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Investing in Options of
Stock Announcing Splits

Frank K. Reilly
Sandra G. Gustavson

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Investing in Options of Stock Announcing Splits

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Abstract

This study examines the profit potential for individuals investing in the options of stocks announcing stock splits. The results indicate very little downside risk and substantial upside potential for those who get the information from the Dow Jones broad tape and invest the day before it is announced in the Wall Street Journal.

INVESTING IN OPTIONS OF STOCKS ANNOUNCING SPLITS*

Frank K. Reilly
Sandra G. Gustavson**

INTRODUCTION

A previous study by one of the authors indicated that the stock market was generally quite efficient in adjusting to the announcement of a stock split.¹ Specifically, the results indicated that trading volume and stock prices reacted rapidly to the announcement of the stock split on the Dow Jones News Service and most of the price and volume adjustment occurred prior to the report in the Wall Street Journal (WSJ). A specific test of the profit potential for an investor who acquired the stock after the announcement of the forthcoming stock split in the WSJ indicated a small positive price movement, but there were no excess returns after allowing for commissions. While it apparently is not possible to derive excess returns from investing in the stock of the firm, one may question whether one might enjoy excess returns from investing in the options of the firms that announce stock splits. There are two main

*The authors acknowledge the data collection of K. S. Subash, the extensive computer programming of Wenchi Wong, the use of the computer facilities at the University of Illinois and the comments of participants in the Finance Seminar at Illinois especially Paul Fellows, John Gilster, Steve Sears, Kevin Waspi and David Whitford.

**The authors are Professor of Finance, University of Illinois and Assistant Professor of Risk Management and Insurance at the University of Georgia.

¹Frank K. Reilly and Eugene F. Drzycimski, "Short-Run Profits from Stock Splits," Financial Management, Vol. 10, No. 3 (Summer, 1981), pp. 64-74.

reasons why such a strategy might be viable. First, the added leverage from options could transform a small profit on the stock into a much larger percent profit on the option. Second, the Black-Scholes option pricing model implies a positive relationship between the variability of return on a stock and the value of an option for that stock.² A study by Bar-Yosef and Brown indicates that stock returns become more volatile during the period surrounding a stock split.³ Thus, one might expect an increase in the value of these options because of the increased variance of returns on the stock caused by the announcement of a stock split.

Therefore, the purpose of this study is to examine the return performance for investors who acquired exchange-listed call options for NYSE stocks that announced splits during the period 1974-1979. The sample and tests are discussed in the next section and the results are reported and discussed in section three. The final section contains a summary and conclusion wherein we discuss the implications of the results.

TEST PERIOD, SAMPLE AND TESTS

Test Period

The test period was similar to that used in the prior stock split study. Specifically, rates of return were examined for the period

²Fisher Black and Myron Scholes, "The Pricing of Options and Corporate Liabilities," Journal of Political Economy, Vol. 81, No. 3 (May/June, 1973), pp. 637-654; Robert Marton, "Theory of Rational Option Pricing," Bell Journal of Economics and Management Science, Vol. 4, No. 1 (Spring, 1973), pp. 141-183.

³Sasson Bar-Yosef and Lawrence D. Brown, "A Reexamination of Stock Splits Using Moving Betas," Journal of Finance, Vol. 32, No. 4 (September, 1977), pp. 1069-1080.

from 15 days prior to the announcement of the stock split in the WSJ to 20 days following the announcement.

Split Sample

The sample of split stocks includes every stock listed on the NYSE that had a stock split during the period 1974-1979 where the firm had options listed on one of the options exchanges at the time of the split. There were several instances where the split stock currently has options listed, but did not have listed options when the split occurred. In these instances the stock could not be considered. Based upon these criteria, the split sample consisted of 35 stocks.

Matched Sample

Each split stock was matched with a similar non-splitting stock that also had a listed option at the time of the split. The matching was based upon three factors. The first matching criterion was comparable systematic risk (beta), which is necessary because of the importance of return volatility in the option pricing model. The systematic risk measure was derived using daily returns during the calendar year prior to the split and also the beta during the year of the split. For example, when looking for a match for a stock that split in 1978, we considered the betas derived from daily returns for the split stock during calendar 1977 and also 1978. For cases in which the betas changed dramatically during the two years the beta that best reflected the period prior to the announcement was used (i.e., if the stock split announcement was early in the year we used the prior years beta; if the announcement came late in the year the current year's beta was chosen).

Given several reasonably similar betas, the firm that was in the same or a closely allied industry as the split stock was selected. The final criterion was that the options for the two stocks have the same expiration cycle. A list of the split sample and the matched sample is contained in Table 1.

Option Data

Option prices and volume were collected for the 36 day period from 15 days prior to the split announcement to 20 days following the announcement. A major question concerned how many option contracts to consider, in terms of striking price and term to expiration. While there are typically several different options for each stock, the option prices will generally move together, based upon price changes for the underlying stock. Because the returns on the various options are highly correlated the options analyzed were limited to one "in the money" issue and one "out of the money" issue using the option prices as close as possible to the stock price on the announcement date. For example, suppose the stock was selling for 74 at the time of the stock split announcement. We would attempt to find a 70 option (in the money) and an 80 option (out of the money) for the stock. The decision was always made based upon the prices prevailing at the time of the announcement, since the study assumed an investor would purchase the appropriate options on this day.⁴

⁴No difference in option selection would have resulted had the decision been based on prices prevailing on either the day before the announcement or two days before.

TABLE 1

SAMPLE STOCKS, ANNOUNCEMENT DATES, AND MATCHED SAMPLE STOCKS

<u>Split Stock Options</u>	<u>Announcement Date</u>	<u>Matched Options</u>
Gulf & Western Ind, Inc.	7/17/75	ITT
Dow Chemical	2/06/76	DuPont
Halliburton, Inc.	2/20/76	Asarco
United Technology Corp.	4/14/76	AMP
Exxon Corp.	5/21/76	Texaco
Levi Strauss & Co.	6/11/76	Weyerhaeuser
Atlantic Richfield	6/29/76	Gulf Oil
Diamond Shamrock Corp.	7/16/76	Hercules
Deere Co.	7/28/76	IBM
Digital Equipment	8/17/76	Sperry Corp.
Bristol Meyers	2/08/77	Corning Glass Works
Sears, Roebuck	2/08/77	Kresge (K-Mart)
Owens Illinois Inc.	2/11/77	Revlon
Pepsi Cola, Inc.	2/25/77	Beatrice Foods
Coca-Cola Co.	3/03/77	Norton Simons
Phillips Petroleum	3/15/77	Mobil Oil
Raytheon	3/24/77	AMP
Boeing Co.	8/02/77	Fleetwood Enterprise
McDermotts Co., Inc.	11/09/77	Hewlett Packard
Santa Fe Int'l	11/30/77	NCR
Abbott Labs	3/13/78	Schering Plough
Baker Int'l Corp.	4/27/78	Corning Glass Works
Northwest Ind, Inc.	5/10/78	Evans Products
Tandy Corp.	5/15/78	Itel
Signal Cos, Inc.	9/18/78	Avnet
Hilton Hotel Corp.	11/17/78	Holiday Inns
IBM	12/20/78	Pitney Bowes
DuPont	1/16/79	Hercules
General Dynamics	1/25/79	Boeing
Mobil Oil	1/29/79	Phillips Petroleum
Bally Mfg.	2/21/79	Fleetwood Enterprise
Union Oil Of Calif.	2/27/79	Gulf Oil
Philip Morris	3/1/79	Pepsi Cola, Inc.
Hewlett-Packard	5/21/79	Black and Decker
R. J. Reynolds	10/19/79	Heublein

Because the most active option issues are those with relatively short expiration dates, only options with less than six months to expiration were considered. As a result, four option contracts per stock were examined when possible--a short and longer term "in the money" option, and a short and longer term "out of the money" option. For example, assume that the previously discussed stock announced the split in March and that the stock options were on a February-May-August-November cycle. Ideally, the following four options would be examined: (1) 70 May, (2) 70 August, (3) 80 May, and (4) 80 August. In addition to the option analysis, the price and volume of trading for the underlying stocks was also considered.

Tests

The analysis of the price and volume for the options involved the examination of the time series plots of the average prices and trading volume for the underlying stocks and options of the split stocks and the matched sample stocks. The trading rules based on this analysis are tested for abnormal profit opportunities.

Price Changes. The average cross-sectional prices for the stocks and options for both the split and matched sample stocks were computed for each day during the 36 day period surrounding the split announcement as follows:

$$\text{MOPSS}_t = \sum_{i=1}^N \text{SOP}_{i,t} / N \quad \text{and} \quad \text{MSP}_t = \sum_{i=1}^{35} \text{SP}_{i,t} / 35$$

MOPSS_t = mean closing price of the options for the split stocks on day t.

$SOP_{i,t}$ = closing option price for split stock i on day t.

MSP_t = mean closing price of the split stocks on day t.

$SP_{i,t}$ = closing price of split stock i on day t.

N = 35 options (if available) for split stocks.

An average cross sectional series for each of the four option groups is computed: in the money short term (I,S); in the money longer term (I,L), out of the money short term (O,S); out of the money longer term (O,L). Series based on closing prices of the matched stock and options were computed in a similar manner.

Finally, mean relative option price (MROP) and mean relative stock price (MRSP) series were derived as follows:

$$MROP_t = MOPSS_t / MOPMS_t \quad \text{and} \quad MRSP_t = MSP_t / MMP_t.$$

where $MOPMS_t$ = average closing price of the options for the matched stocks on day t and

MMP_t = mean closing price of the matched stock on day t.

Based upon the prior split study, relative series were expected to increase over time and experience a major increase during the several days surrounding the stock split announcement. The important question in this study is whether the increase in the option series is enough to cause abnormal returns for an investor.

Volume Changes. The average cross sectional volume series were computed as follows:

$$MOVSS_t = \sum_{i=1}^N SOV_{i,t} / N \quad \text{and} \quad MSV_t = \sum_{i=1}^{35} SV_{i,t} / 35$$

$MOVSS_t$ = mean volume of trading for the options of the split stocks on day t.

$SOV_{i,t}$ = volume of trading in the option of the split stock i on day t.

MSV_t = mean volume of trading in the split stock on day t.

SV_t = volume of trading in split stock i on day t.

N = 35 options (if available).

The mean volume series for the matched sample were computed similarly, and the mean relative option volume (MROV) and stock volume (MRSV) series were calculated as follows:

$$MROV_t = MOVSS_t / MOVMS_t \quad \text{and} \quad MRSV_t = MSV_t / MMV_t.$$

where $MOVMS_t$ = mean volume of trading for the options of the matched sample stocks on day t.

MMV_t = mean volume of trading in the matched stock on day t.

Assuming that the transmittal of information to the public does not occur until the announcement date, trading should increase on that day and for a few days following the announcement.

Investment Tests. The investment tests performed indicate whether an investor could take advantage of the price movements in the options of stocks announcing splits. The analysis is in two parts. The first considers the cumulative percent change for the various cross sectional series assuming a purchase on the announcement date (day 0), the day before (day -1), and two days before (day -2). Day 0 is important because it is the day the announcement appears in the WSJ. The announcement will appear on the broad tape of the Dow Jones News Service sometime on day -1. Both of these tests assume purchase at the closing price

of the day indicated. Purchase on day -2 would imply some inside information. But as noted later, the results of this test are important in bracketing the expected returns available to investors who are able to purchase sometime during day -1--not just at its close. Because this analysis indicates some substantial relative percent changes for the options, the second set of tests considers the specific returns to an investor who acquires the "typical" option during this period (day 0, day -1, -2) and sells it on day +3, paying commissions both to buy and sell. These returns are compared to a similar investment in the matched sample options.

RESULTS

The results are presented in four subsections: (1) the relative price and volume results for the underlying stocks, (2) the option price series (i.e., MOPSS; MOPMS; and MROP) over the 36 day period, (3) the option volume series, and (4) the investment tests.

Underlying Stock Results

Exhibits 1 and 2 contain the time series plot of the relative price and volume series for the underlying stocks. The stock price results are very similar to those in the prior study on stock splits. Specifically, the relative stock price ratio was about 1.80 at the beginning and remained in that area until day -1, when it increased from 1.7953 to 1.8369 (a 2 percent increase). On day 0 it went to 1.8455 and increased each day until it peaked on day +3 at 1.8644. Subsequently, the relative ratio declined slowly and ended the sample period at 1.8407. As before, most of the price reaction occurred prior to the announcement

EXHIBIT 1

MEAN RELATIVE STOCK PRICE --- UNDERLYING STOCK

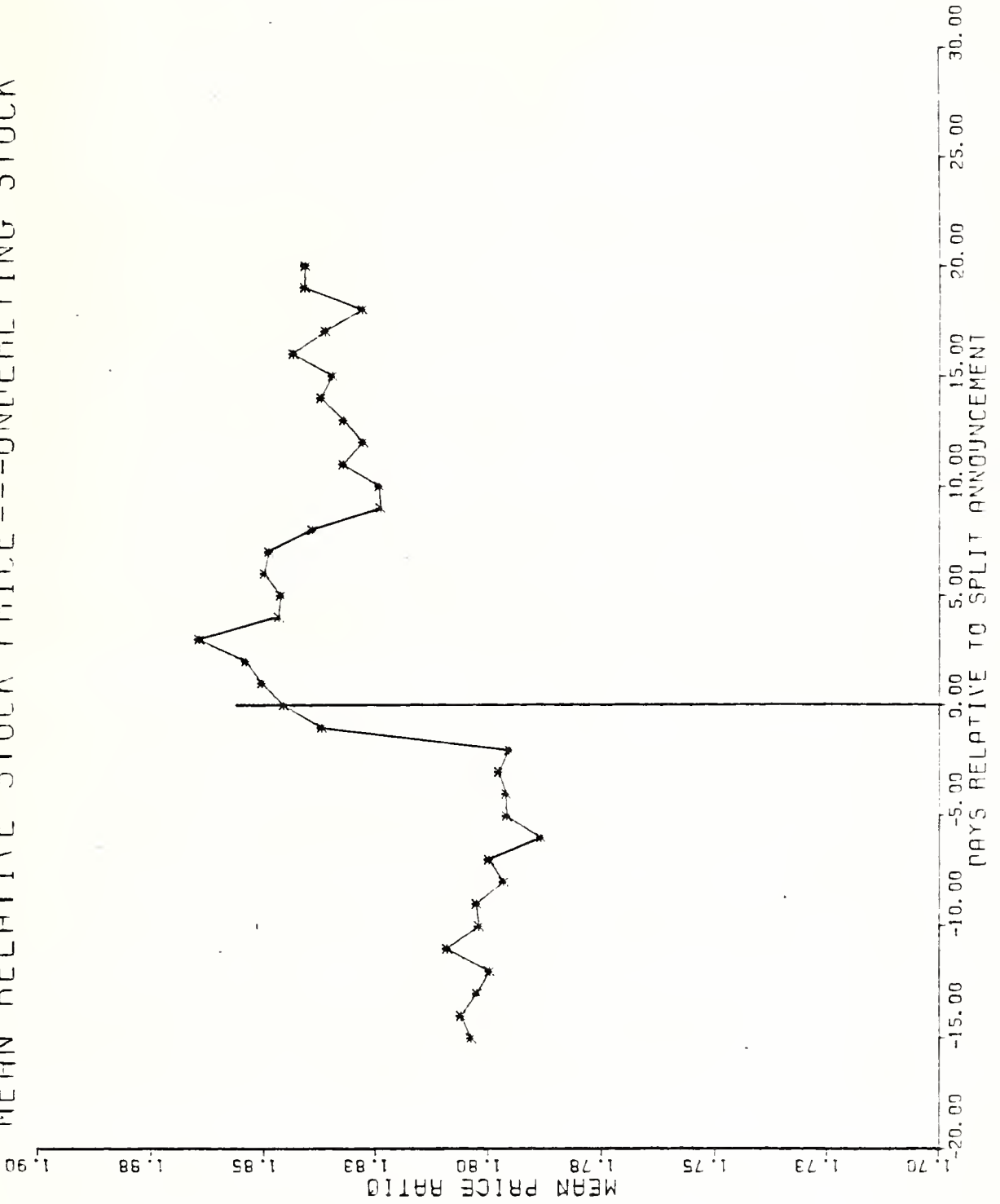
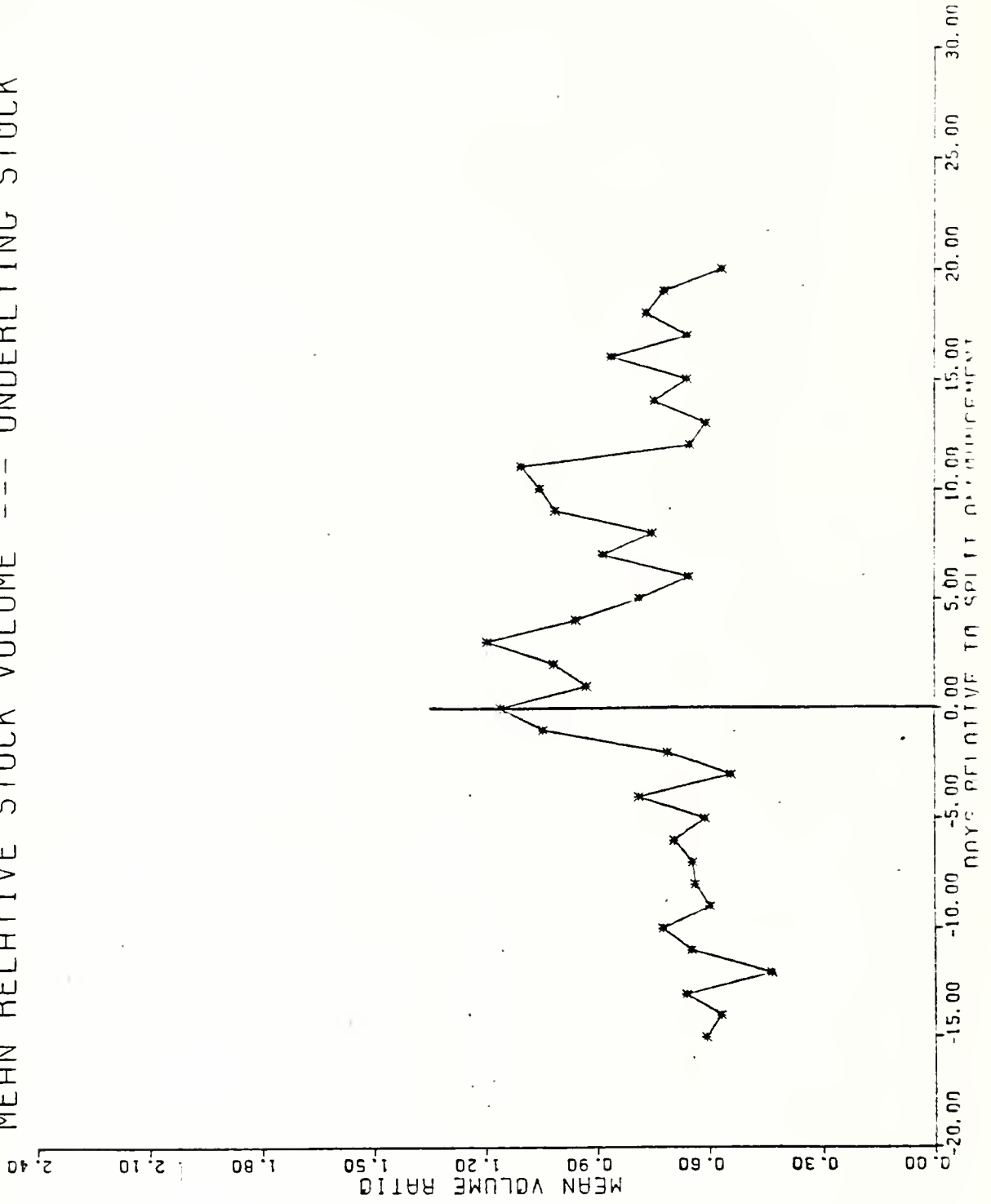


EXHIBIT 2

MEAN RELATIVE STOCK VOLUME --- UNDERLYING STOCK



in the WSJ and the increase after the announcement was not adequate for excess returns after commission.

Prior to any announcement the relative volume series ratio was about .60 to .70. On day -1 it jumped to 1.04, on day 0 it went to about 1.16, and peaked on day +3 at about 1.20. Subsequently it generally declined and ended about where it began.

In summary, although the sample is much smaller than the original stock split study (35 vs 130) and the control sample is different (a matched sample vs the market), the results are very similar. Clearly the major price change occurred on day -1 and it is not possible to derive excess returns after commissions, in the absence of inside information. Likewise, the volume increases are tightly grouped in the time period from day -1 to day +3.

Relative Option Price Results

Table 2 contains the average cross section results for the 36 day period for the 12 series (three sets of mean prices for each of four option types). Exhibits 3, 4, 5, 6 contain the time series plots of the mean relative option prices for the various types of options.

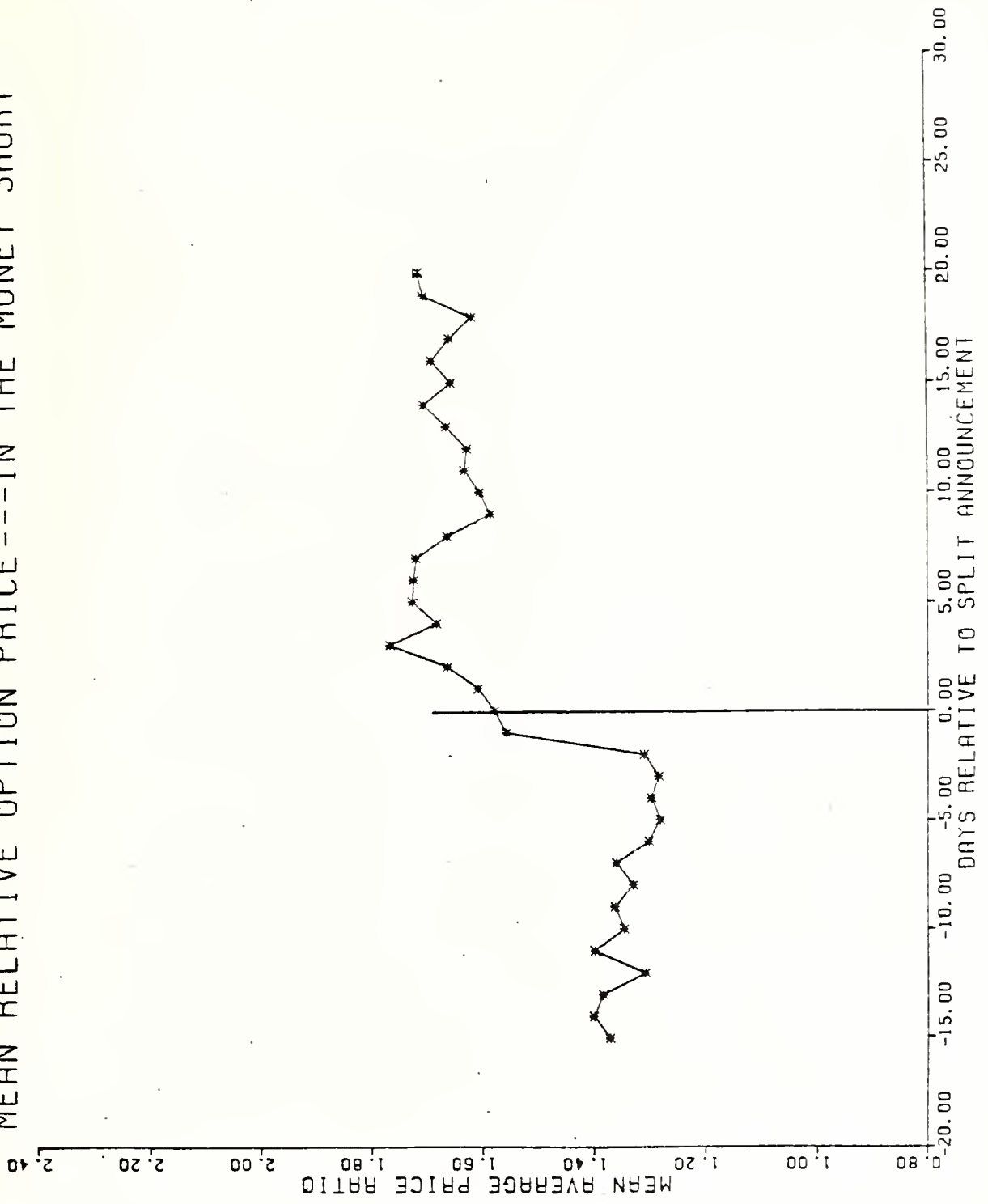
The mean relative option price series for the in the money short option started the sample period at a value of 1.371 and varied between 1.40 and 1.28 prior to day -1. On day -1 the ratio went from 1.310 to 1.558—a 19 percent increase. It peaked on day +3 at 1.768, which is about 13 percent higher than the close of day -1 and 12 percent above the close on day 0. Subsequently the ratio declined somewhat to an ending value of 1.71 which was substantially above the pre-announcement values.

TABLE 2

MEAN CROSS SECTION OF OPTION PRICES

Days Relative to the Announcement Day	Types of Options		Split Set		Matched Set		Split Set/Matched Set					
	I,S	I,L	O,S	O,L	I,S	I,L	O,S	O,L				
-15	6.14	8.14	2.25	4.24	4.48	5.19	1.38	2.39	1.371	1.569	1.631	1.778
-14	6.35	8.23	2.25	4.26	4.53	5.18	1.31	2.30	1.400	1.589	1.720	1.852
-13	6.18	8.15	2.15	4.24	4.47	5.30	1.31	2.29	1.384	1.540	1.638	1.850
-12	6.01	7.88	2.14	4.08	4.60	5.38	1.31	2.29	1.308	1.466	1.627	1.785
-11	6.28	8.04	2.21	4.30	4.49	5.35	1.23	2.23	1.399	1.502	1.801	1.929
-10	6.19	7.96	2.32	4.38	4.60	5.50	1.21	2.23	1.346	1.449	1.916	1.961
-9	6.15	7.89	2.19	4.27	4.52	5.45	1.12	2.13	1.362	1.448	1.963	2.006
-8	6.12	8.06	2.12	4.30	4.60	5.49	1.14	2.13	1.329	1.467	1.903	2.018
-7	6.21	8.06	2.14	4.32	4.57	5.35	1.11	2.11	1.360	1.508	1.933	2.046
-6	6.32	8.19	2.06	4.22	4.86	5.53	1.10	2.09	1.301	1.481	1.873	2.019
-5	6.17	8.12	1.97	4.14	4.81	5.54	1.04	2.07	1.281	1.466	1.884	2.005
-4	5.95	8.03	1.84	3.97	4.59	5.37	1.00	2.00	1.296	1.494	1.849	1.987
-3	5.91	8.06	1.81	3.87	4.60	5.42	0.99	2.03	1.284	1.487	1.828	1.908
-2	6.02	8.19	1.85	3.88	4.59	5.57	0.98	1.99	1.310	1.471	1.886	1.949
-1	7.15	9.05	2.56	4.88	4.59	5.50	0.97	1.98	1.558	1.645	2.645	2.463
0	7.27	9.57	2.40	4.86	4.60	5.51	0.95	2.00	1.581	1.738	2.512	2.426
1	7.13	9.44	2.32	4.86	4.43	5.36	0.91	1.89	1.609	1.761	2.547	2.574
2	7.32	9.57	2.34	4.89	4.40	5.37	0.90	1.86	1.664	1.782	2.593	2.626
3	7.73	10.02	2.63	5.25	4.37	5.26	0.86	1.83	1.768	1.905	3.051	2.867
4	7.47	9.71	2.44	4.96	4.43	5.25	0.96	1.95	1.684	1.849	2.549	2.540
5	7.71	9.81	2.55	5.04	4.46	5.29	0.93	1.93	1.727	1.855	2.731	2.611
6	7.49	9.45	2.37	4.88	4.34	5.18	0.89	1.88	1.725	1.825	2.677	2.591
7	7.29	9.23	2.62	4.70	4.24	5.09	0.79	1.82	1.720	1.812	3.310	2.585
8	7.29	9.27	2.23	4.62	4.38	5.16	0.81	1.85	1.664	1.798	2.743	2.502
9	7.23	9.21	2.15	4.54	4.55	5.35	0.85	1.90	1.586	1.722	2.531	2.388
10	7.28	9.30	2.15	4.56	4.54	5.30	0.83	1.88	1.605	1.754	2.589	2.426
11	7.41	9.37	2.22	4.67	4.54	5.34	0.85	1.89	1.632	1.754	2.595	2.467
12	7.43	9.26	2.27	4.56	4.57	5.39	0.86	1.93	1.628	1.719	2.628	2.364
13	7.37	9.32	2.23	4.72	4.43	5.23	0.89	1.93	1.665	1.782	2.502	2.450
14	7.73	9.59	2.39	4.91	4.53	5.42	0.97	2.09	1.705	1.769	2.465	2.349
15	7.80	9.84	2.45	5.01	4.71	5.51	0.93	2.05	1.657	1.785	2.621	2.450
16	7.79	9.69	2.44	4.91	4.60	5.36	0.84	1.93	1.691	1.806	2.915	2.538
17	7.59	9.52	2.25	4.77	4.58	5.34	0.82	1.88	1.659	1.783	2.737	2.535
18	7.50	9.50	2.28	4.74	4.63	5.31	0.85	1.94	1.618	1.789	2.697	2.448
19	7.57	9.58	2.30	4.78	4.47	5.17	0.73	1.79	1.705	1.851	3.135	2.673
20	7.7	9.77	2.39	4.88	4.50	5.27	0.74	1.81	1.714	1.856	3.238	2.701

MEAN RELATIVE OPTION PRICE --- IN THE MONEY SHORT



MEAN RELATIVE OPTION PRICE --- IN THE MONEY LONG

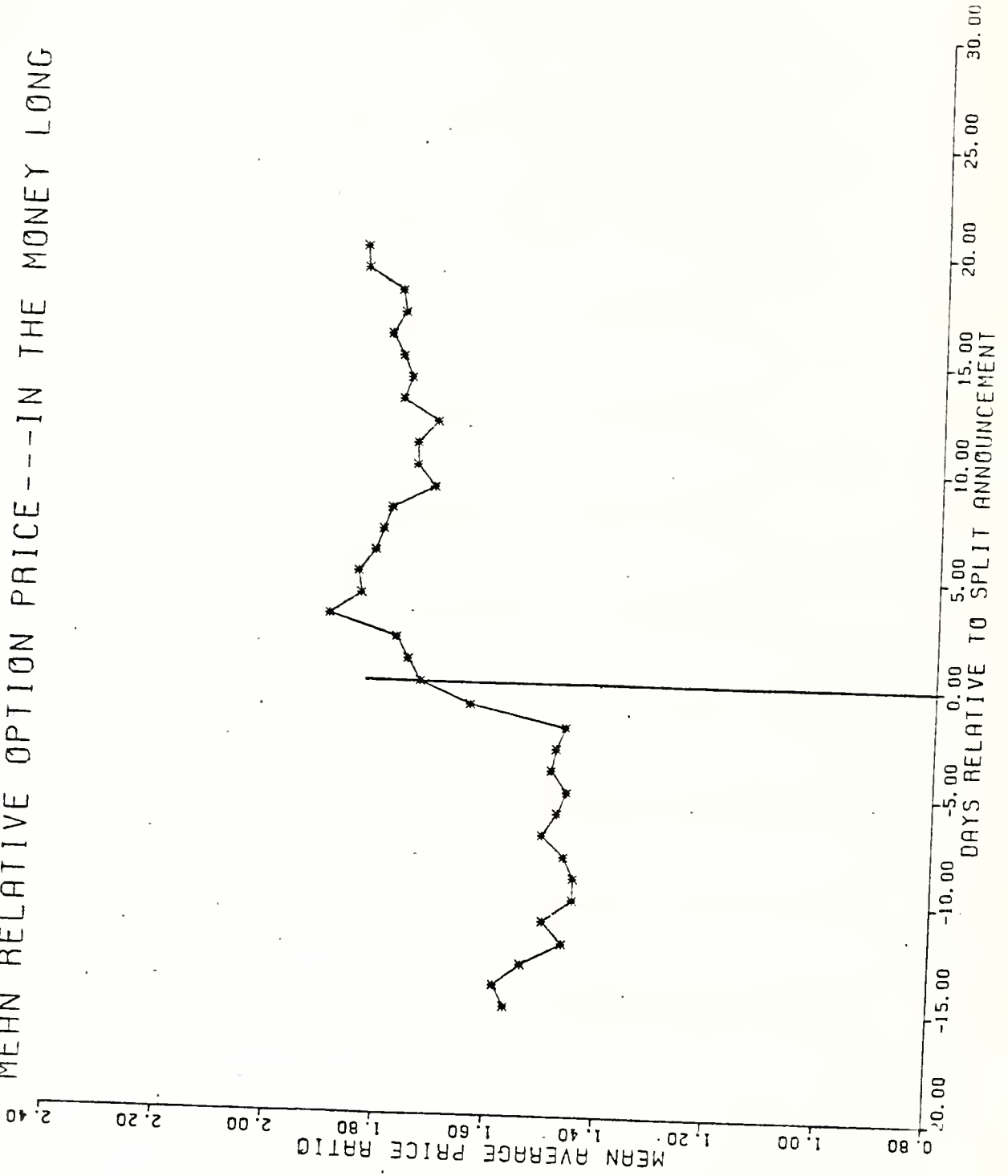
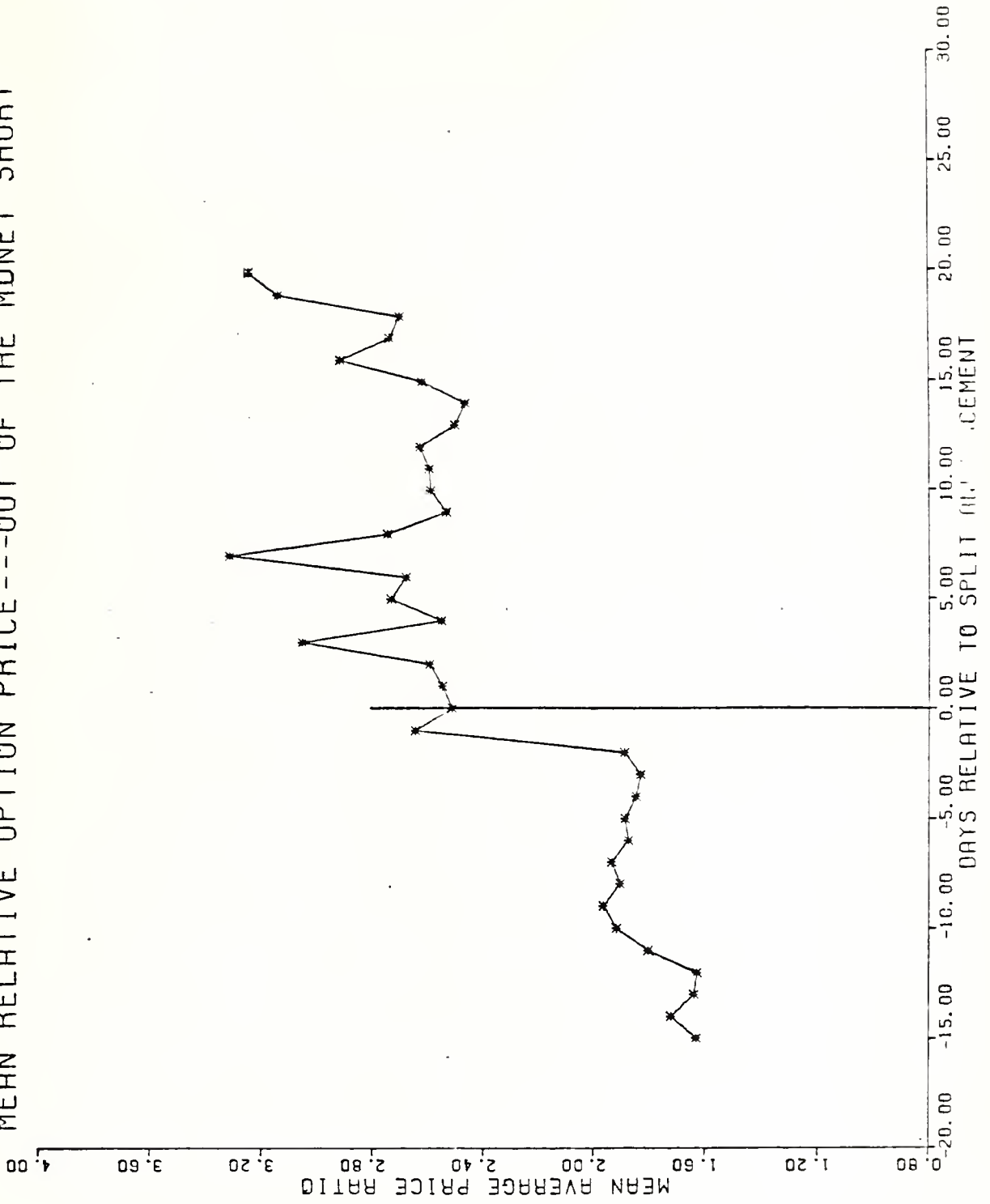
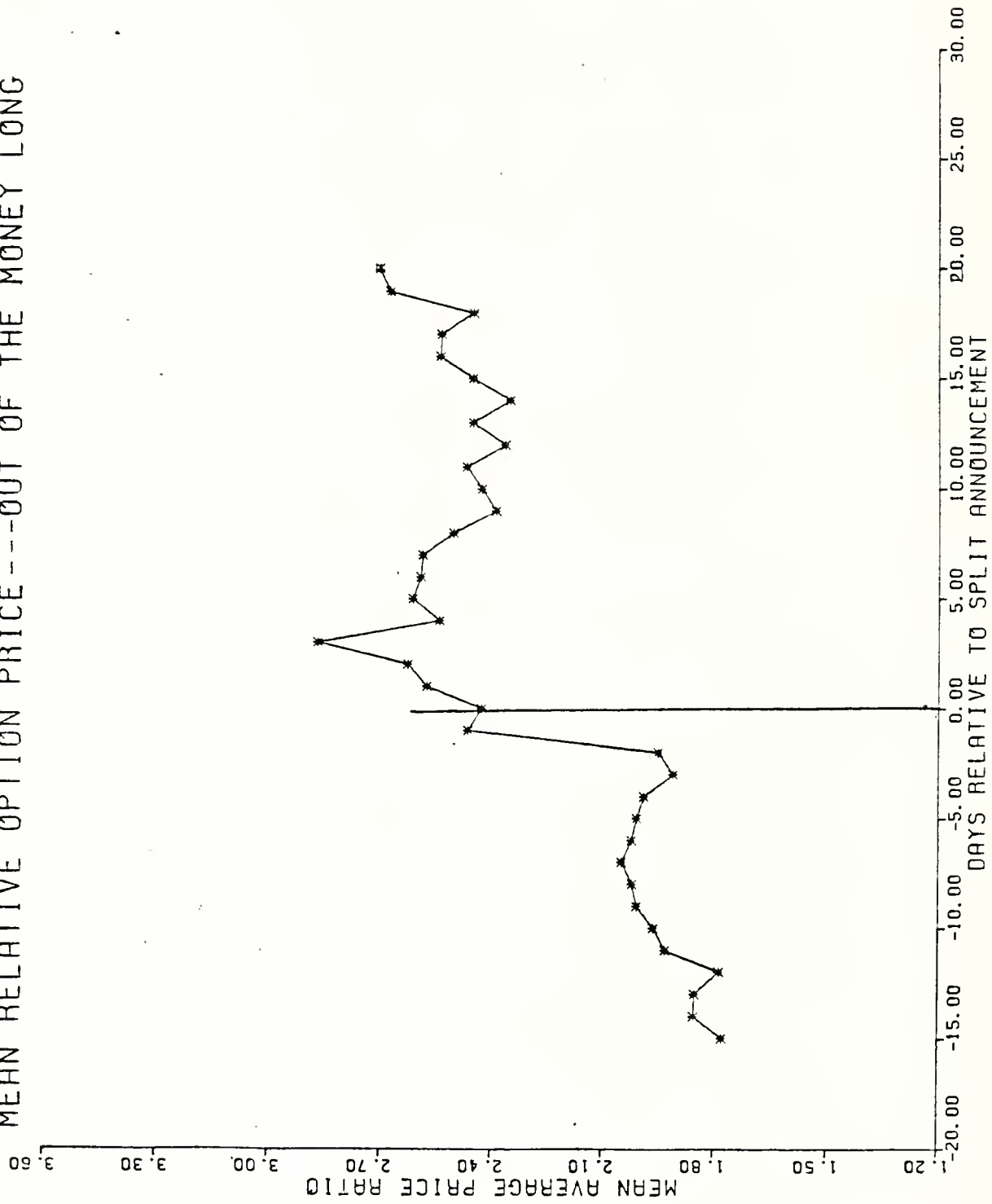


EXHIBIT 5

MEAN RELATIVE OPTION PRICE ---OUT OF THE MONEY SHORT



MEAN RELATIVE OPTION PRICE ---OUT OF THE MONEY LONG



It appears that these prices increased after the announcement, and generally maintained the relative price gain.

The mean relative option price series for in the money long options started at 1.569 and declined to 1.471 on day -2. During Day -1 it increased to 1.645 (12 percent) and peaked on Day +3 at 1.905 (16 percent above day -1). Subsequent values were lower but were consistently above any of the pre-announcement ratios. Again, the big increase occurred on day -1 and continued until day +3, followed by a small decline.

The mean relative option price series for short-term out of the money options (Exhibit 5) increased from 1.631 to 1.886 on day -2. On day -1 the ratio jumped to 2.645 (a 40 percent increase), followed by a small decline on day 0 and twin peaks on day +3 (3.05) and day +7. The ratio ended the period at 3.238 which was the second highest value. Clearly, the relative price performance of these options was quite superior for the period following the initial announcement on day -1 and after day 0.

The time series plot of the mean relative option price series for the long out of the money options (Exhibit 6) indicates that the big increase occurred on day -1, with the overall peak ratio on day +3. The increase on day -1 was 26 percent, while the increase from day 0 to day +3 was an additional 18 percent. The ending values were lower, but still above any pre-announcement values.

In summary, all the relative option price series indicate that the options of stocks that announce a split clearly outperform the options for a matched sample of stocks beginning on the day prior to the public

announcement in the WSJ. Typically, the peak relative option price occurs on day +3, with subsequent ratios above pre-announcement ratios.

Relative Option Volume Results

Table 3 contains the mean relative option volume (MROV) for the four types of options. The relative volume pattern for the in the money short options indicates that the major trading impact occurred on day 0. Note that the big price impact on day -1 was on lower volume than on day 0. These results indicate that the option trading activity was a consequence of the public announcement in the WSJ. The relative volume pattern for long in the money options likewise indicates a large increase in volume on day 0 followed by several days with comparable relative volume. In this case, it apparently took longer for the activity to return to the normal range. Notably, the volume on day -1 was above normal relative to prior days.

The relative volume for short out of the money options also likewise shows a sharp spike starting on day -1, peaking on day 0, and generally declining toward the pre-announcement volume by the 20th day.

Finally, the relative volume for the long out of the money options, indicates a spike starting with day -1, a peak on day 0 and the highest relative volume on day +3 followed by generally declining values. This is the only instance where volume on day +3 is the highest value. Strong volume on day +3 is consistent with the price series peaks on day +3.

In summary, relative volume always shows a definite increase on day -1 when the news comes over the Dow Jones News Service, followed by a clear peak (in three of the four cases) on the day of the public

TABLE 3

MEAN CROSS SECTION OF OPTION VOLUME

<u>Mean Average Volume</u>		<u>Split Set/Matched Set</u>			
Days Relative to the Announcement Day	Types of Options	In the	In the	Out of	Out of
		money short term option	money long term option	the money short term option	the money long term option
-15		.884	.477	.690	.649
-14		.666	.424	.723	.469
-13		1.058	.497	1.011	.589
-12		.823	.614	.613	.484
-11		1.179	.600	1.097	.764
-10		1.189	.576	1.237	.985
-9		.794	.398	1.006	.768
-8		.692	.467	.656	.749
-7		1.089	.491	.670	.566
-6		.983	.788	.885	.830
-5		.750	1.027	.749	.860
-4		1.315	.601	1.126	.685
-3		.834	.752	.918	.829
-2		1.346	.595	.889	.690
-1		1.458	1.469	1.730	1.119
0		2.055	1.429	2.307	1.402
1		1.580	1.371	1.732	1.268
2		1.426	.847	1.041	1.045
3		1.548	1.383	1.499	1.667
4		1.207	.944	.952	.965
5		.876	.716	.702	.807
6		1.095	1.399	1.393	.975
7		1.501	1.381	1.798	1.121
8		.983	.739	.900	.984
9		1.273	1.082	2.066	1.326
10		1.153	1.126	1.980	1.224
11		1.070	1.0587	1.972	1.267
12		.930	.765	1.337	.991
13		.762	.595	1.156	.902
14		.861	.793	1.574	.854
15		1.010	.823	.880	.984
16		1.327	1.351	1.795	1.159
17		.881	1.184	1.555	1.377
18		.801	.941	1.175	.758
19		.588	.891	1.212	.994
20		.724	.531	1.092	1.083

announcement. Typically, there is strong volume on day +3 followed by generally declining values somewhat above the pre-announcement values.

Results of Investment Tests

These tests indicate whether an investor could take advantage of the price movements in the options of stocks announcing splits. The analysis is in two parts. The first presentation considers the cumulative percent change for the various cross sectional series. The second part examines the specific returns to an investor who acquired the "typical" option during this period and paid commissions to buy and sell.

Table 4 part A contains the cumulative percent change figures for the four types of options and Exhibit 7 contains the plot of the four split-minus-match series assuming an investor acquired the options at the closing price on day 0.

The results for the short in the money options showed negative returns the first day, a peak cumulative value on day 3 of 6.305, one subsequent negative value and an ending value of 6.201. The matched sample results were not very good since all the relative values (split minus match) were better. The relative series was never negative, it peaked at 11.259 percent on day 3 and finished at over 8 percent. The unadjusted long in the money options had a peak value of 4.67 percent, followed by numerous negative returns and a final value of about 2 percent. The relative results peaked at 9.2 percent, only had two negative values and the ending cumulative value was 6.4 percent.

The short out of the money options experienced substantial volatility, numerous negative values, a peak of 9.5 percent and ended with

TABLE 4

MEAN CUMULATIVE PERCENT PRICE CHANGES FOR SPLIT OPTIONS UNADJUSTED AND ADJUSTED TO MATCHED OPTIONS

A. Purchase at Close of Announcement Day (Day 0)

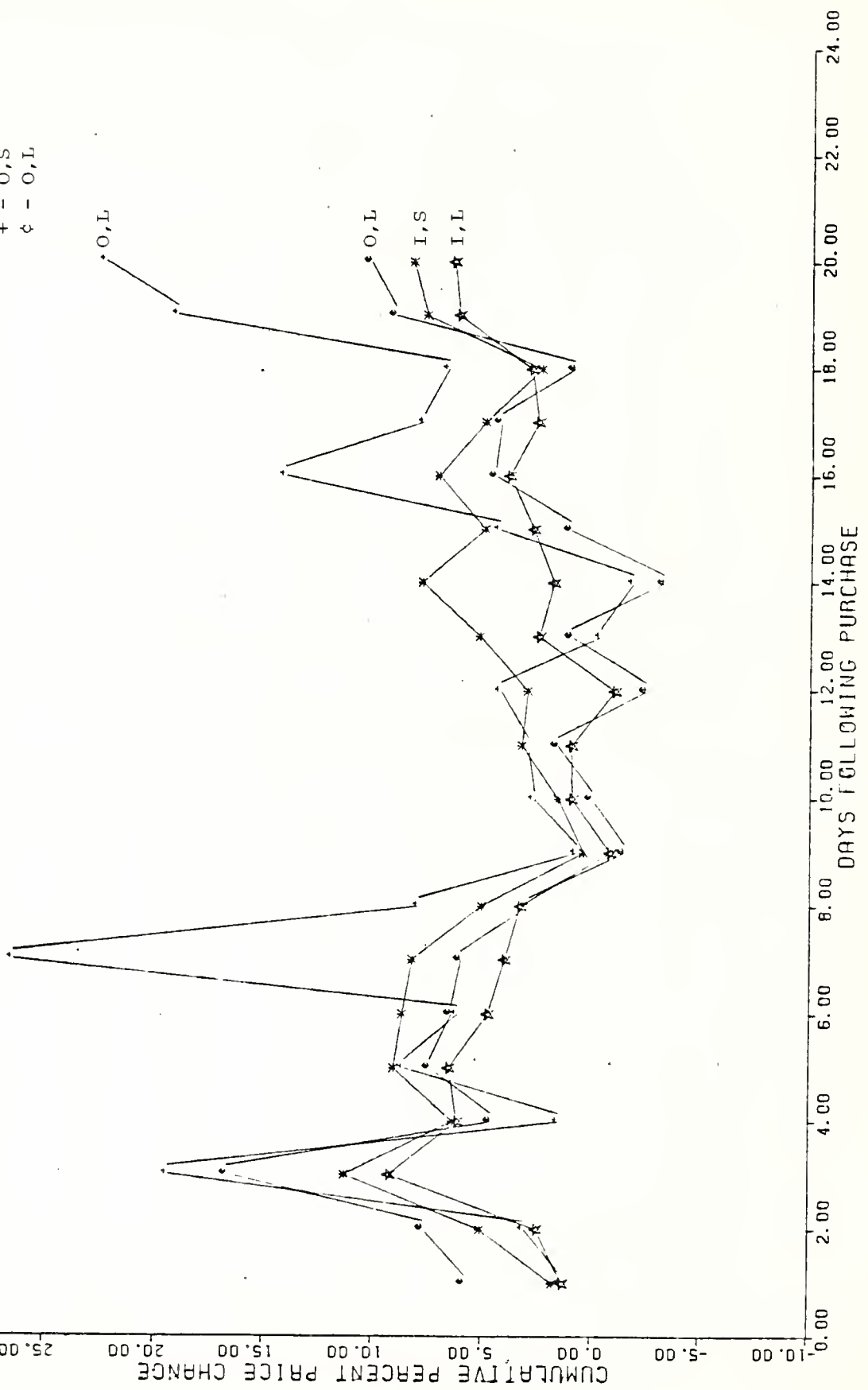
Close of Day	<u>I,S</u>		<u>I,L</u>		<u>O,S</u>		<u>O,L</u>	
	<u>Split</u>	Split minus	<u>Split</u>	Split minus	<u>Split</u>	Split minus	<u>Split</u>	Split minus
		<u>match</u>		<u>match</u>		<u>match</u>		<u>match</u>
1	-1.876	1.763	-1.346	1.315	-3.259	1.326	0.355	5.766
2	0.677	5.061	0.000	2.505	-2.421	3.036	0.665	7.637
3	6.305	11.259	4.671	9.212	9.497	19.323	8.075	16.607
4	2.736	6.331	1.465	6.122	1.676	1.458	2.174	4.567
5	6.071	9.008	2.573	6.487	6.331	8.515	3.815	7.353
6	3.048	8.616	-1.188	4.722	-1.117	6.088	0.444	6.375
7	0.261	8.152	-3.523	3.952	9.311	26.342	-3.327	5.934
8	0.234	5.013	-3.108	3.233	-6.797	7.832	-4.836	2.864
9	-0.599	0.365	-3.721	-0.864	-10.242	2.675	-6.610	-1.512
10	0.182	1.541	-2.771	0.908	-10.242	2.640	-6.034	0.002
11	1.902	3.217	-2.078	0.935	-7.542	2.938	-3.949	1.567
12	2.267	2.968	-3.246	-1.054	-5.214	4.174	-6.034	-2.496
13	1.407	5.133	-2.573	2.437	-7.169	-0.401	-2.795	0.951
14	6.305	7.752	0.277	1.764	-0.372	-1.901	0.976	-3.290
15	7.243	4.920	2.831	2.713	2.048	4.232	3.194	1.009
16	7.139	7.008	1.227	3.810	1.583	14.028	1.020	4.454
17	4.429	4.912	-0.534	2.518	-6.052	7.703	-1.730	4.201
18	3.127	2.381	-0.713	2.849	-4.749	6.605	-2.351	0.874
19	4.117	7.624	0.079	6.146	-4.097	19.047	-1.642	9.076
20	6.201	8.262	2.059	6.403	-0.372	22.335	0.532	10.210

B. Purchase at Close Day Before Announcement (Day -1)

Close of Day	<u>I,S</u>		<u>I,L</u>		<u>O,S</u>		<u>O,L</u>	
	<u>Split</u>	Split minus	<u>Split</u>	Split minus	<u>Split</u>	Split minus	<u>Split</u>	Split minus
		<u>match</u>		<u>match</u>		<u>match</u>		<u>match</u>
0	1.599	1.423	5.668	5.629	-6.446	-4.941	-0.354	-1.512
1	-0.307	3.162	4.246	6.869	-9.495	-3.473	0.000	4.316
2	2.287	6.503	5.668	8.135	-8.711	-1.829	0.309	6.204
3	8.005	12.792	10.604	15.107	2.439	13.622	7.692	15.166
4	4.378	7.804	7.216	11.836	-4.878	-3.588	1.813	3.076
5	7.767	10.534	8.387	12.264	-0.523	3.133	3.448	5.869
6	4.696	10.098	4.413	10.286	-7.491	1.111	0.088	4.931
7	1.864	9.593	1.945	9.385	2.265	20.544	-3.669	4.541
8	1.837	6.448	2.384	8.688	-12.805	3.109	-5.172	1.459
9	0.990	1.781	1.736	4.555	-16.028	-3.770	-6.941	-2.941
10	1.784	2.970	2.740	6.381	-16.028	-1.834	-6.366	-1.419
11	3.531	4.673	3.472	6.448	-13.502	-1.674	-4.288	0.133
12	3.902	4.429	2.238	4.392	-11.324	-0.571	-6.366	-3.945
13	3.028	6.586	2.949	7.922	-13.153	-4.981	-3.139	-0.507
14	8.005	9.279	5.961	7.410	-6.794	-6.794	0.619	-4.855
15	8.958	6.455	8.659	8.503	-4.530	-0.874	2.829	-0.539
16	8.852	8.545	6.965	9.510	-4.965	8.798	0.663	2.979
17	6.099	6.407	5.104	8.118	-12.108	2.946	-2.078	2.764
18	4.776	3.853	4.915	8.439	-10.889	1.800	-2.697	-0.591
19	5.781	9.119	5.752	11.782	-10.279	14.022	-1.989	7.695
20	7.899	9.788	7.844	12.151	-6.794	17.077	0.177	8.808

CUMULATIVE PERCENT PRICE CHANGE -- PURCHASE AT CLOSE OF ANNOUNCEMENT DAY

- * - I, S
- ★ - I, L
- + - O, S
- ¢ - O, L



a negative percent. In contrast, the relative results were 19 percent on day 3, had only two negative values and ended with a peak value of over 22 percent. The long out of the money options were likewise quite volatile and experienced numerous negative values. The relative series had only three negative values, a peak of 16.6 percent on day three, and an ending value over 10 percent.

Overall, the relative results were quite good. The peak cumulative percent generally occurred on day +3 and ranged from 9 percent to over 19 percent. For the total period there were few negative values and all the series ended with positive cumulative values. Comparing the four, it appears that the short in the money series is most conservative, while the short out of the money series has the most volatile set of returns.

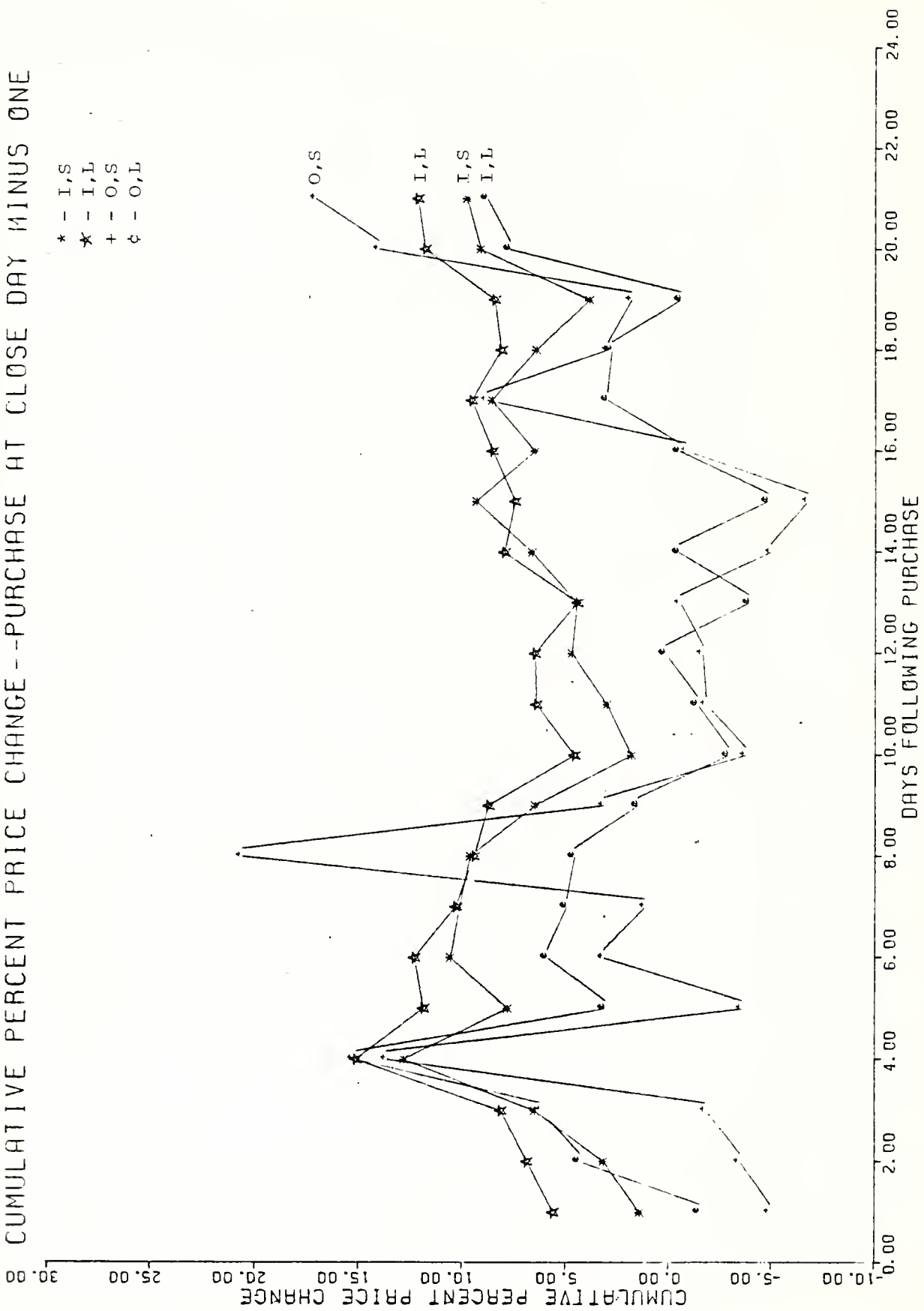
Table 4 part B contains the cumulative return series assuming an investor acquired the option at the close on day -1. As noted, this is clearly a possibility for an individual who watches the Dow Jones News Service or has a broker who watches it and informs the investor of the split announcement. Such an individual might be described as an aggressive investor. The series are plotted in Exhibit 8.

The results for the short in the money options indicated only one negative value, the series was over 8 percent on day 3, subsequently peaked near 9 percent and finished at nearly 8 percent. Relative to the matched sample, the peak on day 3 was almost 13 percent, there were no negative relative returns and the series ended at almost 10 percent.

The long in the money option series peaked at over 10 percent, was never negative and ended at almost 8 percent. For the relative series the peak was over 15 percent and it ended at over 12 percent.

CUMULATIVE PERCENT PRICE CHANGE --PURCHASE AT CLOSE DAY MINUS ONE

- * - I,S
- ★ - I,L
- + - O,S
- ¢ - O,L



Again, the short out of the money option series experienced substantial volatility. The unadjusted results had a negative cumulative value during 19 of the 21 days. The relative results were better, but still quite volatile with 11 negative values, as well as several large positive values ranging from 13 percent to 20 percent and ending at 17 percent.

The long out of the money options experienced several negative values, peaked on day +3 at about 8 percent and ended the period about even. The relative results peaked at 15 percent on day 3, had fewer negative values (8), and ended at 8.8 percent.

Again, the overall returns relative to the matched sample were good. Also, the in the money results were less volatile and experienced fewer negative results.

Table 5 contains the cumulative returns for the four types of options assuming the investor acquired the option at the close on day-2-- i.e., the day before the announcement was on the Dow Jones News Service. These results are implicitly unrealistic because they assume the investor apparently acts before any announcement. Still, these results are of interest because they provide a range of results for those who receive the news from the broad tape (i.e., the aggressive investor). The results in Table 5 assume the investor waits until the close of day -1 to buy. Obviously the investor would be able to buy somewhere between the close of day -2 and the close of day -1. Therefore, the realized rates of return for such an investor should be somewhere between the results in Table 5 and Table 6. The plot of the four relative series is in Exhibit 9.

TABLE 5

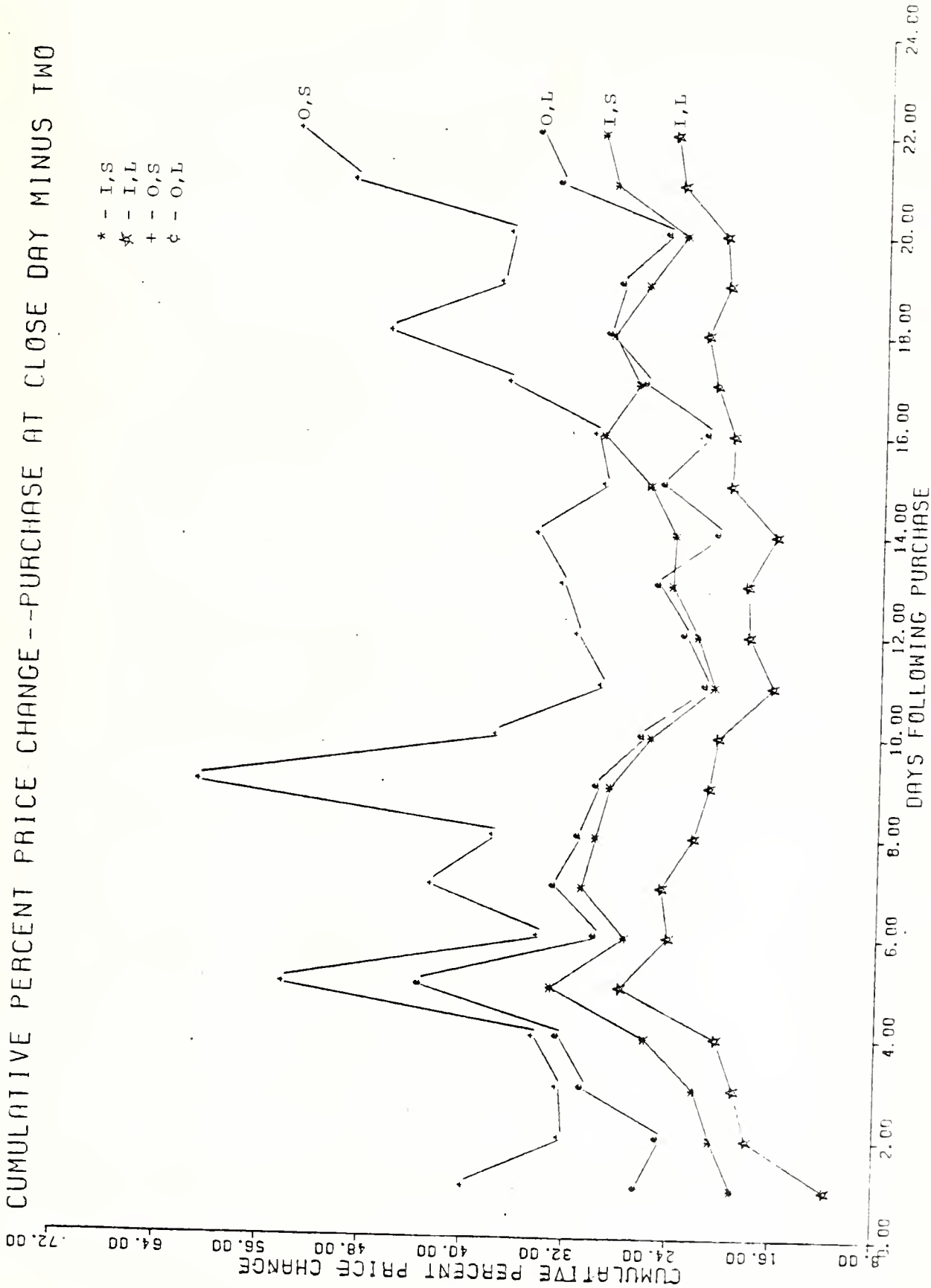
MEAN CUMULATIVE PERCENT PRICE CHANGES FOR SPLIT OPTIONS UNADJUSTED AND ADJUSTED TO MATCHED OPTIONS ASSUMING A PURCHASE AT THE CLOSE OF DAY MINUS TWO

	<u>I,S</u>		<u>I,L</u>		<u>O,S</u>		<u>O,L</u>	
	<u>Split</u>	<u>Split minus match</u>	<u>Split</u>	<u>Split minus match</u>	<u>Split</u>	<u>Split minus match</u>	<u>Split</u>	<u>Split minus match</u>
Close of								
Day -1	18.935	18.978	10.594	11.717	38.147	39.630	25.597	26.225
0	20.836	20.704	16.863	17.947	29.242	32.208	25.153	24.630
1	18.569	22.081	15.290	19.007	25.030	32.445	25.597	30.513
2	21.655	25.913	16.863	20.425	26.113	34.376	25.986	32.471
3	28.455	33.284	22.322	27.897	41.516	54.016	35.258	43.313
4	24.142	27.610	18.515	24.266	31.408	34.162	27.873	29.756
5	28.172	30.981	19.870	24.826	37.425	42.510	29.928	32.961
6	24.520	29.963	15.475	22.405	27.798	37.755	25.708	31.147
7	21.151	28.921	12.746	21.224	41.276	60.767	20.988	29.775
8	21.120	25.773	13.232	20.587	20.457	37.618	19.100	26.318
9	20.112	20.946	12.514	16.425	16.005	29.564	16.880	21.482
10	21.057	22.286	13.625	18.348	16.005	31.471	17.601	23.145
11	23.135	24.320	14.434	18.499	19.495	32.630	20.211	25.232
12	23.575	24.146	13.070	16.322	22.503	34.579	17.601	20.635
13	22.536	26.136	13.856	19.896	19.976	29.510	21.655	24.987
14	28.455	29.772	17.187	19.742	28.761	30.244	26.374	21.563
15	29.589	27.130	20.171	21.139	31.889	36.974	29.150	26.431
16	29.463	29.199	18.297	21.937	31.288	46.330	26.430	29.359
17	26.188	26.540	16.239	20.342	21.420	37.734	22.987	28.427
18	24.614	23.736	16.031	20.638	23.105	37.088	22.210	24.930
19	25.811	29.191	16.956	24.041	23.947	49.371	23.098	23.349
20	28.329	30.261	19.269	24.650	28.761	53.761	25.819	35.024

EXHIBIT 9

CUMULATIVE PERCENT PRICE CHANGE -- PURCHASE AT CLOSE DAY MINUS TWO

- * - I, S
- * - I, L
- + - O, S
- ◊ - O, L



The results in Table 6 are very encouraging. The short in the money option series ranges from 18 percent to 29 percent and is 28.4 percent on day 3. The relative series ranges from 18 to 33 percent and peaks at 33.3 percent on day 3. The results for the other types of options are similar, with the only difference being the value on day 3. The long in the money series is 22 percent (28 percent relative); the short out of the money series is 41 percent (54 percent relative); while the long out of the money series is 35 percent (43 percent relative). In this instance, the higher volatility is advantageous.

In summary, these high return results are somewhat unrealistic since they assume prior information. Still when they are combined with the results in Table 5, they indicate a range of possible returns for an aggressive investor.

Realistic Returns on a "Typical" Investment

Because the prior results indicated positive cumulative returns on day 3, this section presents the results for a investor who is assumed to acquire a typical option contract on day 0, -1, or -2 and sell the option on day +3 paying commissions on both the purchase and the sale at a rate derived from a broker.⁵

The results in Table 6 part A, which assumed the purchase and sale of one contract were initially surprising to the authors who were confident that there would be positive net returns in most instances because the cumulative percent changes on day +3 were typically in the range of 6

⁵The commission rate used is fairly conservative, given the range of commission schedules in existence.

TABLE 6

COSTS AND RETURNS FOR AN INVESTOR WHO ACQUIRED ALTERNATIVE
OPTION CONTRACTS AND SOLD ON DAY THREE

A. Position = 1 Contracts

(Commission = \$24 plus 1% of value of Contract)

Type of Option	Buy on Day	Split Options			Matched Sample Options		
		Orig. Price + Comm.	Net \$ Result	% of Cost	Orig. Price + Comm.	Net \$ Result	% of Cost
I,S	0	758.27	-17.00	-.022	488.60	-79.97	-.164
I,S	-1	746.15	-4.88	-.006	487.59	-78.96	-.162
I,S	-2	632.02	109.25	.173	487.59	-78.96	-.162
I,L	0	990.57	-22.59	-.023	580.51	-83.77	-.144
I,L	-1	938.05	29.93	.032	579.50	-82.76	-.143
I,L	-2	851.19	116.79	.137	586.57	-89.83	-.153
O,S	0	266.40	-30.03	-.113	119.95	-58.81	-.490
O,S	-1	282.56	-46.19	-.164	121.97	-60.83	-.499
O,S	-2	210.85	25.52	.121	122.98	-61.84	-.503
O,L	0	514.86	-19.11	-.037	226.00	-68.83	-.305
O,L	-1	516.88	-21.13	-.041	223.98	-66.81	-.298
O,L	-2	415.88	79.87	.192	224.99	-67.82	-.301

B. Position = 2 Contracts

(Commission = \$24 plus 1% of value of Contract)

Type of Option	Buy on Day	Split Options			Matched Sample Options		
		Orig. Price + Comm.	Net \$ Result	% of Cost	Orig. Price + Comm.	Net \$ Result	% of Cost
I,S	0	1,492.54	14.00	.009	953.20	-111.94	-.117
I,S	-1	1,468.30	38.24	.026	951.18	-109.92	-.116
I,S	-2	1,240.04	266.50	.215	951.18	-109.92	-.116
I,L	0	1,957.14	2.82	.001	1,137.02	-119.54	-.105
I,L	-1	1,852.10	107.86	.058	1,135.00	-117.52	-.104
I,L	-2	1,678.38	281.58	.168	1,149.14	-131.66	-.115
O,S	0	508.80	-12.06	-.024	215.90	-69.62	-.323
O,S	-1	541.12	-44.38	-.082	219.94	-73.66	-.335
O,S	-2	397.70	99.04	.249	221.96	-75.68	-.341
O,L	0	1,005.72	9.78	.010	428.00	-89.66	-.210
O,L	-1	1,009.76	5.74	.006	423.96	-85.62	-.202
O,L	-2	807.76	207.74	.257	425.98	-87.64	-.206

to 15 percent. These results indicate the importance of the commissions which seriously affect all contracts, but which are especially burdensome on the low priced out of the money options. For example, the typical short in the money option was assumed to be priced at \$7.27 on day 0 (see Table 2) causing the commission on the purchase to be \$31.27 (\$24 plus 1 percent of \$727) for a total value of \$758.27. Clearly, this commission of 4.3 percent on the purchase and a similar commission on the sale meant that although the option increased by over 6 percent during the three days, the net dollar result was negative. The results were generally negative for all purchases on day 0 or day -1 (except for the long in the money option). Note that, even with the heavy commissions, all the purchases at the close of day -2 resulted in positive rates of return. As noted, assuming the potential return for an aggressive investor is somewhere between the returns for day -1 and day -2, it appears that many of these investors would have experienced positive returns in spite of the heavy commissions on one contract. Also these realistic returns are substantially above those available on the matched sample stocks options where all the returns were negative and ranged from -14 percent to -50 percent. Obviously, because of the heavy fixed component of the commission (\$24), the low price out of the money options suffered most.

To show the impact of the commission, Table 7, part B contains results similar to part A except that in all cases the investor is assumed to acquire two contracts. Although this requires an increase in capital, it reduces substantially the relative impact of the commission.

With this assumption, almost all the returns become positive irrespective of when the investor makes the purchase--even at the close on day 0. Assuming one acquires an option at the close on day -1, the returns for in the money options are about 3 to 6 percent. Finally, assuming an aggressive investor buys the option prior to the close on day -1, the apparent returns are rather large for a short run investment. Specifically, the ranges are as follows:

Short In the Money	.026 to .215
Long In the Money	.058 to .168
Short Out of the Money	-.082 to .249
Long Out of the Money	.006 to .257

Apparently the downside risk is rather minimal. The major concern is the upside opportunity, which depends upon how fast one can acquire the option after the announcement on the broad tape. As before, the short out of the money option loses money only because of its low price and the commission included. It can be determined that all the option types become profitable for all days if one assumes a purchase of 27 contracts.

SUMMARY AND CONCLUSION

Summary

A prior study indicated that investors could not derive abnormal rates of return by acquiring the stock of companies that announced stock splits. Apparently the prices adjusted quite fast and the size of the price change was not large enough to provide abnormal returns after taking account of commissions. This study examined whether one can derive abnormal returns by acquiring the options of stocks when the company announces a stock split.

The sample included all stocks on the NYSE that split and had options available on one of the exchanges. Each company was matched with another from a similar industry, comparable betas for the underlying stock, and the options were on the same expiration cycle. When possible four types of options were examined--a short and long term in the money option and a short and long term out of the money option. The analysis considered the 36 day period from 15 days prior to the announcement to 20 days following the announcement.

The price and volume results for the underlying stocks were similar to the prior study--i.e., the major price change occurred on day -1 and day 0. The major volume change came on day 0.

The relative option price results were quite consistent. The biggest price move always occurred on day -1. The price changes on day 0 were mixed depending on the type of option. Typically, the peak price occurred on day +3. Notably the subsequent price action continued strong and the option price series always ended the test period above the pre-announcement values. The relative volume results generally showed peak values on day 0 with some tapering off afterwards.

The investment results indicated very profitable opportunities. The cumulative percent changes that assumed purchases on day 0 and day -1 were typically profitable, assuming a sale on day 3, and they were better when related to the matched sample. The results assuming a purchase on day -2 were always quite good. These results are important because they provide a range of returns for aggressive investors who can buy before the close on day -1.

The final analysis examined the potential returns for an investor who acquired the "typical" option on day 0, -1, and -2 and paid the full commission. The results assuming the purchase of one contract generally indicated negative returns for day 0 and day -1, due to the high fixed component of the commission. Assuming the purchase of two contracts, almost all the returns were positive and the range for the aggressive investor who could buy during day -1 were quite good--i.e., the mean of the range generally exceeded a 10 percent return in four days. An analysis of individual trades in the case of a purchase on day -1 and sale on day +3 indicated that typically most of the individual trades were profitable, but the major difference came because of the large positive gains and smaller losses--the range of gains always exceeded 100 percent while the losses range exceeded 70 percent.

Conclusion

The results are encouraging for aggressive investors with the opportunity to learn of split announcements early and acquire option positions quickly. Apparently the downside risk is minimal and the short-run returns can be quite good. Given the information requirements and the time constraints, this might be considered to be evidence against the semi-strong efficient market hypothesis. For the typical investor who would not buy options until day 0, the returns may still be slightly positive after commissions, but the risk may also be somewhat higher.

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