INFORMATION EFFECTS, BID-ASK SPREADS, AND CONVERTIBLE CALLS ON OTC MARKETS

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摘 要

本文探討美國店頭市場上櫃買賣公司，宣佈贖回該公司可轉換證券，對其普通股股價的影響。本研究發現，公司宣佈贖回消息後，該公司普通股股價有顯著下跌的現象。究其原因，贖回消息的宣佈，傳遞了公司前景不佳的訊息於投資大眾，因而造成該公司股價的下跌。本研究進一步探討普通股股價的價差變化，是否與上述的訊息效果相吻合。實證結果顯示，普通股價差的變化，支持了訊息效果的解釋。

ABSTRACT

This paper examines the valuation effects of OTC convertible calls and the changes of bid-ask sprreads on the underlying common stock. Similar to those studies on NYSE/AMEX convertible calls, we find a negative stock price reaction to the announcement of an in-the-money convertible calls on OTC markets. Examination of the bid-ask spread change of the underlying common stock around the announcement of covertible calls lends support to the argument that in-the-money convertible calls signal the unfavorable information on firms' operations to the public.

I. Introduction

This paper examines the change of bid-ask spread of common stock around the announcement of in-the-money convertible calls.[1] Previous studies on in-the-money convertible calls document a negative stock price reaction around the announcement of calls and attribute this to unfavorable information conveyed in the call announcement. Our objective in this study is to investigate whether the adjustment of information component of bid-ask spreads is consistent with the unfavorable information conveyed in the call announcement on over the counter (OTC) market.

Recent development in market microstructure literature provides another way

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[1] A convertible call is said to be in-the-money (out-of-the-money) if the conversion value of the convertible security is greater (less) than the call price plus the accrued interest or dividend.

of testing the information effect associated with corporate events.[2] Bid-ask spreads have been shown to have two major components: (a) an adverse information component and (b) an inventory cost component.

The effect of information asymmetry on the bid-ask spreads of securities was first suggested by Bagehot (1971). He suggested that the role of the market maker is to provide liquidity by stepping in and transacting whenever equal and opposite orders fail to arrive in the market at the same time. In order to assume this role, the market maker stands ready to transact with anyone who comes to the market.

There are two types of transactor that the market maker could confront: one which possesses special information and the other which consists of liquidity-motivated transactor who have no special information but merely want to convert securities into cash or cash into securities. The market maker always loses to transactor of the first type. A wide spread between the bid and asked prices will discourage transactor from trading on any special information that implies only a small change in equilibrium price. Therefore, the market maker never gains from the informed transfactor who have the option of not trading with the market maker.

On the other hand, the market maker always gains in transactions with liquidity-motivated transactor. For the market maker to survive, the gains from liquidity-motivated transactor must exceed the loss to information-motivated transactor.

Recently Copeland and Galai (1983) and Glosten and Milgrom (1985) formalize the asymmetric information model of bid-ask spreads. Copeland and Galai (1983) characterize the supplying of bid and ask price quotes to informationed transactor as writing a put and a call option because the informed transactor have the option of not trading with the market maker. Informed traders possesses inside information and can thus better estimate future security prices than the market maker. If the estimated future security prices are between the bid and ask price quotes, the informed transactor will not trade with the market maker. Thus the market maker can only lose to the informed transactor.

Glosten and Milgrom (1985) also show that the market maker expects to lose to informed transactor, who trade only if the quoted prices are favorable to them. When the market maker suspects an increased degree of information asymmetry, he should widen the bid-ask spread in order to offest the higher expected loss to the informed transactor.

Empirical research on convertible calls have identified the information asymmetry

[2] For a theoretical review on the development of market microstructure, please refer to Easley and O'Hara (1992)

between managers and outside investors as one of the principal factors accounting for the stock price decline of in-the-money convertible calls. If the market maker suspects a large degree of information asymmetry around the convertible calls announcement period, we should expect the market maker to widen the bid-ask spread around the call announcement date.

II. Hypotheses

The following hypotheses are developed to test the change in bid-ask spreads around the announcement period of convertible calls.

1. Information Asymmetry Hypothesis

It is believed that some traders, particularly corporate insiders, in securities markets may possess nonpublic information about future events that may affect security prices. The degree of information asymmetry between the informed and uniformed traders may widen prior to the release of significant firm-specific information. During such period of increasing information asymmetry, the number of informed traders in the market will also increase.

The market maker can be thought of as an uninformed market participant who expects to suffer losses to the informed traders. The informed traders are likely to trade prior to the release of significant firm-specific information. As shown by Copeland and Galai (1983) and Glosten and Milgrom (1985), a market maker should widen the bid-ask spread to offset the higher expected losses to informed traders when he suspects an increased degree of information asymmetry.

Empirical research on convertible calls by Mikkelson (1981) and Mais, Moore, and Rogers (1989) identified the information asymmetry as one of the principal factors accounting for the stock price decline of in-the-money convertible calls. If the informed traders are not deterred from using their informationk, the volume of trading will increase during the period prior to the call announcement. We should expect that the market maker will increase the bid-ask spread by observing the change in volume of trading before the call announcement.

2. Inventory Control Hypothesis

Another reason for the increase in spread around convertible calls announcement could result from an increase in inventory holding cost. For in-the-money convertible calls, the conversion value is greater than the call price. But the conversion value will change as the stock price changes during the redemption period. If the excess of conversion value over call price is very high, investors will hedge the risk of price decline by short selling the stock. Moreover, in the forced convertible call, it is unlikely that convertible security holders will keep the stock acquired through conversion. They will sell the stock in short immediately after the call announcement. Hence, the market maker's inventory would be larger than optimal after the call announcement.

A number of studies, including Garman (1976), Amihud and Mendelson (1980), Ho and Stoll (1981), and O'Hara and Oldfield (1986), have tried to model the inventory cost of market makers. These models by Garman (1976), Amihud and Mendelson (1980), and O'Hara and Oldfield (1986) show that the market maker has an optimal inventory position. The market maker reduces his bid-ask spread as he approaches his preferred inventory position. Conversely, he increases the spread as his long or short position becomes very high. Hence, the inventory control hypothesis predicts an increase in bid-ask spread after the convertible call announcement.

However, the model by Ho and Stoll (1981) arrives at a different conclusion about the impact of inventory holding on the bid-ask spread. Their model implies that the market maker will adjust the bid and asked prices equally whenever there are changes in his inventory position. Thus, the bid-ask spread does not depend upon his inventory position. Hence, the inventory control hypothesis under Ho and Stoll's (1981) model suggests no change in bid-ask spread after the convertible call announcement.

Table 1 summarizes the bid-ask spread changes as predicted by each of these two hypotheses around the call announcement.

III. Sample Collection and Methodology

1. Sample Collection

A list of OTC firms that made convertible bond calls or convertible preferred calls for the period 1975 through 1989 is obtained by examining the *Standard and Poor's Corporate Bond Guide* and *Moody's Annual Dividend Records*. We search the *Wall Street Journal Index (WSJI)* for the announcement date of each call. If no announcement date is found for a particular call, it is discarded from our sample. Then we compare the conversion value to call price for each call. If the call is out-of-the-money, the call is excluded from our study. Both the conversion price and the call price of each call are collected from the *Standard and Poor's Corporate Bond Guide*.

Following the procedures above, we identified 82 in-the-money convertible calls made by OTC firms during the period 1975 through 1989. Furthermore, if a call is made in connection with a merger or is contaminated by other material firm-specific announcements one trading day around the call announcement date, it is excluded from our study. As a result, we are left with 68 clean call events.[3] Table 2 provides descriptive statistics for the sample of 68 OTC in-the-money convertible calls. The mean call firm's common equity market value is \$205 million. The mean amount of called issue is \$28.22 million and the mean amount of called issue as a fraction of market value of equity is 15.31 percent.

The mean excess of conversion value over call price is 52.53 percent for convertible debentures. The figure for convertible preferred is 57.00 percent. These two figures are smaller than those in Ingersoll's (1977) study. Ingersoll (1977) finds that the means are 83.50 percent and 69.9 percent respectively for convertible debentures and convertible preferred.

2. Methodology

Our study will apply the standard market model methodology to assess the impact of the call announcement on the market value of the firm. The rationale behind the market model is that riskier firms should yield higher rates of return. However, the market model requires some distributional assumptions to derive test statistics. Thus, to check the robustness of our results, we will also apply a nonparametric test, the Wilcoxon signed-ranks test.

For the study of bid-ask spread behavior around the call announcement period, we will apply the binomial test to evaluate changes of both dollar spreads and

[3] The distribution of calls is as follows: 2 in 1975, 1 in 1976, 2 in 1977, 3 in 1978, 4 in 1979, 4 in 1980, 9 in 1981, 6 in 1982, 11 in 1983, 1 in 1984, 10 in 1985, 8 in 1986, 4 in 1987, 1 in 1988, and 2 in 1989.

Table 1: Summary of the Changes in Spread Predicted by the Various Hypotheses in Convertible Calls

Hypothesis	Predicted Change in Spread	Timing of Change
Adverse Information	Increase	Before Announcemnt
Inventory Control	Increase	After Announcement

Table 2: Summary Statistics for OTC in-the-Money Convertible Calls

Descriptive Measure	Mean	Standard Deviation	Minimum	Maximum	N
Market Value of Equity ($M)[a]					
Full Sample	205	101	55	428	68
Convertible Bond	209	101	73	428	54
Convertible Preferred	189	105	55	412	14
Excess of Conversion Value over Call Price					
Full Sample	53.45%	44.34%	5.34%	228.13%	68
Convertible Bond	52.53%	41.88%	5.34%	164.48%	54
Convertible Preferred	57.00%	54.44%	25.01%	228.13%	14
Amount of Called Issue Outstanding ($M)[b]					
Full Sample	28.22	38.98	0.56	250.00	68
Convertible Bond	28.47	41.35	1.03	250.00	54
Convertible Preferred	27.24	29.33	0.56	91.12	14
Amount of Called Issue as a Fraction of Market Value of Equity					
Full Sample	15.31%	23.48%	0.45%	166.21%	68
Convertible Bond	14.72%	24.55%	1.21%	166.21%	54
Convertible Preferred	17.58%	19.44%	0.45%	58.05%	14

[a]. Value is calculated on the call announcement date.
[b] Amount is the face amount of the called issues.

and percentage spreads.

2.1 The Market Model

The market model assumes that the return for firm j on day t (R_{jt}) is a linear function of the return for a certain market index on day t (R_{mt}).

(1) $$R_{it} = \alpha_j + \beta_j R_{mt} + e_{it}$$

Where α_j is the intercept of the regression line,

β_j is the sensitivity of R_{jt} to the change of $R_{mt}$and

e_{jt} is the error term assumed to be normally distributed with mean zero and variance σ_e^2.

The error term is assumed to be independent of R_{mt} over time.

The event study methodology focuses on the analysis of the e_{jt} to estimate the effect of an event. If an event does not convey any information that has a valuation effect, then the mean of the e_{jt}'s should not be significantly different from zero. Under the assumed linear relationship, we can use eq. (1) to predict returns for firm j. The abnormal return (AR_{jt}) on day t for firm j, which is an estimate of the error term in eq. (1), is determined by:

(2) $$AR_{jt} = R_{jt} - \hat{\alpha}_j - \beta_j R_{mt}$$

where R_{jt} is the observed return on security j on day t.

R_{mt} is the return on the value-weighted or equally-weighted NASDAQ CRSP Index on day t.

$\hat{\alpha}_j$ and $\hat{\beta}_j$ are the ordinary least squares estimates of α_j and β_j.

The event study method tests the mean reaction of a sample of N firms to the call events. The average abnormal return of the portfolio with N firms on day t, AAR_t, is

(3) $$AAR_t = (1/N) \sum_{j=1}^{N} AR_{jt}$$

and the cumulative average abnormal return over an interval between any two days (T_1, T_2) for a sample of firms is

$$(4) \qquad CAAR_{T_1, T_2} = \sum_{j=T_1}^{T_2} AAR_t$$

The assumption is that the abnormal returns (AR_{jt}) are multivariate normal and that AR_{jt} is idependent of the AR_{kt} ($j \neq k$). Under the null hypothesis, each AR_{jt} has a mean of zero and variance S_{jt}^2, The variance can be estimated as follows:

$$(5) \qquad S_{jt}^2 = \hat{\sigma}_j^2 \, [1 + 1/D_j + (R_{mt} - \bar{R}_m)^2 / \sum_{k=1}^{D_j} (R_{mk} - \bar{R}_m)^2]$$

and

$$(6) \qquad \hat{\sigma}_{jt}^2 = \sum_{k=l}^{D_j} [AR_{jk}^2 / (D_j - 2)],$$

where $\hat{\sigma}_j^{\|}$ is the mean square error of the market model.

D_j is the number of trading day with no missing returns in the estimation period.

R_{mk} is the observed return on the market index in the estimation period.

$\bar{R}_m$ is the sample mean of R_{mk} s.

The test statistic for the abnormal return developed below is using Patell (1976). The standardized abnormal return for firm j's stock on day t, SAR_{jt}, is calculated by dividing AR_{jt} by the standard error S_{jt}. That is,

$$(7) \qquad SAR_{jt} = AR_{jt} / S_{jt}.$$

Under the null hypothesis and the assumption that AR_{jt} is normally distributed, SAR_{jt} is distributed Student-t with D_j-2 degrees of freedom and variance (D_j-2)/(D_j-4).

By the assumption that AR_{jt} is independent of the AR_{kt}, SAR_{jt} is independent of the SAR_{kt}. Summing SAR_{jt} across the sample, we obtain

$$(8) \qquad TSAR_t = \sum_{j=1}^{N} SAR_{jt},$$

which has an expected value of zero with variance $Q_t = \Sigma_{j=1}^{N}(D_j\text{-}2)/(D_j\text{-}4)$.

Patell (1976) shows that the following statistic will be asymptotically unit normal under the null hypothesis:

(9) $$Z_t = TSAR_t \; / \; \sqrt{Q_t}$$

2.2 The Estimation Period Selection

Two things must be done before we can use the market model to derive test statistics: we must choose the market index and the estimation period. We use the CRSP NASDAQ equally weighted market index for our study.

Either the pre-announcement period or post-announcement period can be used as the estimation period to get the estimates of α_j and β_j. However, Campbell, Ederington and Vankudre (1991) recently show that firms calling in-the-money convertible debt are those that have ex-post successfully exploited firm-specific growth opportunities. Therefore, if pre-call data is used in a market model, estimates of α_j, and thus expected returns, are biased upward. Therefore, to check the robustness of test results, we will use both the pre-call period and the post-call period as the estimation period in the market model. The pre-call estimation period will run from day −300 to day −60 and the post-call estimation period will run from day 61 to day 300, where day 0 is the publication date of the *Wall Street Journal* for the call announcement.

2.3 Tests of Bid-Ask Spreads Changes

We investigate the change of dollar spreads and percentage spreads around the announcement date of convertible calls. The dollars spread for security i on day t is defined as follows:[4]

(10) $$DS_{it} = A_{it} - B_{it},$$

where DS_{it} is the dollar spread for security i on day t,

A_{it} is the quoted closing ask price for security i on day t, and

[4] Daily bid and ask prices are obtained from either the 1987 version of the CRSP-NASDAQ tape or the 1989 version of the CRSP-NMS tape.

B_{it} is the quoted closing bid price for security i on day t.

The percentage spread for security i on day t is defined as follows:

$$(11) \qquad PS_{it} = (DS_{it} * 100)/(A_{it} + B_{it}) * 1/2$$

Both dollar spreads and percentage spreads are examined for the five days before and after the call announcement date and are compared to the estimation period spreads to test the information asymmetry hypothesis and inventory control hypothesis. The estimation period runs from day −120 to day −61, where day 0 is the publication date of the *Wall Street Journal* for the call announcement.

To test if spreads have changed in one period compared to the estimation period, we will conduct two tests: one test without adjustments for holding cost and the other test with adjustments for holding cost. As Venkatesh and Chiang (1986) argue that the market maker's spread is based on anticipated losses to informed traders (the information trading cost) as well as inventory holding cost that he or she is obliged to assume, one cannot make valid inference about information asymmetry around announcement simply by examining the spreads around announcement dates. Therefore, it is necessary to adjust for the holding cost.

The binomial test will be employed to test whether the spreads in one period are larger or smaller than the estimation period spreads. For the test without adjustments for holding cost, the mean spreads during the call announcement period are compared to the mean spreads in the estimation period for each security. The binomial test statistic T can be derived as follows:

First, let the mean spreads during announcement period for security j be SPD_{Aj} and the mean spreads in the estimation period be SPD_{Ej}. Let $DSPD_j = SPD_{Aj} - SPD_{Ej}$, and if $DSPD_j$ is positive, then $I_j = 1$. If $DSPD_j$ is negative, then $I_j = 0$.

Second, repeat the first step for other securities in the sample. We get I_1, … , I_N.

Finally, the test statistic T is the sum of I_1, … , and I_N. That is, $T = \Sigma_{j=1}^{N} I_j$, which is the numer of securities for which $SPD_{AJ} > SPD_{Ej}$.

If the null hypothesis is true that positive and negative $DSPD_j$'s are equally likely, then $E(I_j) = 1/2$ and $Var(I_j) = 1/4$. if I_j's are assumed to be independent variables,

$$E(T) = \sum_{j=1}^{N} E(I_j) = N/2 \tag{12}$$

and

$$Var(T) = \sum_{j=1}^{N} Var(I_j) = N/4. \tag{13}$$

When N is large, T, when standardized, has approximately a unit normal distribution. The Z-statistic can be obtained as

$$Z = (T - N/2) / \sqrt{(N/4)} \tag{14}$$

For the test with adjustments for holding cost, the following regression is run for each security in the sample:[5],[6]

$$SPD_{i,t} = \alpha_0 + \alpha_1 P_{i,t} + \alpha_2 VAR_{i,t} + \alpha_3 VOL_{i,t} + \alpha_4 D_t + \epsilon_{i,t}, \tag{15}$$

where $SPD_{i,t}$ is the dollar spreads or percentage spreads for security i on day t,

$P_{i,t}$ is the closing price of security i on day t,

$VOL_{i,t}$ is the average trading volume of security i on day t,

$VAR_{i,t} = (0.627/n)\Sigma_{t=1}^{n}[\ln(H_{i,t}/L_{i,t})]$.[7] It is a measure of the anticipated price variability of security i on day t. $H_{i,t}$ is the highest sale of security i on day t and $L_{i,t}$ is the lowest sale of security i on day t. n is the number of days used in the estimate, and D_t is a dummy variable, taking a value of 1 for the announcement period, and taking a value of 0 for the estimation period.

$P_{i,t}$ is included to remove the suggestion of any apparent trends in the spread

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5 Daily high and low prices, closing prices and volume of trading are obtained from 1989 version of the CRSP-NASDAQ tape.

6 Venkatesh and Chiang (1986) used this model to test the information asymmetry effect with adjustments for the holding cost in their case study of earnings and dividend announcements.

7 This estimate of the daily standard deviation is based on Beckers (1983). We will use five days (day = t-4, ... , t) prices to estimate the price risk for a security on day t. Our estimate could be biased because our estimation period spans the information period of corporate event in which the stock prices may not follow a random walk which is assumed to govern the data in the estimation.

due to trends in the stock price. The variable $VOL_{i,t}$ is a measure of expected dealer inventory holding period, which in turns impacts the inventory holding cost component of the dealer's quoted spreads. The variable $VAR_{i,t}$ is a measure of the anticipated price variability, which also has an impact on the inventory holding costs. Finally, the dummy variables are included to capture the change of information trading cost of the dealer's quoted spreads. An increase in the level of information asymmetry implies a higher expected information trading cost and should be reflected in a positive coefficient of the dummy variables.

The regression equation is run for each security and either a positive or a negative coefficient of the dummy variables will be generated for each security. Again, the binomial test will be employed to test whether the information trading cost during the call announcement period is higher compared to the information trading cost in the estimation period.

IV. Empirical Results

1. Abnormal Returns

Table 3 presents summary statistics of average (AR) and cumulative (CAR) abnormal return 60 days before until 60 days after the announcement of 66 in-the-money OTC (over-the-counter) convertible calls. The abnormal returns for trading day $t=-60$ to $t=+60$ are based on market model estimated over the 240-day period commencing on day $t=-300$ and ending on day $t=-61$.[8]

It is evident that OTC in-the-money convertible calls, like NYSE/AMEX in-the-money convertible calls, are also associated with significant negative average price reactions. The two-day cumulative average return is -1.756 percent, with an associated Z value of -4.84. The average abnormal returns observed here are close to those reported by Mikkelson (1981) and Mais, Moore, and Rogers (1989).

The cumulative average abnormal return of pre-call period ($t=-60$, $t=-2$) is positive, but not significant. This only provides weak support for Mikkelson's (1981) observation that firms tend to call convertible securities following a period of unusually strong stock price performance.

[8] Since results based on post-call estimation period are similar to those based on pre-call estimation period, we do not report them here. These results are available upon request from the author.

Table 3: Average (AR) and Cumulative Average (CAR) Abnormal Returns 60 Days before until 60 Days after the Announcement of 66 In-the-Money OTC Convertible Calls

Event Day	AR(%)	Z-Value	Ratio of Positive to Negative	Wilcoxon Z-value
−60	−0.019	0.75	30:36	−0.51
−50	−0.159	−0.43	23:43	−1.81
−40	0.454	1.28	34:32	0.32
−30	−0.086	−0.49	28:38	−0.81
−20	−0.152	−0.62	28:38	−1.03
−10	−0.366	−0.58	24:42	−1.76
−9	−0.172	−0.22	26:40	−1.28
−8	−0.021	0.45	31:35	−0.05
−7	0.146	0.56	27:39	−0.57
−6	0.084	0.59	26:40	−1.21
−5	0.028	−0.56	29:37	−0.52
−4	0.105	0.32	33:33	0.30
−3	−0.143	−0.29	30:36	−0.56
−2	0.312	−0.79	30:36	−0.86
−1	−1.421	−5.57	10:56	−4.81
0	−0.335	−1.32	27:39	−1.47
1	−0.164	−0.49	28:38	−1.12
2	−0.226	−0.29	30:36	−1.13
3	−0.231	−1.52	27:39	−1.36
4	0.244	1.20	31:34	0.53
5	0.183	0.48	29:36	−0.10
6	0.567	1.68	35:30	1.33
7	−0.191	−0.32	28:37	−0.67
8	0.213	0.74	30:35	−0.05
9	−0.063	0.22	30:35	−0.21
10	−0.116	0.32	32:33	−0.59
20	−0.647	−1.96	25:40	−1.94
30	0.095	0.13	25:39	−0.52
40	−0.256	−1.00	26:38	−1.28
50	−0.050	−0.04	26:38	−0.92
60	0.719	2.14	32:32	0.80

Cumulative Average Abnormal Returns:
Days -60 through -2 = 1.936%; Z-Value = 0.95
Days -1 through 0 = -1.756%; Z-Value = -4.84
Days 1 through 60 = -0.400%; Z-Value = 0.15

1. Day 0 is the publication dte of the *Wall Street Journal* for the call announcement.
2. The pre-call period (-300, -60) data used to estimate the market model parameters. Two calls are excluded because they do not have more than 50 days returns during the estimation period.

Table 4 presents summary statistics of average and cumulative average abnormal returns during the two-day announcement period on two sub-samples: convertible bonds and convertible preferred stock.[9] Both sub-samples are associated with significant negative average stock price reactions. For convertible bonds, the cumulative average abnormal return for the two-day announcement period is -1.505 percent, which is significant at the 0.01 level (Z=-3.74). For convertible preferred stock, the two-day cumulative average abnormal return is -2.775 percent, with an associated Z value of -3.42, which is also significant at the 0.01 level.

2. Analysis of Spreads Around the Announcement Date

Both the average dollars spreads and the average percentage spreads for 59 OTC convertible calls around the announcement period are documented in

Table 4: Average (AR) and Cumulative Average (CAR) Abnormal Returns 60 Days before until 60 Days after the Announcement of 53 Convertible Bond Calls and 13 Convertible Preferred Calls

Bond Calls (N=53)			Preferred Calls (N=13)		
Event Day	AR(%)	Z-Value	Event Day	AR(%)	Z-Value
−60, −2	−0.244	0.30	−60, −2	10.815	1.55
−1	−1.257	−4.48	−1	−2.089	−3.50
0	−0.248	−0.81	0	−0.686	−1.33
−1, 0	−1.505	−3.74	−1, 0	−2.775	−3.42
1, 60	−2.619	−0.69	1, 60	8.449	1.72

1. Day 0 is the publication date of the *Wall Street Journal* for the call announcement.
2. The pre-call period (-300, -61) data are used to estimate the market model parameters. Two calls are excluded because they do not have more than 50 days returns during the estimation period.

[9] Of 68 calls in our study, 54 calls are convertible bond calls and 14 calls are convertible preferred calls.

Table 5.[10]. The average dollar spreads in pre-call period declined from $0.361 (day -120 to -61) to $.357 (day -60 to -16) and then to $.346 (day -15 to -6). The average percentage spreads in pre-call period also declined from 2.103% (day -120 to -61) to 1.844% (day -60 to -16) and then to 1.681% (day -15 to -6). First, the decline of percentage spreads could be due to the strong stock price performance during the pre-call period, which is observed in our sample. Second, to meet

Table 5: Daily Average Dollar Bid-Ask Spreads and Percentage Bid-Ask Spreads for 59 OTC Convertible Calls Around the Announcement Period

Event Day	Dollar Spreads	Percentage Spreads
−5	0.360	1.736
−4	0.354	1.730
−3	0.351	1.697
−2	0.341	1.654
−1	0.360	1.760
0	0.352	1.731
1	0.350	1.681
2	0.373	1.757
3	0.364	1.756
4	0.350	1.628
5	0.362	1.769
Average Spreads for Different Pre-Call Periods:		
Days -120 to -61	0.361	2.103
Days -60 to -16	0.357	1.844
Days -15 to -6	0.346	1.681

1. Day 0 is the publication date of the *Wall Street Journal* for the call announcement.

[10] Before July, 1980, the bid and asked prices reported in CRSP/NASDAQ tape are the median closing bid and asked prices quoted by the dealers. The highest closing bid and the lowest ask are reported beginning July, 1980. To avoid the impact of reporting changes on our analysis, three calls made in 1980 are excluded from the study. We also exclude six calls because of missing bid or asked prices during the call announcement period.

conversion requests of convertible security holders, firms probably have equity offerings before they call convertible securities.[11] The equity offereing will increase the outstanding shares and hence the average dollar spreads and percentage spreads decline during the pre-call period.

The average dollar spread on the announcement (t=-1) is $.360, which is close to the average dollar spreads $3.61 during the pre-call pedriod, day -120 through -61. However, the average percentage spread on the announcement date (t=-1) is 1.760%, which is about 20% below the average percentage spreads, 2.103%, during the pre-call period, days -120 through -61.

The binomial tests are employed to compare the spreads during the announcement period (days -5 to +5) to the estimation period spreads for each security. The binomial test is set up as follows:

$$H_0 : Spread_{AP} \leq Spread_{EST}$$
$$H_1 : Spread_{AP} > Spread_{EST}$$

where $Spread_{AP}$ is the average spread for a security in the announcement period (AP = -5, -4, ... , 0, 1, 2, ... , 5) and $Spread_{EST}$ is the average spread for the same security in the estimation period.

Panel A of Table 6 presents the results in the case of dollar spread using days -120 to -61 relative to the announcement as the estimation period. The number of securities for which the spread between the announcement period and the estimation period increased, decreased, or were unchanged were recorded. The null hypothesis of no increase in the announcement period spreads compared to the estimation period spreads cannot be rejected.

Panel B of Table 6 reports the results of changes in percentage spreads between the announcement period and the estimation period. The results, similar to those in the case of the dollar spreads, cannot reject the null hypothesis that there is no increase in the announcement period percentage spreads compared to the estimation period percentage spreads.

In order to confirm the results, we also use the pre-announcement period (days -15 to -6 relative to the announcement) as the estimation period. Table 7 reports

[11] We check the *Wall Street Journal Index* and find that six firms have made equity offerings announcements during the period of six months before the convertible call announcements.

Table 6: Binomial Tests for Changes in Spreads: Announcement Period Minus Estimation Period (t=-120 to -61)

Panel A: Dollar Spreads

Event Day	Increase	Decrease	No Change	Total	Z-Value
−5	22	24	13	59	−1.95
−4	20	26	13	59	−2.47
−3	16	28	15	59	−3.52
−2	16	30	11	59	−3.52
−1	18	27	14	59	−2.99
0	17	29	13	59	−3.25
1	18	28	13	59	−2.99
2	22	24	13	59	−1.95
3	18	28	13	59	−2.99
4	18	28	13	59	−2.99
5	21	25	13	59	−2.21

Panel B: Percentage Spreads

Event Day	Increase	Decrease	No Change	Total	Z-Value
−5	16	43	0	59	−3.52
−4	18	41	0	59	−2.99
−3	15	44	0	59	−3.78
−2	16	43	0	59	−3.52
−1	20	39	0	59	−2.47
0	15	44	0	59	−3.78
1	15	44	0	59	−3.78
2	17	42	0	59	−3.25
3	15	44	0	59	−3.78
4	17	42	0	59	−3.25
5	18	41	0	59	−2.99

1. Day 0 is the publication dte of the *Wall Street Journal* for the call announcement
2. Testing Hypotheses:
   H_0 : No increase in spreads
   H_1 : Increase in spreads

Table 7: Binomial Tests for Changes in Spreads: Announcement Period Minus Estimation Period (t=-15 to -6)

Panel A: Dollar Spreads

Event Day	Increase	Decrease	No Change	Total	Z-Value
−5	21	19	19	59	−2.21
−4	21	19	19	59	−2.21
−3	16	25	18	59	−3.52
−2	16	24	19	59	−3.52
−1	18	22	19	59	−2.99
0	18	21	20	59	−2.99
1	16	25	18	59	−3.52
2	22	20	17	59	−1.95
3	17	23	19	59	−3.25
4	16	25	18	59	−3.52
5	20	21	18	59	−2.47

Panel B: Percentage Spreads

Event Day	Increase	Decrease	No Change	Total	Z-Value
−5	31	27	1	59	0.39
−4	30	29	0	59	0.13
−3	25	33	1	59	−1.17
−2	24	35	0	59	−1.43
−1	31	28	0	59	0.39
0	30	29	0	59	0.13
1	28	31	0	59	−0.39
2	33	26	0	59	0.91
3	28	30	1	59	−0.39
4	26	32	1	59	−0.91
5	29	30	0	59	−0.13

1. Day 0 is the publication dte of the *Wall Street Journal* for the call announcement
2. Testing Hypotheses:

   H_0 : No increase in spreads

   H_1 : Increase in spreads

changes in dollar and percentage spreads between the announcement period (days -5 to +5) and the pre-announcement estimation period. These results cannot reject the null hypothesis of no increase in the announcement period average spreads either.

The results in Table 6 and Table 7 do not support the inventory control hypothesis which predicts an increase in spreads after the call announcement. Nor do the results support the adverse information hypothesis which predicts an increase in spreads during the period preceding the call announcement. However, to have a more precise test on the adverse information hypothesis, we need to adjust for the holding cost. In other words, part of the spread changes during the information asymetry period is caused by the increase or decrease in the inventory control component.

We use equation (15) in Section III to adjusting for the holding cost and test for increase in information asymmetry. Equation (15) is as follows:

$$SPD_{i,t} = \alpha_0 + \alpha_1 P_{i,t} + \alpha_2 VAR_{i,t} + \alpha_3 VOL_{i,t} + \alpha_4 D_t + \epsilon_{i,t}, \quad (16)$$

where $D_t = 1$ if t = -5, -4, -3, -2, and -1,

$D_t = 0$ if t = -120, -119, ..., -62, and -61,

$P_{i,t}$ is the closing price of security i on day t,

$VAR_{i,t}$ is the estimate variance of security i on day t, and

$VOL_{i,t} = (V_t + V_{t-1} + V_{t-2} + V_{t-3} + V_{t-4})/5$ is the average trading volume of security i on day t and V_t is the trading volume of security i on day t.

The number of shares traded is available on the CRSP/NASDAQ tape on a daily basis from November 1, 1982. Only 36 convertible calls in our sample have trading volume data in the tape. In order to have a larger sample in our analysis, we collected daily trading volume data prior to November 1, 1982 from *OTC Daily Price Records*.

First, we examine changes in dollar sprreads after adjusting for changes in price, variance, and volume. We do this by estimating the regression for each of the 61 stocks in our sample.[12] The numbers of positive and negative α_1, α_2, α_3, and α_4 coefficients are presented in Table 8. Of the 61 stocks, 30 stocks have

[12] Three calls are excluded to avoid the impact of price reporting changes. We also exclude four calls because of missing spreads or volume data.

positive α_4 estimates and 20 stocks have negative α_4 estimates.[13] Although α_4 coefficients tend to be positive, we cannot reject a null hypothesis that positive and negative α_4 coefficients are equally likely. Therefore, the results only provide weak support for the adverse information hypothesis that predicts an increase in dollar spreads during the pre-announcement period.

The coefficients on both variance (α_2) and trading volume (α_3) tend to be of the expected sign. For 38 of the 61 stocks, α_2 estimates are positive. The estimates of the variance coefficients tend to be positive because the market maker demands more compensation for the higher price risk associated with holding an inventory position in a more volatile stock. For 22 of the 61 stocks, α_3 estimates are positive. The estimates of the volume coefficients tend to be negative. This is consistent with the market maker demanding less compensation for assuming an inventory in a stock with higher volume of trading because the higher the volume of trading, the easier it is for the market maker to reverse his position and thus the shorter his holding period.

We also examine changes in percentage spreads after adjusting for changes in variance and volume. The results are shown in Table 9. For 42 of the 61 stocks in our sample, α_4 estimates are positive. The binomial z-statistic is 2.94, which allows us to reject a null hypothesis that positive and negative α_4 coefficients are equally likely at the 0.01 level. Hence, the results from percentage spreads provide support for the adverse information hypothesis.

The coefficients on price (α_1) and variance (α_2) also tend to be of the expected sign. For 53 of the 61 stocks, α_1 estimates are negative. The estimates of the price coefficients tend to be negative. The result is consistent with the suggestion that a steadily declining price and a fixed dollar spread would give the appearance of an increased percentage spread. For 48 of the 61 stocks, α_2 estimates are positive. The coefficients on trading volume (α_3) do not tend to be of expected sign. For 34 of the 61 stocks, α_3 estimates are positve. The estimates of the trading volume coefficients tend to be positive. But we do expect tht the coefficients tend to be negative.

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[13] For 11 of the 61 stocks, α_1, α_2, α_3, and α_4 estimates are zero. This occurs because dollar spreads for these stocks are the same for the estimation period and the call announcement period.

Table 8: Binomial Tests for Changes in Dollar Spreads with Adjustments for Holding Costs

Coefficients	No. Positive	No. Negative	Zero	Total	Z-Value
α_0	42	19	0	61	2.96
α_1	28	22	11	61	−0.64
α_2	38	12	11	61	1.92
α_3	22	28	11	61	−2.17
α_4	30	20	11	61	−0.12

The regression equation is as follows:

(16) $SPD_{i,t} = \alpha_0 + \alpha_1 P_{i,t} + \alpha_2 VAR_{i,t} + \alpha_3 VOL_{i,t} + \alpha_4 D_t + \epsilon_{i,t}$

Table 9: Binomial Tests for Changes in Percentage Spreads with Adjustments for Holding Costs

Coefficients	No. Positive	No. Negative	Zero	Total	Z-Value
α_0	56	5	0	61	6.07
α_1	8	53	0	61	−5.76
α_2	48	13	0	61	4.48
α_3	34	27	0	61	0.90
α_4	42	19	0	61	2.94

The regression equation is as follows:

(16) $SPD_{i,t} = \alpha_0 + \alpha_1 P_{i,t} + \alpha_2 VAR_{i,t} + \alpha_3 VOL_{i,t} + \alpha_4 D_t + \epsilon_{i,t}$

V. Conclusion

This paper investigates the behavior of bid-ask spreads around the announcement of convertible calls. We study convertible calls made by NASDAQ-lited stock over the 1975-1989 period. We find support for the adverse information hypothesis which predicts an increase in the bid-ask spread of securities before the call announcement. A significant increase in percentage spread is observed before announcement after adjusting the holding cost. No support is found for the inventory control hypothesis which predicts an increase in spread after the call announcement. No significant increase either in dollar spread or in percentage spread is found after the call announcement.

Recently convertible securities have become a popular means of financing for firms listed on Taiwan Stock Exchange. So far, no firms have ever exercised call options on the convertibles. The empirical evidence on convertible calls of U.S. markets have implications for local investors dealing with forced calls in the future.

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