] is discussed in nearly every investments text and is also commonly referenced in practitioner-oriented, investment articles. Similar information for basic option strategies is near non-existent in both general investment texts and derivative oriented texts as well. Though numerous studies calculate and assess historical returns on options, the findings are rarely presented in a fashion that facilitates their interpretation or use in a pedagogical setting. This paper attempts to fill this void by providing historical return results for both call options, put options, and covered call options in an easily interpretable format.

The typical textbook approach for explaining the risks and rewards associated with investing in options is to use profit and loss graphs which illustrate the dollar loss or gain at maturity for different assumed ending stock prices. While such an approach is informative, it reveals little about actual results. By supplementing profit and loss graphs with actual return distributions, students and prospective investors can gain a better appreciation of the risk and rewards associated with investments in options.

### **DATA AND METHODOLOGY**

The options data utilized in the study are obtained from the Resorted Berkeley Options data base and include the recorded bid and ask prices for all options listed on the Chicago Board and Options Exchange (CBOE) between 1/1/86 and 12/31/89. The time period is limited to the data available to the authors. Price and dividend information required for the underlying stocks is obtained from the CRSP tapes.

The options strategies for which historical return distributions are generated include purchased call options, purchased put options, and covered call options. In each case, distributions are provided for in-the-money (ITM), at-the-money (ATM), and out-of-the-money (OTM) options. Designation as ITM, ATM, or OTM is based on the stock price to exercise price ratio ( $S/X$ ) at the time the option position is taken. The ranges in  $S/X$  used to classify both call options and put options is as follows:

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	Call Options	Put Options
<b>OTM</b>	$.80 \leq S/X < .95$	$1.05 < S/X \leq 1.20$
<b>ATM</b>	$.95 \leq S/X \leq 1.05$	$.95 \leq S/X \leq 1.05$
<b>ITM</b>	$1.05 < S/X \leq 1.20$	$.80 \leq S/X < .95$

Twelve week holding period return distributions are provided for each strategy. The specific screening criteria utilized in generating each sample is as follows. Beginning on the fourth Friday in January, 1986, the Berkeley Options data base is screened for all relevant options that expire in twelve weeks in April, 1986. Next, the fourth Friday in February is screened for all options expiring twelve weeks later in May, with options written on stocks included in the January sample excluded. The fourth Friday in March is then screened for options expiring in twelve weeks in the month of June with options written on stocks included in either the January or February samples excluded from consideration. Then the fourth Friday in April is screened for options expiring in twelve weeks in July with options written on stocks in either the February or March sample excluded from consideration, but those in the January sample included once again. This procedure ensures that there is never more than one option position on a single stock at any point in time. This process is continued through the entire time period for which data is available.

The options database contains records of all trades and bid/ask quotes sorted by ticker symbol and chronological order. All options are assumed to be purchased at the ask price and sold at the bid price. This procedure produces somewhat conservative return results because a significant amount of transactions actually occur within the spread. Quotes that occur between 10:00 a.m. and 3:30 p.m. EST are utilized for purposes of calculating returns. Omitting the last half-hour of trading on each Friday reduces the likelihood of obtaining fictitious prices, as discussed in Cox and Rubenstein [1]. The first available bid/ask quote on every option is the one utilized in the return calculations.

The holding period returns (HPRs) for purchased call options are calculated as follows:

Equation 1

$$HPR_i = [C_{1b} - C_{0a}] / C_{0a}$$

where,

$C_{0a}$  = call option ask price at purchase date

$C_{1b}$  = call option bid price at expiration date

Similarly, for purchased put options,

Equation 2

$$HPR_i = [P_{1b} - P_{0a}] / P_{0a}$$

where,

$P_{0a}$  = put option ask price at purchase date

$P_{1b}$  = put option bid price at expiration date

Covered calls consist of a long position in the stock and a short position in a call option written on the same stock. The HPR for the covered call position is calculated by buying the stock and writing the call option at the bid price when the position is opened, and the position is terminated by selling the stock on the option's expiration date. If the stock price is less than the exercise price on that date, the HPR is calculated using the actual stock price, and if the stock price exceeds the exercise price then the stock is assumed to be sold at the exercise price. In equation form:

Equation 3

$$HPR_i = [S_1 - (S_0 - C_{0b}) + D] / [S_0 - C_{0b}]$$

where,

- $S_0$  = stock price on purchase date  
 $S_1$  = stock price on option's expiration date (or exercise price if stock price exceeds the exercise price)  
 $S_0 - C_{ob}$  = initial investment

Descriptive statistics reported for each sample include the mean HPR, the standard deviation, the coefficient of skewness, mean returns by decile, minimum and maximum returns, and relative frequency histograms. Results are presented for each year (classified by the year in which the option position originates) as well as the entire four year period covered by the study. Return results for the underlying stocks over the period the option positions are maintained are also provided to enable relevant comparisons to be drawn.

## EMPIRICAL RESULTS

Since options are derivative securities, it is essential that option returns be interpreted in light of the market environment that existed over the period for which returns are generated. Table 1 provides overlapping twelve week holding period returns for the S&P 500 Index that correspond to the twelve week periods used in calculating the option returns. With the exception of the three twelve week periods that include the market crash of October 1987, the market was generally up over the 1986-1989 period. The twelve week HPRs range from a low of minus 26.6 percent for the period beginning on the fourth Friday in August 1987, to a high of 19.0 percent for the period beginning on the fourth Friday in January 1986. Of the 45 twelve week periods considered, ten are characterized by negative returns while thirty-five had positive returns. The annual returns on the S&P 500 Index for the 1986 to 1989 period in chronological order are 31.1 percent, 18.5 percent, 5.7 percent, and 20.4 percent, respectively.

**TABLE 1**  
**12-Week Holding Period Returns on the S&P 500 Index (%) that Correspond to the Holding Periods Over Which Option Returns are Calculated (1986-1989) and the Average of the 12-Week HPRs for each Year:**

Month	1986	1987	1988	1989
<b>Jan</b>	19.0	6.2	2.7	6.3
<b>Feb</b>	5.1	2.0	-4.9	9.1
<b>Mar</b>	3.2	1.5	2.1	9.6
<b>Apr</b>	-2.8	8.1	2.4	9.4
<b>May</b>	1.3	14.2	2.8	8.3
<b>Jun</b>	-6.9	2.7	-0.3	6.4
<b>Jul</b>	0.0	-18.2	5.5	1.2
<b>Aug</b>	-6.2	-26.6	1.0	-1.2
<b>Sep</b>	4.8	-22.2	3.1	-0.7
<b>Oct</b>	11.2	4.0	1.8	–
<b>Nov</b>	14.7	6.2	9.4	–
<b>Dec</b>	18.6	6.1	7.0	–
<b>Average</b>	5.2	-1.7	2.7	5.4

### Call Options

Summary statistics for the returns on purchased call options are provided in Table 2, and corresponding results for the underlying stocks are presented in Table 3. For the total period, the mean 12-week HPRs returns are 6.4 percent for the ITM calls, 10.6 percent for the ATM calls, and 5.6 percent for the OTM calls. On a year-by-year

basis, the highest returns occur during the strong bull market of 1986 with mean returns of 23.2 percent, 48.7 percent, and 95.4 percent, for the ITM, ATM, and OTM samples, respectively. As expected, call options perform the worst during 1987 where the ITM, ATM, and OTM samples are characterized by mean returns of minus 8.7 percent, minus 12.6 percent, and minus 26.8 percent, respectively. To ascertain the impact of the market crash of October, 1987, results for 1987 are further broken down into “bad” and “good” months with the bad months including the HPRs that include the crash period (option positions that originate in July, August, and September of 1987). For the bad months, the mean HPRs range from minus 53.9 percent for the ITM calls to minus 65.1 percent for the OTM calls. The results in Table 3 indicate that the mean 12 week return for the underlying stocks for the entire period is close to 4 percent for each sample. As alluded to above, the highest mean returns for the stocks occur in 1986 and the lowest mean returns occur in 1987.

The variability in the HPRs of call options is extremely high for all samples. Minimum returns are truncated at minus 100 percent while maximum returns are 479 percent for the ITM calls, 964 percent for the ATM calls, and 3,157 percent for the OTM calls. The standard deviation of HPRs are 86.3 percent, 147.7 percent and 268.3 percent for the ITM, ATM, and OTM samples, respectively. In contrast the standard deviation of the HPRs for the underlying stocks is close to 15 percent for each sample. The HPRs for each call option sample exhibit positive skewness with the degree of skewness being highest for OTM options and least for the ITM options. This is attributable to the small investment base required for OTM options and thus the potential for extremely high returns on a few options.

Table 4 presents the mean HPRs by decile for the ITM, ATM, and the OTM samples. These results clearly indicate the high probability that call purchases will result in a loss. In fact, over 28 percent of the ATM calls resulted in a 100 percent loss while over 55 percent of the OTM calls resulted in a 100 percent loss. From the breakdown by deciles, it is obvious that the overall positive mean HPRs for each sample are primarily driven by large returns on a relatively small portion of the sample. Figure 1 provides relative frequencies of the HPRs for each sample.<sup>1</sup> These graphs also illustrate the high probability of suffering losses when purchasing call options, especially if the options are at-the-money or out-of-the-money at the time of purchase. The increasing degree of positive skewness in the return distributions as one moves from the ITM options to the OTM options is also readily apparent from the graphs. Once again, it is important to remember that these results are generated during a period over which the market was generally quite bullish.

## Put Options

HPRs and descriptive statistics associated with purchased put options for the entire period and on a year-by-year basis are provided in Table 5, and the results for the underlying stocks are presented in Table 6. The period studied is not a good one for put options as the mean HPRs are minus 24.7 percent, minus 27.9 percent, and minus 27.1 percent for the ITM, ATM, and OTM samples, respectively. On an annual basis, the mean HPRs are lower than minus 20 percent for all samples in 1986, 1988, and 1989. The only year in which the mean HPR for puts is positive is 1987, and then only for the ATM and OTM samples. The mean HPRs for puts during the periods that include the October 1987 crash (labeled “bad” in Table 5) are quite high as expected, ranging from nearly 57 percent for the ITM puts to nearly 374 percent for the ATM puts.

The variability in the HPRs for put options is similar to that found for call options. Returns range from a low of minus 100 percent for each sample to highs of 387 percent, 1,115 percent and 4,033 percent for the ITM, ATM, and OTM samples, respectively. The standard deviations of HPRs are comparable to those for the call options with values of 104.3 percent for the ITM puts, 145.7 percent for the ATM puts, and 291.6 percent for the OTM puts. The standard deviation of HPRs for the underlying stocks is, as for the call options, approximately 15 percent for each sample. Positive skewness is also characteristic of HPRs for put options, and the degree of skewness increases substantially as we move from ITM puts to OTM puts.

A breakdown of the HPRs for each sample by decile provided in Table 7 and the relative frequency graphs provided in Figure 2 provide further confirmation of the poor performance of put options over the period studied.<sup>2</sup> Approximately 20 percent of the ITM puts, 48 percent of the ATM puts, and 75 percent of the OTM puts result in 100 percent losses. With respect to mean HPRs by decile, there are only six deciles across the three samples (deciles 8, 9, and 10 for the ITM puts, deciles 8 and 9 for the ATM puts, and decile 10 for the OTM puts) with positive means. Figure 2 clearly reveals the positive skewness in the distributions of HPRs for puts and how the skewness increases in moving from ITM puts to OTM puts.

**TABLE 2**  
**Call Option Summary Statistics, 1986-1989: Number of Observations,**  
**Mean 12-Week HPRs (%), Standard Deviation of HPRs (%),**  
**Minimum and Maximum HPRs (%), and Coefficient of Skewness**

**In-the-Money Call Options**

	<b>N</b>	<b>Mean</b>	<b>SD</b>	<b>Min</b>	<b>Max</b>	<b>Skewness</b>
Total	2196	6.4	86.3	-100.0	479.2	1.10
1986	573	23.2	104.6	-100.0	479.2	1.00
1987	548	-8.7	81.2	-100.0	305.0	0.75
bad	194	-53.9	68.5	-100.0	305.0	2.12
good	354	16.0	76.8	-100.0	294.0	0.44
1988	605	0.6	70.0	-100.0	460.0	1.11
1989	470	11.0	82.8	-100.0	443.1	1.13

**At-the-Money Call Options**

	<b>N</b>	<b>Mean</b>	<b>SD</b>	<b>Min</b>	<b>Max</b>	<b>Skewness</b>
Total	2149	10.6	147.8	-100.0	964.0	1.99
1986	556	48.7	192.1	-100.0	931.2	1.60
1987	545	-12.6	118.8	-100.0	470.1	1.51
bad	194	-64.0	86.5	-100.0	412.0	3.33
good	351	15.6	124.7	-100.0	470.1	1.09
1988	565	-10.8	111.2	-100.0	964.0	2.42
1989	483	17.7	146.6	-100.0	823.1	1.76

**Out-of-the-Money Call Options**

	<b>N</b>	<b>Mean</b>	<b>SD</b>	<b>Min</b>	<b>Max</b>	<b>Skewness</b>
Total	2187	5.6	268.3	-100.0	3,157.1	4.61
1986	554	95.4	394.6	-100.0	2,677.8	2.86
1987	577	-26.8	162.0	-100.0	1,214.3	3.22
bad	215	-65.1	126.4	-100.0	933.3	5.16
good	362	-4.0	176.2	-100.0	1,214.3	2.69
1988	634	-40.1	191.2	-100.0	3,157.1	9.54
1989	422	0.6	251.2	-100.0	2,200.0	3.40

## Covered Calls

Descriptive statistics for covered calls (CCs), the underlying stocks, and the differences between HPRs on CCs and HPRs on the underlying stocks are provided in Tables 8, 9, and 10, respectively. The overall mean HPRs for CCs are 1.7 percent for the ITM sample, 2.7 percent for the ATM sample, and 4.0 percent for the OTM sample. The corresponding mean HPRs for the underlying stocks are 3.9 percent, 3.9 percent, and 4.2 percent, respectively. Thus,

**TABLE 3**  
**Summary Statistics for Stocks Underlying Call Options in Table 2:**  
**Number of Observations, Mean 12-Week HPRs (%), Standard Deviation of HPRs (%),**  
**Minimum and Maximum HPRs (%), and Coefficient of Skewness**

**Underlying Stocks for In-the-Money Call Options**

	<b>N</b>	<b>Mean</b>	<b>SD</b>	<b>Min</b>	<b>Max</b>	<b>Skewness</b>
Total	2196	4.0	15.0	-78.4	75.1	0.06
1986	573	5.7	16.9	-78.4	73.2	0.08
1987	548	0.8	17.3	-60.9	59.8	-0.33
Bad	194	-9.5	20.0	-60.9	59.8	-0.44
Good	354	6.5	12.5	-54.0	42.1	0.04
1988	605	4.6	11.5	-26.2	75.1	1.11
1989	470	4.6	13.0	-41.5	66.7	0.51

**Underlying Stocks for At-the-Money Call Options**

	<b>N</b>	<b>Mean</b>	<b>SD</b>	<b>Min</b>	<b>Max</b>	<b>Skewness</b>
Total	2149	3.9	15.0	-60.9	74.2	0.03
1986	556	5.7	16.2	-49.3	74.2	0.22
1987	545	0.8	17.9	-60.9	63.7	-0.29
bad	194	-9.9	20.6	-60.9	63.7	0.44
good	351	6.8	12.8	-54.0	53.6	0.21
1988	565	4.4	11.3	-28.8	66.6	0.69
1989	483	4.8	13.2	-45.5	66.7	0.48

**Underlying Stocks for Out-of-the-Money Call Options**

	<b>N</b>	<b>Mean</b>	<b>SD</b>	<b>Min</b>	<b>Max</b>	<b>Skewness</b>
Total	2187	4.2	15.4	-66.8	75.1	0.03
1986	554	6.5	16.8	-49.3	74.2	0.19
1987	577	1.4	18.1	-66.8	63.7	-0.36
bad	215	-9.0	20.9	-60.9	63.7	0.35
good	362	7.0	13.5	-66.8	56.1	-0.29
1988	634	4.7	11.7	-29.2	75.1	0.97
1989	422	4.4	13.6	-50.4	66.7	0.32

on average, covered calls produced lower mean HPRs than those of the underlying stocks. The overall mean HPRs for the differences from Table 10 are minus 2.2 percent for the ITM sample, minus 1.2 percent for the ATM sample, and minus 0.2 percent for the OTM sample. The lower average returns associated with covered calls are attributable to sacrificing the upside potential on the stock beyond the exercise price. In other words, on average the premiums received from writing the calls were insufficient to compensate for the opportunity losses on the stocks because of the relatively bullish market that existed during the period of study. The OTM CCs, as expected, perform the best in a relative sense in an up market because while the premium received when writing the calls is lower, less of the upside potential on the stock is sacrificed.

**TABLE 4**  
**Mean HPRs by Decile for ITM, ATM, and OTM Call Options (%)**

Decile	ITM	ATM	OTM
1	-99.9	-100.0	-100.0
2	-90.8	-100.0	-100.0
3	-62.7	-99.8	-100.0
4	-36.4	-94.9	-100.0
5	-14.6	-72.7	-100.0
6	7.2	-28.3	-98.5
7	29.5	20.9	-86.6
8	55.9	74.8	-31.3
9	90.5	149.2	115.3
10	180.2	342.5	636.7

The year-by-year results reported in Table 10 indicate that CCs generally underperformed the underlying stocks in every year but 1987 where both strategies produced similar returns. However, the downside protection afforded by CCs during declining markets is evident in the mean HPRs for the returns which include the market crash of 1987. During this period (designated as “bad”), the differences in the mean HPRs for CCs and the underlying stocks are 6.6 percent for the ITM CCs, 4.2 percent for the ATM CCs, and 3.0 percent for the OTM CCs.

Covered calls represent a conservative strategy aimed at generating some extra income and downside protection in return for giving up some of the upside potential on the stock. In other words, covered calls should exhibit less variability in returns than do the underlying stocks.

The empirical evidence confirms this relationship as the standard deviation of the HPRs for CCs are 5.8 percent for the ITM sample, 8.7 percent for the ATM sample, and 11.8 percent for the OTM sample, versus approximately 15 percent for the underlying stocks in each case. A comparison of the minimum and maximum returns for the CCs versus the underlying stocks also reveals a smaller range for the HPRs of CCs. However, much of the reduction in the range is due to the reduction of maximum returns as opposed to higher minimum returns. The mean HPRs by deciles for the CCs and the underlying stocks presented in Table 11 further illustrate the reduced variability in the HPRs of CCs versus those for the underlying stocks. An examination of the difference in the mean HPRs for the CCs and stocks in the extreme deciles (deciles 1 and 2 versus deciles 9 and 10) reveals considerably larger differences for the upper end of the return distribution than for the lower end.

Unlike the HPRs for calls and puts, the return distributions for CCs exhibit negative skewness, as indicated by the skewness measures from Table 8 of minus 3.42, minus 2.30, and minus 1.19 for the ITM, ATM, and OTM CC samples, respectively. The results by decile reveal the negative skewness in the HPRs of CCs. Absolute differences between the mean HPRs for decile one (Table 11) and the overall mean HPRs from Table 8 are significantly greater than the differences between means for decile 10 and the overall means. In addition, the overall mean of the HPRs for the ITM and the ATM samples are lower than the corresponding mean for decile 4, while the overall mean for the OTM CCs is less than the corresponding mean HPR for decile 5. It is important that the negative skewness in the HPRs of CCs be considered when evaluating the performance of CCs versus that of the underlying stocks in order that erroneous conclusions be avoided. That is, while it is true that on average the underlying stocks outperformed the CC positions, on a case-by-case basis the majority of CCs provide higher HPRs than the stocks. This can be seen in Figures 3, 4, and 5 which provide relative frequency histograms for the CC samples and for the differences in HPRs for the CCs versus the underlying stocks. From the “difference” graphs it is apparent that a majority of the CC positions outperformed the underlying stocks, but that the negative skewness in these distributions is sufficient to drive the average performance of the stocks above that of the CC positions. Simply put, large opportunity losses associated with covered call positions affect the averages to a large degree.

**TABLE 5**  
**Put Option Summary Statistics, 1986-1989:**  
**Number of Observations, Mean 12-Week HPRs (%),**  
**Standard Deviation of HPRs (%), Minimum and Maximum HPRs (%),**  
**and Coefficient of Skewness**

**In-the-Money Put Options**

	<b>N</b>	<b>Mean</b>	<b>SD</b>	<b>Min</b>	<b>Max</b>	<b>Skewness</b>
Total	2113	-24.7	104.3	-100.0	387.2	1.49
1986	538	-32.1	77.6	-100.0	219.0	1.11
1987	541	-7.6	105.9	-100.0	387.2	1.42
bad	197	56.8	131.5	-100.0	387.2	0.60
good	344	-44.5	63.4	-100.0	191.1	1.22
1988	622	-34.1	56.8	-100.0	210.2	0.79
1989	412	-23.2	71.6	-100.0	310.5	1.11

**At-the-Money Put Options**

	<b>N</b>	<b>Mean</b>	<b>SD</b>	<b>Min</b>	<b>Max</b>	<b>Skewness</b>
Total	2147	-27.9	145.7	-100.0	1,115.4	3.35
1986	544	-31.2	131.7	-100.0	1,100.0	2.85
1987	522	12.1	213.1	-100.0	1,115.4	2.55
bad	184	151.6	297.4	-100.0	1,115.4	1.20
good	338	-63.8	75.8	-100.0	355.0	2.68
1988	544	-57.0	73.4	-100.0	319.6	2.12
1989	437	-35.5	118.3	-100.0	728.6	2.80

**Out-of-the-Money Put Options**

	<b>N</b>	<b>Mean</b>	<b>SD</b>	<b>Min</b>	<b>Max</b>	<b>Skewness</b>
Total	2006	-27.1	291.6	-100.0	4,033.3	6.74
1986	556	-43.0	227.8	-100.0	3,500.0	8.75
1987	507	74.6	493.9	-100.0	4,033.3	3.87
bad	174	373.6	751.0	-100.0	4,033.3	1.98
good	333	-81.7	80.0	-100.0	900.0	7.57
1988	553	-80.9	78.1	-100.0	1,133.3	8.92
1989	390	-60.3	139.2	-100.0	1,071.4	4.95



**TABLE 6**  
**Summary Statistics for Stocks Underlying Put Options in Table 5:**  
**Number of Observations, Mean 12-Week HPRs (%), Standard Deviation of HPRs (%),**  
**Minimum and Maximum HPRs (%), and Coefficient of Skewness**

**Underlying Stocks for In-the-Money Put Options**

	<b>N</b>	<b>Mean</b>	<b>SD</b>	<b>Min</b>	<b>Max</b>	<b>Skewness</b>
Total	2113	3.9	15.0	-61.7	75.1	0.01
1986	538	6.1	16.3	-49.3	58.8	0.02
1987	541	1.5	17.8	-61.7	59.0	-0.29
bad	197	-8.2	20.8	-61.7	59.0	0.39
good	344	7.1	13.0	-55.3	56.1	0.11
1988	622	4.4	11.8	-29.2	75.1	1.00
1989	412	3.5	13.0	-50.0	71.3	0.20

**Underlying Stocks for At-the-Money Put Options**

	<b>N</b>	<b>Mean</b>	<b>SD</b>	<b>Min</b>	<b>Max</b>	<b>Skewness</b>
Total	2047	3.7	14.7	-61.6	71.3	-0.08
1986	544	5.4	15.9	-49.3	59.4	0.10
1987	522	1.4	17.3	-61.6	53.5	-0.39
bad	184	-8.7	19.9	-61.6	47.4	0.21
good	338	6.9	12.7	-53.7	53.5	0.18
1988	544	4.3	11.4	-30.5	58.5	0.51
1989	437	3.9	13.0	-50.0	71.3	0.21

**Underlying Stocks for Out-of-the-Money Put Options**

	<b>N</b>	<b>Mean</b>	<b>SD</b>	<b>Min</b>	<b>Max</b>	<b>Skewness</b>
Total	2006	3.7	14.7	-61.4	75.1	0.04
1986	556	5.2	15.9	-49.3	59.9	0.12
1987	507	1.1	17.0	-61.4	59.0	-0.44
bad	174	-8.9	20.1	-61.4	59.0	0.33
good	333	6.4	12.1	-53.9	43.4	-0.12
1988	553	4.2	11.7	-27.5	75.1	0.97
1989	390	4.1	13.2	-41.5	71.6	0.51

**TABLE 7**  
**Mean HPRs by Decile for ITM, ATM, and OTM Put Options (%)**

Decile	ITM	ATM	OTM
1	-100.0	-100.0	-100.0
2	-100.0	-100.0	-100.0
3	-96.0	-100.0	-100.0
4	-78.7	-100.0	-100.0
5	-52.7	-99.7	-100.0
6	-29.6	-93.9	-100.0
7	-9.3	-70.9	-100.0
8	13.6	-17.0	-96.9
9	50.4	65.9	-59.5
10	152.9	324.5	567.7

## CONCLUSIONS

This study provides historical return distributions using 12-week HPRs for call options, put options, and covered calls for the period from 1986 through 1989. Distributions are provided using ITM, ATM, and OTM options for each strategy. The evidence provided clearly delineates the extreme risks and potentially large rewards associated with the purchase of either call options or put options. The chances of suffering a 100 percent loss when purchasing calls or puts is shown to be quite high, especially for options that are at-the-money or out-of-the-money at the time of purchase. Both calls and puts exhibited positive skewness in their return distributions, and the degree of skewness in HPRs increases substantially in moving from ITM to OTM options. The average performance of call options during the 1986-1989 period was considerably higher than that for put options due to the market environment that characterized these years.

## ENDNOTES

1. The first category in Figure 1 includes only those options that expired worthless (HPRs equal minus 100 percent). Subsequent categories include a return range of 50 percent. For example, the second bar in the graph includes all call options where  $-100\% < \text{HPR} \leq -50\%$ , the third includes options where  $-50\% < \text{HPR} \leq 0\%$ , and so on. The numbers on the horizontal axis represent the midpoint of the return range for that category.
2. The scale interpretation for the put options in Figure 2 is the same as for the call options in Figure 1.

## REFERENCES

1. Cox, John C. and Rubinstein, Mark, *Options Markets*, Englewood Cliffs, Prentice Hall, 1985.
2. Ibbotson, Roger G. and Rex A. Sinquefeld, *Stocks, Bonds, Bills and Inflation*, updated in *Stocks, Bonds, Bills and Inflation 1994 Yearbook*, Ibbotson Associates, Chicago.
3. *Options: Essential Concepts and Trading Strategies*, Edited by The Options Institute: The Educational Division of the Chicago Board Options Exchange, 1994.

**TABLE 8**  
**Covered Call Option Summary Statistics, 1986-1989:**  
**Number of Observations, Mean 12-Week HPRs (%), Standard Deviation of HPRs (%),**  
**Minimum and Maximum HPRs (%), and Coefficient of Skewness**

**In-the-Money Covered Call Options**

	<b>N</b>	<b>Mean</b>	<b>SD</b>	<b>Min</b>	<b>Max</b>	<b>Skewness</b>
Total	2211	1.7	5.8	-56.1	32.8	-3.42
1986	575	1.4	4.8	-41.1	14.3	-4.41
1987	550	0.7	9.3	-56.1	30.4	-2.10
bad	195	-3.0	14.2	-61.7	30.4	-0.78
good	355	2.7	3.5	-39.9	12.8	-5.67
1988	612	3.0	3.0	-15.6	32.8	0.74
1989	474	1.6	3.8	-29.6	8.8	-5.01

**At-the-Money Covered Call Options**

	<b>N</b>	<b>Mean</b>	<b>SD</b>	<b>Min</b>	<b>Max</b>	<b>Skewness</b>
Total	2172	2.7	8.7	-58.7	30.7	-2.30
1986	559	2.4	7.7	-44.6	14.9	-2.24
1987	550	1.0	12.7	-58.7	30.7	-1.59
bad	195	-5.7	17.9	-58.7	30.7	-0.38
good	355	4.7	5.9	-45.6	18.8	-2.64
1988	573	4.3	5.6	-25.0	24.0	-1.50
1989	490	3.0	6.6	-38.5	16.0	-2.95

**Out-of-the-Money Covered Call Options**

	<b>N</b>	<b>Mean</b>	<b>SD</b>	<b>Min</b>	<b>Max</b>	<b>Skewness</b>
Total	2203	4.0	11.8	-61.4	53.8	-1.19
1986	558	4.3	11.3	-49.3	27.7	-1.16
1987	577	2.4	15.5	-61.4	53.8	-0.99
bad	216	-5.1	20.3	-61.4	53.8	-0.11
good	361	6.9	9.3	-53.9	28.2	-1.00
1988	640	5.4	8.7	-27.5	27.0	-0.48
1989	428	3.8	10.2	-41.5	23.6	-1.31

**TABLE 9**  
**Summary Statistics for Stocks Underlying Covered Call Options in Table 8:**  
**Number of Observations, Mean 12-Week HPRs (%), Standard Deviation of HPRs (%),**  
**Minimum and Maximum HPRs (%), and Coefficient of Skewness**

**Underlying Stocks for In-the-Money Covered Call Options**

	<b>N</b>	<b>Mean</b>	<b>SD</b>	<b>Min</b>	<b>Max</b>	<b>Skewness</b>
Total	2211	3.9	14.9	-60.9	75.1	0.12
1986	575	5.9	16.4	-49.3	73.2	0.28
1987	550	0.8	17.2	-60.9	59.8	-0.37
bad	195	-9.5	19.9	-60.9	59.8	0.44
good	355	6.5	12.4	-53.7	42.1	-0.32
1988	612	4.6	11.6	-26.2	75.1	1.10
1989	474	4.0	13.0	-41.5	66.3	0.41

**Underlying Stocks for At-the-Money Covered Call Options**

	<b>N</b>	<b>Mean</b>	<b>SD</b>	<b>Min</b>	<b>Max</b>	<b>Skewness</b>
Total	2172	3.9	15.0	-60.9	74.2	0.02
1986	559	5.7	16.2	-49.3	74.2	0.22
1987	550	0.8	17.8	-60.9	63.7	-0.30
bad	195	-9.9	20.6	-60.9	63.7	0.44
good	355	6.7	12.7	-54.0	53.5	0.19
1988	573	4.4	11.4	-28.8	66.6	0.69
1989	490	4.7	13.3	-45.5	66.7	0.40

**Underlying Stocks for Out-of-the-Money Covered Call Options**

	<b>N</b>	<b>Mean</b>	<b>SD</b>	<b>Min</b>	<b>Max</b>	<b>Skewness</b>
Total	2203	4.2	15.3	-60.9	75.1	0.05
1986	558	6.5	16.8	-49.3	74.2	0.19
1987	577	1.4	17.8	-60.9	63.7	-0.31
bad	216	-8.2	20.6	-60.9	63.7	0.32
good	361	7.1	12.8	-54.0	56.1	0.14
1988	640	4.8	11.7	-29.2	75.1	0.96
1989	428	4.3	13.8	-50.4	66.7	0.24

**TABLE 10**  
**Summary Statistics for the Differences Between Returns on**  
**Covered Calls Options and Returns on the Underlying Stocks:**  
**Number of Observations, Mean 12-Week HPRs (%), Standard Deviation of HPRs (%),**  
**Minimum and Maximum HPRs (%), and Coefficient of Skewness**

**Differences for In-the-Money Covered Call Options**

	<b>N</b>	<b>Mean</b>	<b>SD</b>	<b>Min</b>	<b>Max</b>	<b>Skewness</b>
Total	2211	-2.2	12.5	-68.4	30.9	-1.00
1986	575	-4.6	14.7	-68.4	23.4	-0.85
1987	550	-0.0	12.1	-48.8	30.9	-0.74
bad	195	6.6	10.8	-48.8	30.9	-2.10
good	355	-3.7	11.2	-39.3	18.1	-0.43
1988	612	-1.6	10.9	-67.5	22.4	-1.30
1989	474	-2.4	11.5	-60.8	19.9	-1.05

**Differences for At-the-Money Covered Call Options**

	<b>N</b>	<b>Mean</b>	<b>SD</b>	<b>Min</b>	<b>Max</b>	<b>Skewness</b>
Total	2172	-1.2	10.0	-62.9	29.7	-1.66
1986	559	-3.3	11.7	-62.9	18.6	-1.38
1987	550	0.2	9.8	-50.6	29.7	-1.43
bad	195	4.2	9.1	-50.6	29.7	-2.37
good	355	-2.0	9.6	-41.5	14.0	-1.27
1988	573	-0.2	8.5	-61.6	21.8	-1.88
1989	490	-1.7	9.5	-57.2	13.7	-2.03

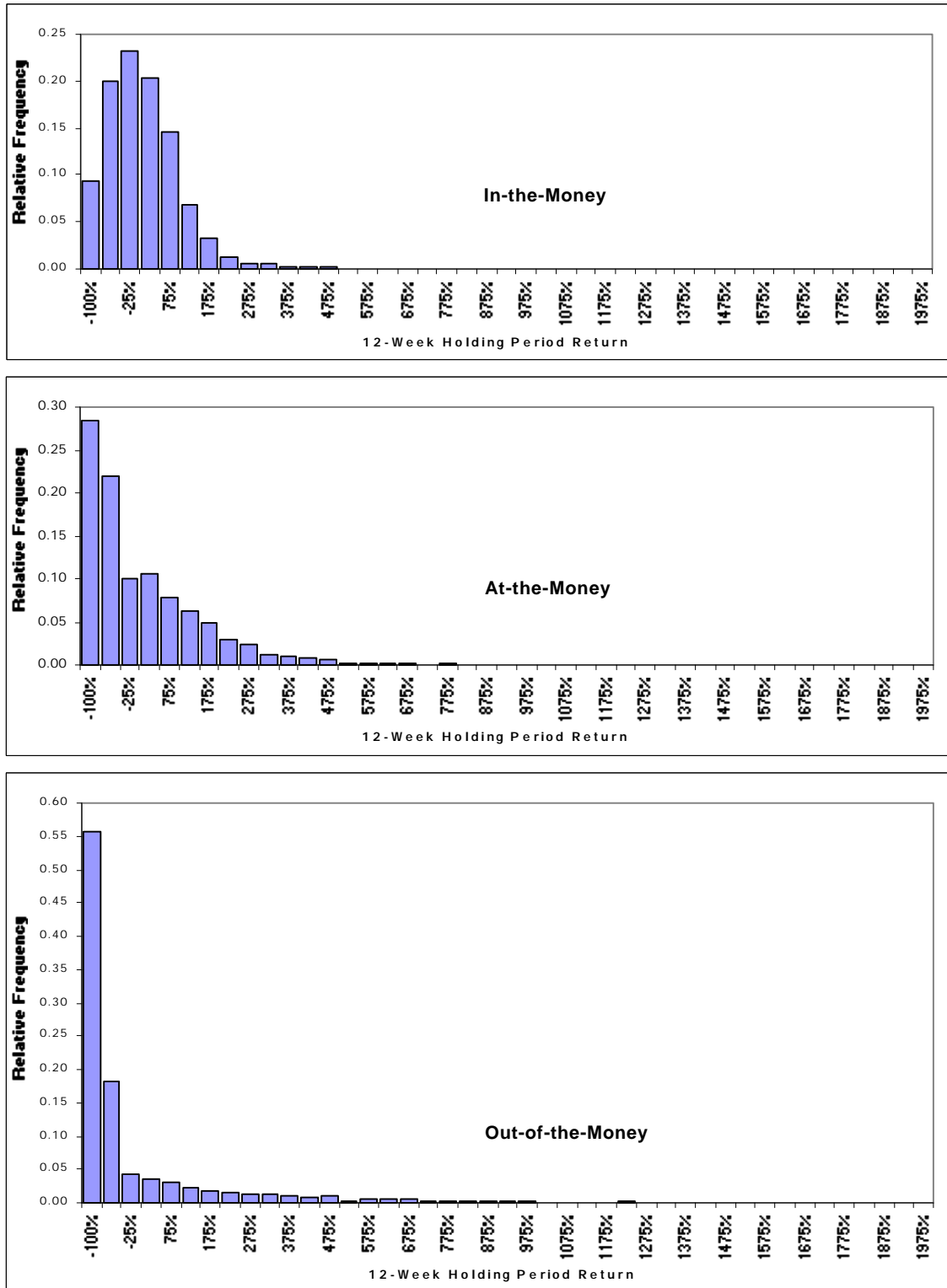
**Differences for Out-of-the-Money Covered Call Options**

	<b>N</b>	<b>Mean</b>	<b>SD</b>	<b>Min</b>	<b>Max</b>	<b>Skewness</b>
Total	2203	-0.2	7.1	-61.8	29.4	-3.19
1986	558	-2.2	8.8	-56.6	15.5	-2.42
1987	577	1.0	6.7	-41.6	29.4	-2.00
bad	216	3.0	6.7	-41.6	29.4	-1.97
good	361	-0.2	6.3	-39.6	10.4	-2.41
1988	640	0.6	5.8	-61.8	13.0	-5.35
1989	428	-0.4	6.5	-52.0	7.3	-4.16

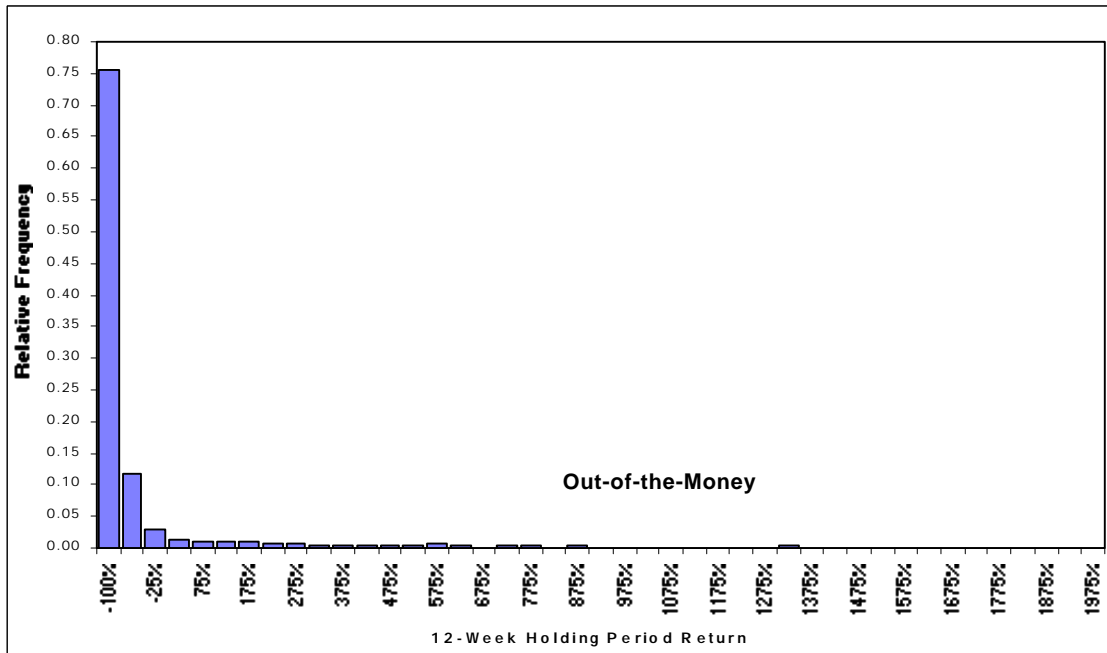
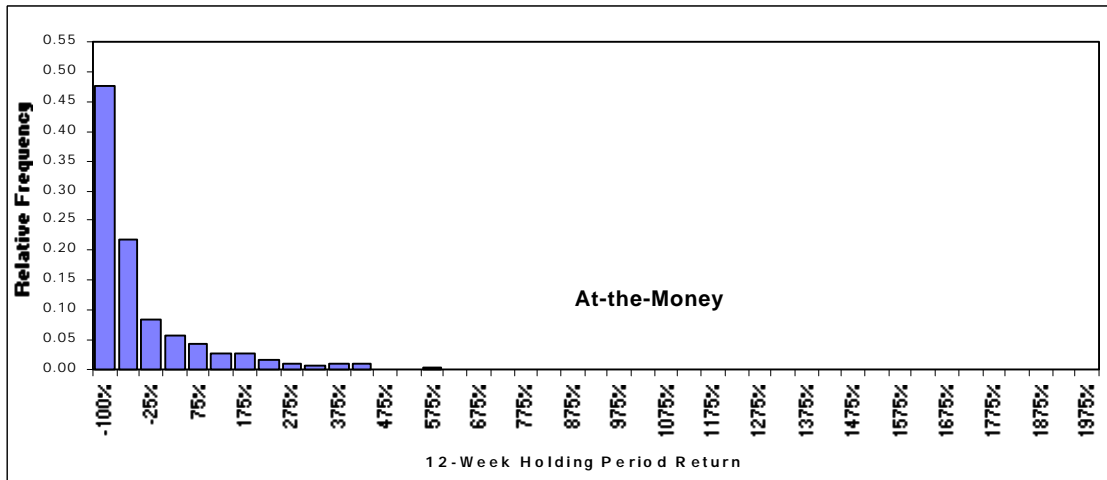
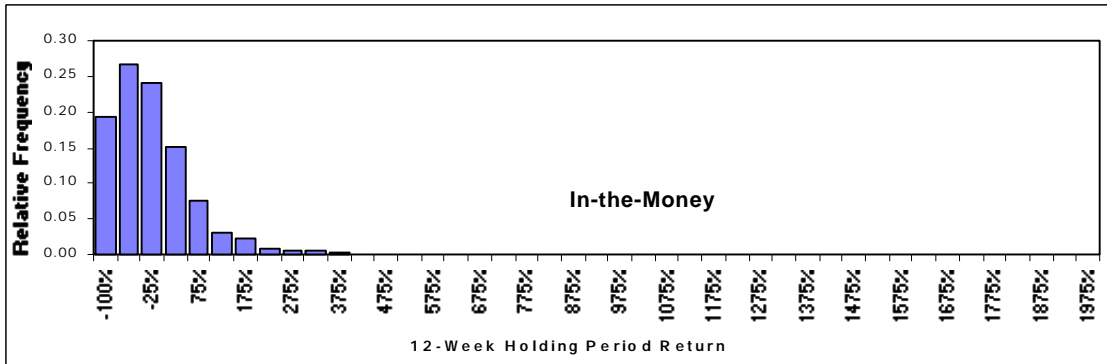
**TABLE 11**  
**Mean HPRs by Decile for ITM, ATM, and OTM**  
**Covered Calls and the Underlying Stocks (%)**

<b>Decile</b>	<b>ITM</b>	<b>Stocks</b>	<b>ATM</b>	<b>Stocks</b>	<b>OTM</b>	<b>Stocks</b>
1	-10.8	-22.9	-18.2	-23.6	-21.5	-23.8
2	0.7	-9.4	-3.6	-9.4	-7.0	-9.3
3	1.5	-4.5	1.4	-4.4	-1.7	-4.3
4	1.9	-1.1	3.7	-1.0	1.8	-0.7
5	2.2	2.0	4.6	2.2	4.8	2.3
6	2.6	5.1	5.4	5.2	7.9	5.5
7	3.0	8.5	6.2	8.7	10.1	9.2
8	3.5	12.3	7.0	12.6	11.7	13.1
9	4.4	17.6	8.2	17.7	14.0	18.2
10	8.0	30.9	12.0	30.7	19.8	31.6

**FIGURE 1**  
**Relative Return Frequency Distribution, 1986-1989: In-the-Money Call Options, At-the-Money Call Options, and Out-of-the-Money Call Options**

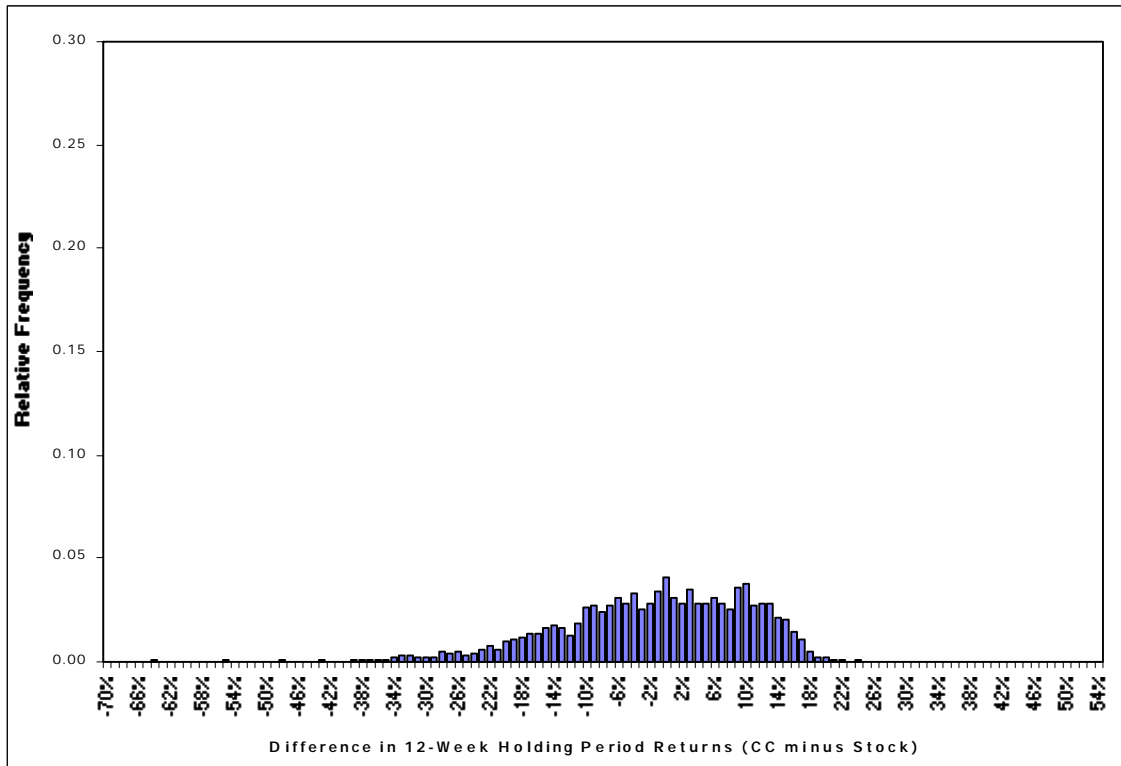
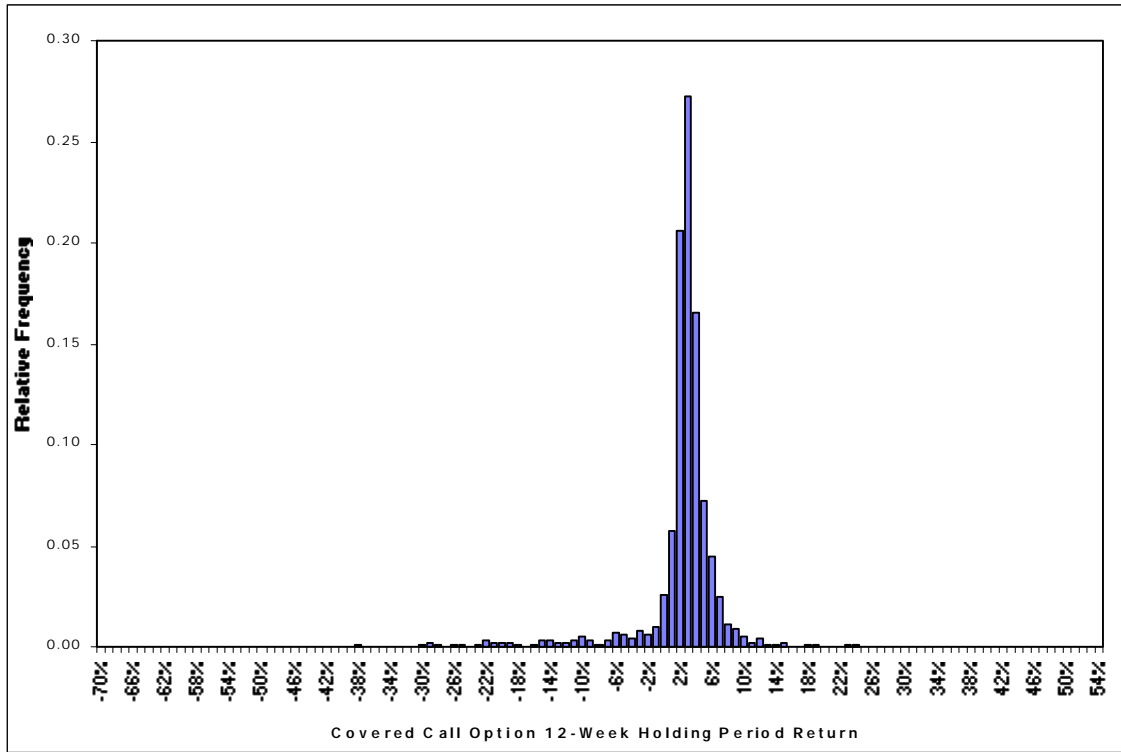


**FIGURE 2**  
**Relative Return Frequency Distribution, 1986-1989: In-the-Money Put Options, At-the-Money Put Options, and Out-of-the-Money Put Options**

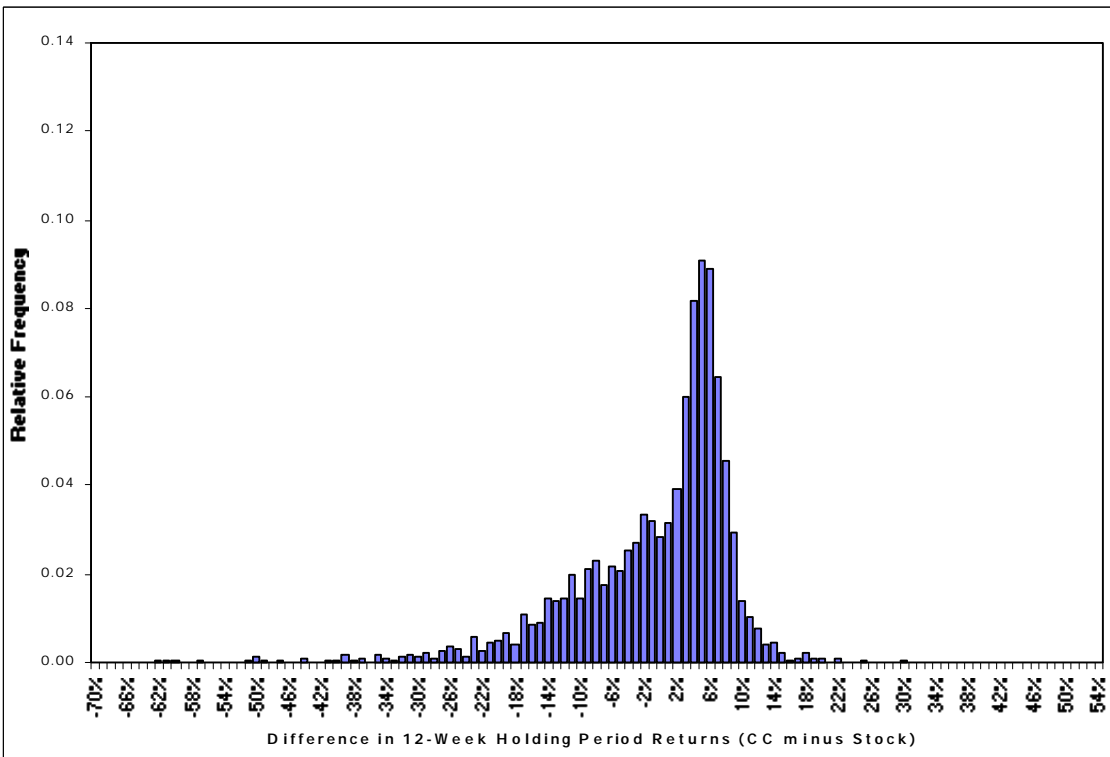
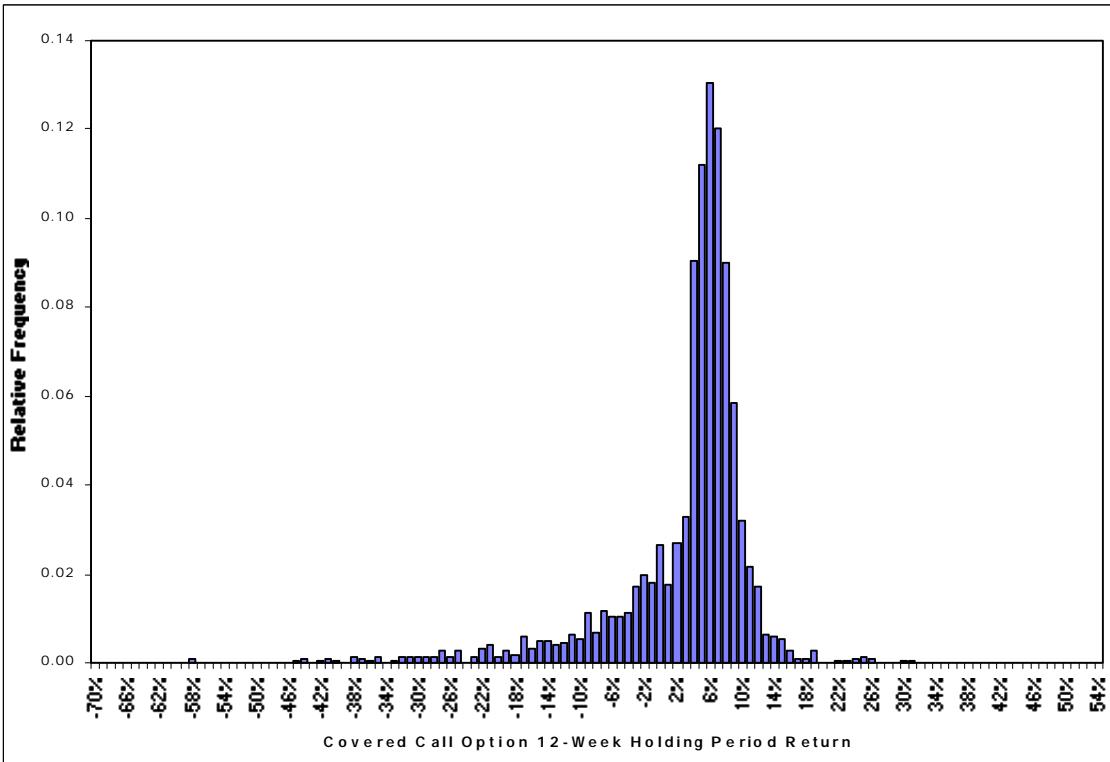




**FIGURE 3**  
**Relative Return Frequency Distribution, 1986-1989**  
**In-the-Money Covered Call Options**



**FIGURE 4**  
**Relative Return Frequency Distribution, 1986-1989**  
**At-the-Money Covered Call Options**



**FIGURE 5**  
**Relative Return Frequency Distribution, 1986-1989**  
**Out-of-the-Money Covered Call Options**

