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Calls of Warrants: Timing and Market Reaction

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ABSTRACT

This paper examines the timing of, and reaction to, calls of callable warrants. Three main findings emerge. First, unlike convertible bonds or preferred stock, callable warrants are called almost as soon as possible. Second, there is a negative price reaction of about 3 percent when a call is announced. Finally, at the completion of a call, the stock price rebounds by an average of 7 percent. The total reaction from announcement through completion of the call is a positive excess return of about 4 percent.

SINCE 1980, SEVERAL HUNDRED firms have issued callable warrants. Typically, these warrants become callable only after a predetermined date and only when the price of the underlying stock exceeds a minimum price for a prespecified number of days. If the company then calls, warrantholders are allotted a notice period (usually 30 days) to decide whether to exercise their warrants or accept a nominal call price.

This paper is the first to study market reaction to calls of warrants and to see if firms delay calls. The results indicate that warrants are called almost as soon as exercise can be forced. At the announcement of a call, stock prices fall about 3 percent. However, they rebound by about 7 percent around the last day that warrants can be exercised. Because this date is known in advance, this result is not expected in an efficient market.

The investigation of calls of warrants may provide insights into calls of convertible bonds and preferred stock. Both calls of warrants and calls of convertibles transfer wealth to stockholders by reducing the life of the other securityholder's options. So, if management tries to maximize shareholder wealth, management's incentive to call warrants may resemble their incentive to call convertible securities.[1] However, in contrast to the results pre-

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[1] Of the 116 warrants in the sample, 91 were issued as part of a unit in an initial public offering. Hence many warrants were owned by shareholders. However, all the warrants were detachable before they were called. In addition, management, venture capitalists, and others who held stock prior to a firm's initial public offering almost never held callable warrants. So, while many of the warrants issued by sample firms were held by shareholders, typically only a small portion of shares were held by warrantholders.

sented here, Ingersoll (1977) reports that firms typically delay calling convertibles for years.

The remainder of this paper is organized as follows. Section I describes the data used here. Empirical results are presented in Section II. Lastly, Section III summarizes the results on the timing of, and market reaction to, calls of warrants.

I. Data

Called warrants and potentially callable warrants are identified using the *R.H.M. Survey of Warrants, Options and Low Price Stocks*.[2] To assemble the sample of called warrants, news announcements from each week's *R.H.M. Survey* from 1980 through 1989 are searched for calls, redemptions, or accelerated expirations.[3] The announcements in the *R.H.M. Survey* provide the call completion date (the last date that the warrants can be exercised). However, the call is usually public knowledge well before it appears in the *R.H.M. Survey*. Most call announcement dates are obtained from *The Wall Street Journal* or the Dow Jones News Retrieval Service. Because most of the sample warrants were issued by small over-the-counter firms, precise announcement dates are not found for 14 of the 81 warrant calls. Hence, in the empirical work to follow, a "completion sample" of completed calls is used in examining returns around the last possible exercise dates while a smaller "announcement sample" is used to examine returns at the announcement.

The sample of warrants that could have been called but were not is collected by first recording the call provisions of the 489 callable warrants that appeared in the *R.H.M. Survey* from the end of 1980 through the end of 1988. The Daily Master and NASDAQ tapes from the Center for Research in Securities Prices (CRSP) are then used to determine which stocks underlying the warrants reached the minimum prices needed to allow a call. In many cases, the warrant agreement specifies the minimum stock price that had to be exceeded before a call could take place. For other warrants, the minimum stock price required for a call is assumed to be the minimum price that would induce warrantholders to exercise rather than accept the call price. A total of 116 warrants issued by 111 firms are found to be callable at some point in their lives. All potentially callable warrants are double-checked for calls using the Dow Jones News Retrieval Service.

Panel A of Table I provides summary characteristics for the final sample. Of the 116 warrants, 107 traded over the counter when called. The majority, 91 of 116, were issued as part of an initial public offering. As of December 31,

[2] Noreen and Wolfson (1981), and Lauterbach and Schultz (1990) also use the *R. H. M. Survey* as a source of information on warrants.

[3] Warrant redemptions are indistinguishable from warrant calls. Many prospectuses contain phrases like "when the callable warrants are redeemed" or "the company may call the redeemable warrants if. . . ." Warrants that allow the company to accelerate expiration are equivalent to callable warrants with a call price of zero.

Table I

The Sample of Warrants That Were Called or Fulfilled Requirements to be Called

The sample of called warrants is assembled from announcements of calls, redemptions, or accelerated expirations reported in the *R. H. M. Survey of Warrants, Options, and Low Price Stocks* from 1980 through 1989. Warrants that could have been called but were not are identified by first examining the call provisions of all of the 489 callable warrants that appeared in the *R. H. M. Survey* over 1980 through 1988. The CRSP tapes are then used to see if underlying stocks met the criteria for a call.

Panel A: General Characteristics of the Sample

	Warrants
Total sample	116
Underlying stock traded over the counter	107
Issued as part of an initial public offering	91
Issued with a later stock issue or given to shareholders	25
Total called as of 12/31/1988	81
Called in	
1983	5
1984	10
1985	8
1986	20
1987	19
1988	11
1989	8

Panel B: Characteristics of Call and Exercise Provisions of Warrants Included in the Sample

	Call Price Divided by the Exercise Price	Minimum Stock Price for a Call Divided by the Exercise Price	Number of Days Stock Must Remain Above Minimum Price
Number of observations	113	58	54
Maximum	2.000	3.00	60
75th percentile	0.100	1.56	30
Median	0.044	1.48	30
25th percentile	0.018	1.28	15
Minimum	0.000	1.00	5

1988, only 35 of the 116 warrants that could have been called were still outstanding. The other 81 were called between 1983 and 1989.

Panel B of Table I describes call and exercise provisions for sample warrants. The median ratio of the call price to the exercise price is 4.4 percent. For approximately half the warrants in the sample, warrant agreements require that the underlying stock price exceed a minimum level for a specified number of days before a call. The third column of Panel B shows the distribution of ratios of required minimum prices to the exercise prices. Most of these warrants are required to be in the money by 30 to 60 percent before a call can take place. As shown in the last column of the table, most warrants

with this kind of agreement must exceed the minimum price for 20 to 30 days before a call is permitted.

II. Results

A. Are Warrants Called as Soon as Exercise Can Be Forced?

For 77 of the 81 eventually called warrants in the sample, there is sufficient information to determine exactly when a call was first possible. The timing of calls is also examined for the 35 warrants that could have been, but were not called. In either case, if the underlying stock price had to exceed a minimum level for a specified period before a call could take place, the CRSP tapes are searched for the first date after the warrant's issue that the stock price meets the criteria for a call. The following day is considered the first possible call date. If no minimum stock price is required for a call, the first possible call date is the day after the stock price first exceeds the exercise price by more than the call price.[4]

The timing of calls is described in Table II. Panel A covers the 42 warrants with a minimum stock price requirement that were called. As the first column shows, the median firm's stock price at completion exceeds its price on the first possible call date by only 3 percent. In contrast Ingersoll (1977) finds that the median firm in his sample waits to call bonds until the conversion value of the bonds exceeds the minimum price to force conversion by 43.9 percent. As the next column shows, the median firm allows only 38 trading days to pass from the time its warrants first became callable until the firm receives the proceeds from the warrant exercise. Four of the warrants have a time from the first possible call to the completion of the call that is equal to zero. These firms complete their calls on or before the date the CRSP tapes indicate is the first date that the requirements of their warrant agreements were completely met.[5]

The next two columns of Panel A are similar to the first two except that the stock price at the first possible call date is compared to the price at the announcement of a call, and the timing of the call is measured from the first possible call date to the announcement. Because the precise announcement date cannot be found for all firms, the number of observations declines from 42 to 36. For these 36 firms, the median time from the date that the warrant first becomes callable until a call is announced is only 14 days. If a firm

[4] In some cases the prospectus did not explicitly state how exercise provisions would change if the stock split. In these cases, if the stock split say, 2 for 1, warrantholders were assumed to then be able to buy twice as many shares for half the price.

[5] For example, Medical Imaging's stock price had to exceed \$7.50 for 30 consecutive days before they were allowed to call their warrants. However, their stock price exceeded \$7.50 for only 28 days prior to their warrant call. Similarly, a condition for Molecular Biosystem to be able to call their warrants was that the bid price of their stock exceed \$5 for 30 days. Before the call, the bid price of their stock was equal to or exceeded \$5 for 30 days, but was not strictly greater than \$5 for the required period. These apparent discepancies may result from CRSP using inside closing quotes while warrant agreements may be satisfied by intraday quotes.

announces their intention to call in the near future and the conditions for a call have not been met, the warrant is recorded as having less than zero days from the first possible call date to the call announcement.

Panel B characterizes calls of warrants that do not have a required minimum price for a call. The last column shows that the median firm waits 61 days from the first time the warrant is in the money by more than the call price until a call is announced. For the median firm, the announcement date stock price is only 5 percent above the stock price at the first possible call. This does not mean the stock price for the median firm exceeds the warrant exercise price by only 5 percent. Some of the warrants cannot be called for a specified period. Stocks underlying these warrants can be well above their exercise prices at the first possible time for a call.

Panel C describes the 16 warrants that met minimum price requirements for a call but were not called. For the median firm, the maximum price reached by the stock over the warrant's life exceeded the minimum price requirement for a call by 28 percent. The median firm's stock exceeded the minimum price for 65 days while the median number of days from the first possible call to the option's expiration was 287 days.

Panel D examines the 19 warrants that had no minimum stock price for a call and were in the money at some point in their lives but were not called. For the median firm, the warrant was in the money by a maximum of 38 percent and it was in the money for 88 days. Some of the 35 warrants in Panels C and D clearly could have been called, but many were only callable for a brief period, or were only slightly in the money.

To summarize, Table II shows that, as a rule, warrants are called almost as soon as possible. More than two-thirds of all warrants that met requirements for a call were called. Warrants were usually called within days of the time that they were first callable. Many of the warrants that were not called were only in the money for short periods of time.

Warrants are called promptly even though firms have incentives to delay calling in some cases. Usually, warrantholders have a 30-day notice period after a call announcement to decide to exercise their warrants or take the call price. For warrants that become callable after the stock price exceeds a minimum price, the difference between the minimum price and the exercise price insures that the warrant will remain in the money until exercise. However, it is also assumed in Table II that warrants with no minimum stock price required for a call should be called as soon as they are in the money by more than their call price. However, normal stock price fluctuations over the notice period can lead firms to delay enough to insure exercise.[6]

Table II's description of delays in calling warrants also ignores step-up exercise prices. These are exercise prices that increase the warrant's life. For example, Learning Annex warrants purchased 1 share of stock for $2.50

[6] Some of these warrants are only callable after a specified date. These warrants may be in the money when they first become callable.

through August 26, 1986, and at $3.50 thereafter. Of the 77 called warrants described in Table II, 7 had step-exercise prices, and the time from the first possible call to the completion exceeded the median for all 7 of these warrants. These firms may have rationally delayed calling in order to force exercise at the higher price. In 4 of these cases, the stock price was never high enough to force exercise at the highest price. Of the 35 warrants in Table II that could have been called but were not, 6 had step-up exercise prices. Two of these warrants were never exercisable at the highest exercise price.

Table II

The Timing of Calls of Warrants

Stock prices at the announcement and completion of calls are compared with prices at the time a call was first possible for 77 firms that called warrants over 1983 to 1989. The distribution across firms of the time from the first possible call to the announcement and completion of a call are described. For 35 firms that could have, but did not call warrants over 1983 to 1989, the maximum stock price reached over the period of a possible call is compared with the minimum price needed for a call.

Panel A: Warrants that were called where the stock had to exceed a specified minimum price for a given time period before a call was permitted.

	Stock Price at the Call Completion Divided by Stock Price at First Possible Call[a]	Number of Trading Days from First Possible Call to Completion	Stock Price at Call Announcement Divided by Stock Price at First Possible Call	Number of Trading Days from First Possible Call to Announcement
Maximum	2.79	342	2.79	243
75th percentile	1.15	103	1.10	83
Median	1.03	38	1.00	14
25th percentile	0.87	20	0.87	0
Minimum	0.59	0[b]	0.61	< 0
Number of observations	42	42	36	36

Panel B: Warrants that were called where there was no contractual minimum stock price required to permit a call. The first possible call date is assumed to be the first date after the stock closes at a price that would lead to voluntary exercise if the warrants were called.

	Stock Price at the Call Completion Divided by Stock Price at First Possible Call[a]	Number of Trading Days from First Possible Call to Completion	Stock Price at Call Announcement Divided by Stock Price at First Possible Call	Number of Trading Days from First Possible Call to Announcement
Maximum	2.41	511	2.52	490
75th percentile	1.32	143	1.31	122
Median	1.17	91	1.05	61
25th percentile	1.00	28	0.91	1
Minimum	0.58	0[c]	0.43	< 0
Number of observations	35	35	28	28

Table II—*Continued*

Panel C: Warrants that exceeded contractual minimum stock prices requirements for a call for the required period but were not called.

	Maximum Price Reached by the Stock Divided by the Stock Price Required for a Call	Number of Trading Days the Stock Price Exceeded the Minimum Needed for a Call	Number of Trading Days from the First Possible Call to the Last Observation
Maximum	3.49	209	636
75th percentile	2.06	142	425
Median	1.28	65	287
25th percentile	1.11	19	100
Minimum	1.00	1	22
Number of observations	16	16	16

Panel D: Warrants with no contractual minimum stock price required for a call that were in the money but were not called.

	Maximum Price Reached by the Stock Divided by the Stock Price Required for a Call	Number of Trading Days the Stock Price Exceeded the Minimum Needed for a Call	Number of Trading Days from the First Possible Call to the Last Observation
Maximum	5.56	631	1636
75th percentile	2.00	298	692
Median	1.38	88	566
25th percentile	1.16	33	159
Minimum	0.96	0	91
Number of observations	19	19	19

[a] If the stock is required to exceed a minimum price for a specified number of days before a call is permitted, the first possible call date is the day after the date on which that requirement is met. If there is no minimum stock price specified for a call, the first possible call date is the day after the first date on which the difference between the stock price and the exercise price exceeds the call price.

[b] The minimum number of trading days from call to completion is equal to zero because four warrants were called before the CRSP tapes record that they meet the exact requirements for a call. Medical Imaging warrants were callable if the price of the underlying stock exceeded \$7.50 for 30 consecutive days. The price of the stock appears to have exceeded \$7.50 for only 28 consecutive days before the call. Similarly, Molecular Biosystems bid price was required to exceed \$5 for 30 consecutive days, but was only greater than or equal to \$5 for the specified period. Senior Service warrants were callable if the bid price exceeded \$4.50 for 30 consecutive days. According to CRSP, the bid was only greater than or equal to \$4.50 for 28 days. Summit Technology stock had a bid price in excess of the \$3.40 specified minimum for only 15 of 30 days.

[c] Three warrants were called despite never reaching a stock price large enough to force exercise. American Kefir announced a reduction in the exercise price of their warrants from \$2.50 to \$0.75 at the same time that they announced the call. Clinitherm similarly reduced the price of their warrants from \$2 to \$1 on the day that they announced a call of their warrants. Network Video's call took place when their stock price was significantly below the exercise price of their warrants, but no announcement of a decrease in exercise price was found. This was the only case where warrants were called when the stock price was below the exercise price and no announcement of a lowered exercise price was found.

B. A Comparison of the Timing of Calls of Warrants With Calls of Convertibles

One reason why warrants are usually called on time while calls of convertibles are usually delayed may be that firms view cash received from exercise of warrants as a source of financing. Three of the warrants described in Panel B of Table III were called while the stock price was below the exercise price. In one case, American Kefir simultaneously announced a call and a reduction in their warrant's exercise price from \$2.50 to 75 cents. Another firm, Clinitherm, lowered the exercise price of their warrants from \$2 to \$1 at the call announcement. Similarly, of the 81 calls, 8 were extended to give warrantholders more time to exercise. In 7 of these cases the stock price was significantly above the exercise price of the warrants for the entire notice

Table III

Excess Returns around Calls of Warrants

Estimated expected returns for stock i on day t are given by

$$E(R_{it}) = \alpha_i + \beta_i^{-1}R_{m,t-1} + \beta_i^{0}R_{m,t} + \beta_i^{1}R_{m,t+1} + \epsilon_{it}$$

where R_{mt} = the CRSP equally weighted over-the-counter index return on day t.

The sample consists of 64 calls of warrants listed in the *R. H. M. Survey of Warrants, Options, and Low Price Stocks* over 1983 to 1989 that were announced in *The Wall Street Journal* or by the Dow Jones News Retrieval Service. For listed stocks, the CRSP equally weighted listed index is used. Parameters are estimated using the 250 days starting 51 days after the completion of the call. Excess or abnormal returns are obtained by subtracting expected returns from observed returns.

Panel A: Returns around the call announcement. Observations include 64 stocks.

Date Relative to Announcement	Mean Excess Return	t-Statistic	Proportion of Excess Returns That Are Positive	t-Statistic for Proportion of Positive Returns[a]	Mean Cumulative Excess Return	t-Statistic
−20	0.0018	(0.29)	0.438	(−0.53)	0.0018	(0.29)
−15	−0.0022	(−0.37)	0.453	(−0.28)	0.0112	(0.76)
−10	0.0024	(0.40)	0.531	(0.97)	0.0351	(1.76)
−9	−0.0003	(−0.06)	0.422	(−0.79)	0.0348	(1.67)
−8	0.0033	(0.54)	0.531	(0.97)	0.0382	(1.76)
−7	0.0144	(2.39)[c]	0.609	(2.22)[c]	0.0531	(2.36)
−6	0.0041	(0.68)	0.594	(1.97)	0.0574	(2.46)[c]
−5	0.0005	(0.08)	0.469	(−0.03)	0.0580	(2.41)[c]
−4	0.0085	(1.40)	0.578	(1.72)	0.0669	(2.70)[b]
−3	0.0001	(0.01)	0.484	(−0.22)	0.0670	(2.62)[b]
−2	0.0007	(0.11)	0.438	(−0.53)	0.0677	(2.58)[b]
−1	−0.0091	(−1.51)	0.460	(−0.17)	−0.0091	(−1.51)
0	−0.0240	(−3.98)[b]	0.344	(−2.04)[c]	−0.0329	(−3.96)[b]
1	0.0018	(0.30)	0.469	(−0.03)	0.0018	(0.30)
2	0.0012	(0.20)	0.469	(−0.03)	0.0030	(0.35)
3	0.0038	(0.63)	0.594	(1.97)	0.0068	(0.65)
4	−0.0024	(−0.40)	0.500	(0.47)	0.0044	(0.37)
5	−0.0008	(−0.13)	0.500	(0.47)	0.0036	(0.27)

Table III—*Continued*

Panel B: Average excess returns around the last date that warrantholders can exercise (the completion date). Observations include 74 calls listed in the *R. H. M. Survey of Warrants, Options, and Low Price Stocks* over 1983 to 1989.

Date Relative to Completion	Mean Excess Return	*t*-Statistic	Proportion of Excess Returns That Are Positive	*t*-Statistic for Proportion of Positive Excess Returns[a]	Mean Cumulative Excess Returns	*t*-Statistic
−10	−0.0024	(−0.44)	0.514	(0.68)	−0.0024	(−0.44)
−9	−0.0022	(−0.40)	0.486	(−0.22)	−0.0046	(−0.59)
−8	−0.0063	(−1.13)	0.514	(0.68)	−0.0109	(−1.13)
−7	−0.0043	(−0.77)	0.405	(−1.18)	−0.0151	(−1.36)
−6	0.0088	(1.58)	0.635[b]	(2.78)[b]	−0.0065	(−0.52)
−5	0.0056	(1.01)	0.554	(1.38)	−0.0009	(−0.07)
−4	0.0081	(1.46)	0.568	(1.61)	0.0072	(0.49)
−3	0.0096	(1.72)	0.459	(−0.25)	0.0168	(1.07)
−2	0.0122	(2.20)[c]	0.554	(1.38)	0.0292	(1.75)
−1	0.0120	(2.17)[c]	0.635[b]	(2.78)[b]	0.416	(2.37)[c]
0	0.0146	(2.64)[b]	0.622[c]	(2.54)[c]	0.0568	(3.09)[b]
1	0.0141	(2.55)[c]	0.568	(1.61)	0.0718	(3.73)[b]

[a] During the 250-day period from 51 through 300 days after the call completion, the portfolio of firms in the announcement sample had positive excess returns 47.1% of the time. The portfolio of firms in the completion sample had positive excess returns 47.4% of the time.

[b] Significantly different from the mean proportion of positive returns at the 1% level (two-tailed test).

[c] Significantly different from the mean proportion of positive returns at the 5% level (two-tailed test).

period. Apparently, some "sleeping warrantholders" forgot to exercise, but calling firms needed cash too much to expropriate them.[7]

Another reason why warrants are called on time may be that firms that have issued callable warrants, unlike firms that have issued convertibles, seldom pay dividends. Dunn and Eades (1989) hypothesize that firms delay calling convertibles if they expect future dividends to make voluntary exercise optimal. Stockholders gain from this policy when "sleeping bondholders" fail to convert. Asquith and Mullins (1991) refine this hypothesis by incorporating the tax deductibility of interest payments in their empirical work. They identify 112 convertible bonds that, at the beginning of 1984, were not call protected and had conversion values exceeding call prices by at least 20 percent. For 90 of these 112 bonds, the dividends that the issuing corporation would have to pay if conversion was forced exceeded after tax interest payments to bondholders. Of the 22 remaining bonds, 15 were retired or called by year's end.

[7] An alternative explanation for extending notice periods is to avoid lawsuits.

In contrast, only 8 of the 111 firms that issued the warrants studied in Table III paid any cash dividends at all while their warrants were callable. At a minimum, the quarterly dividend must exceed the foregone quarterly interest on the exercise price to induce warrantholders to exercise early. Only 1 of the 111 firms paid a regular dividend that exceeded foregone interest on the exercise price at any time while their warrant was callable. Thus the finding that firms call warrants almost as soon as possible lends indirect support to the conjecture of Dunn and Eades (1989), Asquith and Mullins (1991), and Constantinides and Grundy (1989), that firms delay calls of convertibles in anticipation of dividend-induced voluntary conversion.[8]

C. The Stock Price Reaction to Calls of Warrants

The Wall Street Journal and Dow Jones News Retrieval Service provide announcement dates for 67 of the 81 calls of warrants in the sample. Expected returns for a stock on days around the announcement are calculated using a version of the market model that takes into account nontrading of the individual security and the index.[9] Formally,

$$E(R_{it}) = \alpha_i + \beta_i^{-1}R_{m,t-1} + \beta_i^{0}R_{m,t} + \beta_i^{1}R_{m,t+1} + \epsilon_{it} \quad (1)$$

where R_{mt} = the CRSP equally weighted over-the-counter index return on day t. For listed stocks, the CRSP equally weighted listed index is used.

Parameters are estimated using the 250 days starting 51 days after the completion of the call.[10,11] Excess or abnormal returns for stock i on day t, AR_{it}, are obtained by subtracting expected returns from observed returns. It was possible to estimate expected returns for 64 of the 67 stocks in the announcement sample and 74 of the stocks in the completion sample.[12]

To measure the effect of a call of warrants on the price of the underlying stock, the cross-sectional average of the N abnormal returns is computed for days around the announcement date and the date of the call's completion as

$$\overline{AR_t} = \frac{1}{N}\sum_{i=1}^{N} AR_{it} \quad (2)$$

[8] The 8 firms that paid dividends at any time while their warrants were callable issued 9 warrants in total. All of these warrants were called, but for 7 of the 9 warrants, the elapsed time between the first date that exercise of the warrant could be forced and the date the call was completed was greater than the median time for the sample.

[9] Reinganum (1990) also uses this adjustment for nontrading of NASDAQ stocks.

[10] Warrants are only called if underlying stocks exceed minimum prices. Thus historical estimates of expected returns or market model intercepts would be biased upward. This point is made in regard to examining returns around calls of convertibles by Campbell, Ederington, and Vankudre (1991), and by Cowan, Nayer, and Singh (1990).

[11] The coefficient on the lagged market return was significantly different from zero at the 5-percent level in 12 of the 78 regressions, while the coefficient on the lead market return was statistically significant at that level 7 times.

[12] Inclusion requires 40 days of usable returns beginning 51 days after the call completion.

Cumulative average abnormal returns from day t_1 to t_2 are then calculated as

$$CAR_{t_1,t_2} = \prod_{t=t_1}^{t_2} \left(1 + \overline{AR_t}\right) - 1 \tag{3}$$

For significance tests, the standard deviation of the cross-sectional average is computed using the 250 days from 51 through 300 days after the completion of the call. That is,

$$S(\overline{AR}) = \sqrt{\frac{1}{250} \sum_{t=51}^{300} \left(\overline{AR_t} - \overline{\overline{AR}}\right)^2} \tag{4}$$

where $\overline{\overline{AR}}$ = the time series mean of the mean daily abnormal return for days 51 through 300

Assuming that the means of the AR_{it} are independent and identically distributed, the statistic

$$T = \frac{\overline{AR_t}}{S(\overline{AR})} \tag{5}$$

has a Student t-distribution with 250 degrees of freedom. Test statistics for N day cumulative abnormal returns are obtained by multiplying the standard deviation by $\sqrt{N}$.

Average abnormal returns, the proportion of the excess returns that are positive, and cumulative average abnormal returns are shown in Panel A of Table III for the days surrounding call announcements. The cumulative average abnormal return for days −20 through days −2 relative to the announcement is 6.8 percent. Positive abnormal returns are observed ex post because stocks need to exceed a minimum price level before a call is permitted. On the day prior to the call announcement, the average abnormal return is a statistically insignificant −0.91 percent. The announcement day mean abnormal return is −2.40 percent which is significantly different from zero at the 1-percent level. The abnormal returns are surprisingly large given that evidence on the timing of calls implies that they should be partially anticipated.

Only 34.4 percent of stocks experience positive abnormal returns on the announcement day. The average proportion for the announcement sample is 0.471 for the 250 days from 51 through 300 days after the call completion. A t-test based on the normal approximation to the binomial distribution rejects, at a 5-percent level, a null hypothesis that the proportion of positive abnormal returns on the announcement date is 0.471.

Average abnormal returns around call completions are shown in Panel B of Table III. Day 0 is the last day that a warrant owner could exercise. As shown in Table III, abnormal returns are positive starting 6 days before the

last day that warrantholders can exercise. For each of the days -2 through $+1$ they are significantly positive and range from 1.2 to 1.5 percent. The proportions of positive abnormal returns on days -1 to 0 are significantly greater than the average of 47.4 percent observed for the completion sample over the parameter estimation period. The cumulative abnormal return from day -10 through day 1 is 7.18 percent.

To measure the total effect of a call on stock prices, cumulative abnormal returns are computed from the day prior to the announcement through the day after the call for the 62 stocks with both announcement and call dates. The cross-sectional average cumulative abnormal return for this period, which has a median duration of 23 days, is 4.09 percent. Because there are differing numbers of days between the announcement and completion of a call, the t-statistic is calculated with the cross-sectional standard deviation of cumulative abnormal returns

$$S(\overline{CSCAR}) = \sqrt{\frac{1}{N-1}\sum_{n=1}^{N}\left(CAR_n - \overline{CAR}\right)^2} \tag{6}$$

where $\overline{CAR}$ = the cross-sectional mean cumulative abnormal return for the N sample stocks

CAR_n = the cumulative abnormal return for stock n

The t-statistic of 1.70 rejects a null hypothesis of zero abnormal returns from the announcement through the completion of a call of warrants at a 10-percent confidence level (two-tailed test) but not a 5-percent level. Cumulative abnormal returns in the fifty days after the call completion (not shown) do not reveal any abnormal performance.

The absence of negative abnormal returns over the entire time from the announcement through the completion of a call contrasts with the findings of Mikkelson (1981) and others. This again is indirect support for the theories of Dunn and Eades (1989) and Constantinides and Grundy (1989) that firms call convertibles late if rational investors would be expected to convert voluntarily in the future. With warrants, a call is not bad news because underlying stocks are not expected to pay dividends that would induce exercise.

The puzzling aspect of the returns around warrant calls is that while excess returns over the entire period are positive, abnormal returns are significantly negative at the announcement and significantly positive at the call completion. To check the robustness of these results, abnormal returns are recalculated after adding additional terms to the market model for the leading, lagging, and contemporaneous differences between the returns of the portfolio of all stocks in the firm's size decile and the returns of the equally weighted index. Daily excess returns calculated this way are always within 0.2 percent of the market model excess returns and remain significant.[13]

[13] Size adjustment makes little difference in computing abnormal returns because sample firms tend to be close to the median size for NASDAQ stocks. Of the 74 stocks in the completion sample, 47 are in NASDAQ size deciles 4 through 7. Only 1 is in the smallest size decile.

Excess returns in Table III are also compared with raw returns. The raw returns are also always within 0.2 percent of the market model excess returns and are significantly different from zero on the same days as the market model excess returns.

Lease, Masulis, and Page (1991) note that systematic shifts of closing prices between bid and ask quotations may impart a bias in measured returns around financial events. For 41 of the 64 stocks in the announcement sample and 50 of the 74 stocks in the completion sample, CRSP calculates returns for the days around events using bid-ask midpoints rather than closing transactions. Market model abnormal returns of these firms are examined separately. As with the full sample, excess returns around the call announcement are negative and significant and excess returns at the completion remain positive and significant. These results, along with the size-adjusted returns and raw returns, are not shown but are available from the author.

Although the abnormal returns observed around the completion of calls appear to be robust with respect to excess return measurement, transactions costs may eliminate any profits from trading around call completions. To examine this, the average spread for days -11 through -2 is calculated for each of the 56 NASDAQ stocks in the announcement sample, and each of the 67 NASDAQ stocks in the completion sample. The mean dollar spread averaged across all stocks and all days is 24.5 cents, while the mean percentage spread is 5.89 percent.[14] The cross-sectional average ratio of the price change to the historical spread is then calculated for days around call announcements and completions.

The third and fourth columns of Table IV show cross-sectional mean and median ratios of returns to bid-ask spreads. On average, prices fall by about 81 percent of the spread on the the announcement date. A sign rank test rejects a cross-sectional mean of zero at the 1-percent level. The mean and median ratio of cumulative price changes to spreads are shown in the fifth and sixth columns of the table. The mean cumulative price change for days -1 through 0 relative to the announcement date is 107 percent of the spread.

Mean price changes on days -6 through $+1$ relative to the call completion are always positive and are usually about 30 percent of the spread. The largest mean ratio, which is significant at the 5-percent level, is the 51 percent observed for day -1. The cumulative price changes are significantly greater than zero at the 5-percent level on day -4, and at the 1-percent level thereafter. Cumulative price changes are, on average, greater than the spread from day -2 on, and are significantly greater than the spread when stocks are bought on day -7 and held through the day after the last possible exercise. On day $+1$, the cumulative price change was, on average, 2.48 times the size of the spread.

[14] Kaul and Nimalendran (1990) report a mean spread of NASDAQ stocks over 1983 to 1987 of 2.24 percent.

Table IV

The Size of Price Changes Around the Announcement and Completion of Calls Compared to the Size of Bid-Ask Spreads

The sample consists of calls of warrant described in the *R. H. M. Survey of Warrants, Options, and Low Price Stocks* over 1983 to 1989. Underlying stocks must be listed on the CRSP NASDAQ tape. Calls are included in the announcement sample only if an announcement date could be found in *The Wall Street Journal* or through the Dow Jones News Retrieval Service.

		Price Change[a]		Cumulative Price Change		Bid-Ask Spread	
		Mean Spread		Mean Spread		Mean Spread	
Date Relative to	Observations	Mean	Median	Mean	Median	Mean	Median
Announcement							
−1	56	−0.2650	0	−0.2650	0	0.9844	0.9640
0	56	−0.8092[c]	−0.3377	−1.0741[c]	−0.2941	0.8541[e]	0.7922[h]
Completion							
−6	67	0.3135[b]	0	0.3135[b]	0	0.9239	0.8333
−5	67	0.2374	0	0.5509	0	0.9652	0.9091
−4	67	0.1545	0	0.7054[b]	0.0794	0.9795	0.9091
−3	67	0.2366	0	0.9420[c]	0.4545	0.9773	0.9091
−2	67	0.3208	0	1.2629[c]	0.4548[f]	0.9888	0.9092
−1	67	0.5078[b]	0.1183	1.7706[c]	0.9092[g]	1.0623	0.9524
0	67	0.3874	0	2.1580[c,d]	1.4706[g]	1.0277	0.9092
1	67	0.3189	0	2.4769[c,d]	1.8056[g]	1.0091	0.9091

[a] The mean spread is the mean bid-ask spread for days −11 through −2 relative to the announcement.

[b] A sign rank test rejects a mean of zero at a 5-percent confidence level.

[c] A sign rank test rejects a mean of zero at a 1-percent confidence level.

[d] A sign rank test rejects a mean of one at a 5-percent confidence level.

[e] A sign rank test rejects a mean of one at a 1-percent confidence level.

[f] A null hypothesis that the median is zero is rejected at the 5-percent level with a binomial test.

[g] A null hypothesis that the median is zero is rejected at the 1-percent level with a binomial test.

[h] A null hypothesis that the median is one is rejected at the 1-percent level with a binomial test.

These results cannot be attributed to changes in the size of spreads. As shown in the last two columns of Table IV, the only day on which spreads are significantly different from their preannouncement size is the announcement day when spreads narrow an average of 15 percent. On other days, spreads range from 92 to 107 percent of their previous level.

The results in Table IV indicate that investors would find it worthwhile on average to accelerate a planned purchase of stock ahead of a call completion or to delay a planned sale until after a call notice period. The evidence also implies a trading rule: buy on the seventh day prior to the end of a call notice period and sell the day after the call completion. However, individual in-

vestors must pay brokerage commissions in addition to the spread. The mean spread for all stocks across days in Table IV is 24.5 cents, so, extrapolating from Table IV, profits after the spread would amount to about 3/8 per share. Much of this would be lost to commissions.

Because the completion date is known in advance, the excess returns around the completion cannot be attributed to new information. One explanation for the pattern of returns around calls of warrants is that it is due to inventory control by market makers or specialists. When a call is announced, many warrantholders may sell their warrants rather than exercise them. A market maker who expects to be a net buyer of warrants may lower his bid and ask prices for the stock to eliminate any long position in the stock and perhaps go short. At the end of the notice period, when the market maker no longer expects to be a buyer of warrants, he raises prices and covers his short position in the stock by exercising warrants.

While inventory control is consistent with the pattern of negative excess returns at the call announcement, and positive excess returns at the call completion, there is no cross-sectional relation between abnormal returns at the announcement and completion of a call. To save space, these regressions are omitted but are available from the author.

III. Summary and Conclusions

This paper examines corporate call policy toward warrants and the stock market reaction to a call. Three main findings emerge. First, unlike convertible securities, warrants are usually called as soon as possible. Second, stock prices decline about 3 percent when a firm announces a call. Finally, there is a rebound in the stock price of about 7 percent at the completion of a call. The total stock price reaction to warrant calls is positive.

The timing of calls of warrants is roughly consistent with theories for late calls of convertibles posited by Dunn and Eades (1989), Asquith and Mullins (1991), and Constantinides and Grundy (189). In these papers, firms optimally delay calls if common stock dividends are large enough to induce holders of convertibles to convert voluntarily. Unlike convertibles, warrants seldom have underlying stocks that pay dividends, so voluntary exercise will not occur. Hence warrants, unlike convertibles, are called as soon as possible. These theories also receive support from the finding of positive returns from the announcement through the completion of a call. Because stocks underlying warrants almost never pay dividends, a call of warrants, unlike a call of convertibles, does not signal unexpectedly small future payouts.

The pattern of stock returns around calls of warrants is puzzling. In particular, the positive abnormal stock returns around the completion of warrant calls is predictable. These returns are not explained by shifts between bid and ask prices or inadequate risk adjustment. On average, total cumulative price changes around the call completion exceed the bid-ask spread.

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