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Firms' announcements to call in-the-money convertible securities for redemption essentially force their conversion into common stock, and such announcements are generally met with significant reductions in the calling firms' equity values. An explanation based on liquidity costs is advanced and tested. The explanation implies that investors who choose to sell their shares early in the conversion period bear liquidity costs by selling at reduced prices. Consistent with the explanation, the average share price decline is short-lived, lasting most of the conversion period. Thus, a component of the call announcement effect appears to be due to liquidity costs.

I. Introduction

Calls of in-the-money convertible securities are reexamined in light of a short-run liquidity cost explanation of observed price behavior. In the scenario described below the announcement of a conversion-forcing call heralds the beginning of a period of abnormally high sell-order volume in the calling firm's common stock. Market dealers respond to the order imbalances by lowering prices to deter sellers and attract buyers. Thus, observed negative stock price reactions to call announcements contain a transitory component reflecting the price of liquidity in the capital markets. The evidence we report is broadly consistent with predictions related to the liquidity explanation for stock price reactions to convertible bond calls and is partially consistent for calls of convertible preferred stocks.

The liquidity hypothesis presented below joins several other possible explanations for observed

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negative stock price reactions to calls of in-the-money convertible bonds and preferred stocks (Mikkelson 1981, 1985; Mais, Moore, and Rogers 1989). Mikkelson (1985) finds evidence that lost interest tax shields due to calling convertible bonds account for at least some of the negative announcement effect. However, this explanation cannot extend to the negative effects of calls of convertible preferred stocks because preferred dividends do not provide tax shields. Information signaling is suggested as a theoretical explanation by Harris and Raviv (1985) for (1) the adverse stock price effects and (2) the reality that convertible bond calls are typically delayed until the convertibles are substantially in the money (Ingersoll 1977*b*).[1] Their model has found empirical support in the evidence reported by Ofer and Natarajan (1987), though some of their most persuasive evidence is shown to be critically sensitive to the choice of estimation period for the return-generating process used in their study (Cowan, Nayar, and Singh 1990). Moreover, the predictions of the model set forth by Harris and Raviv (1985) do not extend in an obvious way to calls of convertible preferred stocks, though perhaps a signaling argument can be made that would explain the negative price effect observed for these securities as well.

Though no single explanation set forth so far has found general support across different types of security calls, negative stock price reactions to call announcements represent an empirical regularity that may be partially explained by short-run liquidity costs. A liquidity-based explanation of stock price behavior around calls of convertible bonds and preferred stocks is set forth in Section II. Evidence of negative equity valuation effects due to calls of both types of convertible securities is reported in Section III, and stock price behavior before and after the announcement period also is examined in that section. For our combined sample of 169 calls of convertible bonds and preferred stocks, we find a significant negative average abnormal return of about 1.9% for the 2-day announcement period, consistent with the negative effects documented by Mikkelson (1981) for convertible bond calls and by Mais, Moore, and Rogers (1989) for convertible preferred stock calls. For the period following announcement ending on the last day on

1. In perfect capital markets with zero call notice period, Ingersoll (1977*a*) and Brennan and Schwartz (1977, 1980) show that the optimal policy is to call when stock value just equals the effective call price, i.e., the stated call price plus accrued interest. An alternative explanation for delayed calls is set forth by Constantinides and Grundy (1987). If calling is costly, the firm will rationally delay if voluntary conversion by the convertible security holders is anticipated. Jaffee and Shleifer (1990) offer another explanation for delayed calls based on avoidance of financial distress. Given a positive call notice period, the firm will rationally wait until a convertible security is well in the money to minimize the chance that it will be out of the money by the call date. If the security goes out of the money, the firm is faced with redeeming for cash a large security issue, and this may lead to financial distress.

which conversion is possible, we find a significant *positive* cumulative average abnormal return of about 2.2%, suggesting that a component of the announcement effect is transitory. Tests of the liquidity-based explanation are reported in Section IV. We show that stock prices rebound significantly following announcements of convertible *bond* calls. That is, those stocks that decline the most upon announcement tend to regain the most during the period of conversion. No evidence of rebounding following calls of convertible *preferred stocks* is found. The combined findings are interpreted and summarized in Section V.

II. Liquidity Effects of Calls of Convertible Securities

Short-run liquidity costs may arise in "the form of an explicit commission or a price away from the equilibrium price" (Kraus and Stoll 1972, p. 571). Liquidity costs due to prices set away from equilibrium have been detected in the case of block trades by Kraus and Stoll (1972), in new equity issues via general cash offers by Barclay and Litzenberger (1988), and for equity issue via rights offers by Hansen (1988). Liquidity costs in the form of explicit dealer compensation as measured by the bid-ask spread are detected for secondary equity distributions by Mikkelson and Partch (1985). In hypothesizing the behavior of stock prices around convertible calls, we follow Kraus and Stoll (1972), Mikkelson and Partch (1985), and others in recognizing that increases in supply may lead to long-term price effects due to less than perfectly elastic demand, or short-term effects due to liquidity costs.

A conversion-forcing call in our scenario marks the beginning of a period of accelerated trading that is largely seller initiated.[2] Rather than holding newly converted shares as permanent additions to their portfolios, holders of called convertibles may decide to liquidate the shares. The decision to liquidate may be based on differences in yields and capital gains potential between the convertibles and underlying shares, leading to changes in tax liability. If the investor is an institution such as a bank, there may be regulatory or policy requirements that dictate rebalancing of the portfolio after conversion. Because the market value of the convertible will be very close to its conversion value after the call announcement, the decision to convert, then sell the shares, or to sell the convertible security directly, will rest on relative brokerage fees and perhaps the relative speed with which the convertibles and the shares can be liquidated.

In response to an in-the-money call, market makers (specialists) adjust bid and ask prices to deter sellers and attract buyers. If sell orders

2. During the week of the call announcement, trading volume in our data set increases by an average of 44% for bond calls and 38% for preferred calls relative to average weekly volume before the announcement.

are not reduced sufficiently, or buy orders are not increased sufficiently by the price change, dealers must temporarily absorb some of the shares. For compensation for providing liquidity, a dealer should lower bid and ask quotes so that transaction prices are below the new long-run equilibrium.[3] In this scenario, we are casting convertible security calls as "liquidity events" in the sense described by Grossman and Miller (1988), and dealers' responses are consistent with various models of dealer markets under conditions of inventory risk (Garman 1976; Stoll 1978; Ho and Stoll 1981; and O'Hara and Oldfield 1986).

If forced conversion leads to portfolio-rebalancing behavior as we have described, the call announcement will be followed by a protracted period of high sell-order volume unless bid and ask quotes are kept low to deter sellers and attract buyers. We do not know how many trades are due to rebalancing, and we cannot pin down when such trading takes place in the aftermath of a forced conversion. But the scenario is rich enough to allow us to predict that investors who sell early in the process will do so at lower prices than those willing to wait. Thus, call announcements should result in immediate stock price reductions below long-run equilibrium, and prices will begin to recover thereafter, continuing until the demand for immediacy by sellers is diminished.

This scenario brings us to view a conversion-forcing call as similar to issuance of new common stock via a rights offering in which current shareholders receive the right to purchase additional shares, usually at a discount. When the rights are exercised the shareholders will then have more shares in their portfolios, and they may wish to sell some in order to rebalance. The effect is a price decline during a temporary period of selling, and a price recovery therafter. The price decline is to entice buyers to provide immediacy to sellers, and the loss in portfolio value suffered by the sellers (original shareholders) represents an additional cost of marketing the shares. This is the scenario presented by Hansen (1988), and it appears to go far in resolving a long-standing paradox in finance.[4] Under the scenario presented above, a conversion-forcing call also passes some of the task of marketing newly issued common shares to security holders, in this case, convertible bondholders and preferred stockholders.

All of the convertible securities examined in this study are issued

3. The *quoted* spread is the set of bid and ask prices quoted by the specialist and represents the *realized* spread only if the specialist could execute a buy and a sell order simultaneously. The realized spread (Stoll 1989), or effective spread (Roll 1984), represents the difference between proximate buy and sell transaction prices.

4. The paradox, summarized by Brealey and Myers (1991, pp. 359–60), is that underwritten general cash offers are more expensive than nonunderwritten rights offers in the United States, but firms rely predominantly on underwritten general cash offers to market securities.

by firms listed on the New York Stock Exchange or, in a few cases, the American Stock Exchange. These exchanges feature continuous auction markets with single dealers (specialists) appointed to maintain liquid markets for specified securities. The liquidity-based explanation for stock price behavior around calls of convertibles predicts a decline in stock price upon announcement. This is the same prediction, at least for convertible bonds, that arises from the asymmetric information model of Harris and Raviv (1985) and the lost tax shield explanation supported by Mikkelson (1985). Thus, the liquidity explanation is not set forth as an exclusive alternative to other explanations. It supplements these in suggesting that a component of the announcement period price reaction will be transitory, while not ruling out a permanent price change as well.

III. Stock Price Behavior Surrounding Security Calls

A. Sample Selection

The preliminary sample of calls of convertible bonds was identified in annual editions of *Moody's Industrial Manual.* Redemptions of preferred stocks are not identified in *Moody's,* thus the preliminary sample was identified by first isolating firms that had convertible preferred stock outstanding according to Standard and Poor's Compustat data base. Firms that reduced the amount of outstanding convertible preferred during a given year were selected as candidates.

The preliminary samples were subjected to the screening criteria enumerated below; the final samples consist of 111 convertible bond calls and 58 convertible preferred calls:[5]

1. The calling firm's daily rates of return on common stock surrounding the redemption date must be available on the Center for Research in Securities Prices (CRSP) Daily Returns File. This requirement effectively limits the sample to only those firms that have their common stock listed on either the New York or American stock exchange. In addition, each conmmon stock is required to have at least 100 daily returns recorded in the CRSP file during each of the estimation periods described in the next section.
2. An unambiguous first public announcement of the call decision appeared in the *Wall Street Journal,* and the announcement was the only firm-specific news item on that date, or at any time during the period from 2 days before to 2 days after that date.

5. Though the sample selection criteria differ slightly, this should not pose a problem for inferences drawn from the analysis. The tests are performed on the combined sample and on each subsample independently.

TABLE 1 **Percentage Increases in Common Shares and Length of Conversion Periods for Calls of Convertible Bonds and Preferred Stocks**

	Convertible Bond Calls (N = 111)	Convertible Preferred Calls (N = 58)
Percentage increase in common shares:		
Mean	13.2	12.8
Range	1.0–15.3	.1–36.6
Length of conversion period (in days):		
Mean	27.5	26.5
Range	16–60	14–56

3. The effective call date, the last day by which the bonds could be converted, was available.
4. The conversion value of the called security exceeded the call price at the time of call; thus the calls are made in the money.

In table 1, descriptive statistics are presented for the two samples. The calls of convertible bonds and preferred stocks represent relatively large increases in common shares outstanding upon conversion. The average ratio of the actual number of shares issued due to conversion to the number of shares outstanding before conversion is 13.2% for the bonds and 12.8% for the preferred stocks. These average values are close to the ratios reported by Mikkelson and Partch (1986) and Asquith and Mullins (1986) for new issues of common equity.

The length of time between public announcement and the end of the conversion period averages 27.5 trading days for bonds and 26.5 trading days for preferred stocks. The length of time varies from 16 to 60 trading days for bonds and from 14 to 56 days for preferred stocks; thus there is substantial variability in the notice periods stipulated by the call provisions.

B. Measurement of Abnormal Returns

We measure abnormal returns and assess statistical significance of various cross-sectional averages of those returns using the market model primarily and supplement the analysis with the mean-adjusted returns model estimated over identical estimation periods. The abnormal return (AR_{jt}) based on the market model for security j during period t is given by equation (1):

$$AR_{jt} = R_{jt} - (\hat{\alpha}_j + \hat{\beta}_j R_{mt}), \tag{1}$$

where

R_{jt} = rate of return of security j, inclusive of dividends, over day t;
R_{mt} = rate of return on the CRSP equal-weighted index, over day t;
$\hat{\alpha}_j, \hat{\beta}_j$ = regression parameter estimates.

Parameter estimates ($\hat{\alpha}_j$, $\hat{\beta}_j$) are calculated by ordinary least squares. Two different 180-day estimation periods were chosen in order to determine if the findings are sensitive to the choice. We define the before-event estimation period as that beginning with $t = -360$ and ending on $t = -181$ relative to the announcement date (AD). Before-event estimation was used by Ofer and Natarajan (1987). We define the after-event estimation period as that from $t = +181$ to $t = +360$ relative to the last day the security can be converted, the conversion ending date (CED), plus 20 days. After-event estimation is used by Mikkelson (1981) and by Singh, Cowan, and Nayar (1991) and is justified given the evidence from Mikkelson (1981) and Cowan, Nayar, and Singh (1990) that security calls follow a period of positive abnormal price behavior; thus, preevent estimation may lead to biased predictions in equation (1).

The cross-sectional average abnormal return (AAR) for day t is calculated as in equation (2):

$$\text{AAR}_t = 1/N \sum_{j=1}^{N} \text{AR}_{jt}. \tag{2}$$

In equation (2), N denotes sample size. The cumulative average abnormal return (CAAR) for days a_j to b_j is given by equation (3):

$$\text{CAAR}_{a,b} = 1/N \sum_{j=1}^{N} \sum_{t=aj}^{b_j} \text{AR}_{jt}. \tag{3}$$

The abnormal return (AR_{jt}) in equation (1) is a regression prediction error, thus its standardized form is given by equation (4):

$$\text{SAR}_{jt} = \text{AR}_{jt}/S_j, \tag{4}$$

where

$$S_j = \sqrt{\hat{\sigma}_j^2} \left[1 + \frac{1}{\text{ED}} + \frac{(R_{mt} - \bar{R}_m)^2}{\sum_{i=1}^{\text{ED}} (R_{mi} - \bar{R}_m)^2} \right]^{1/2}. \tag{5}$$

In equation (5), $\hat{\sigma}_j^2$ is the mean square error of the market model, ED is the number of days in the estimation period, and $\overline{R}_m$ denotes the sample mean return on the CRSP equal-weighted index during the estimation period.

Over the interval a_j to b_j, the cross-sectional average cumulative standardized abnormal return (ACSAR) is given by equation (6):

$$\text{ACSAR}_{a,b} = 1/N \sum_{j=1}^{N} \sum_{t=a_j}^{b_j} \text{SAR}_{jt} / \sqrt{b_j - a_j + 1}. \tag{6}$$

Assuming normality of AR_{jt}, with AR_{jt} independent of AR_{kt}, $j \neq k$, and with AR_{jt} independent of AR_{js}, $s \neq t$, the following test statistic is a unit normal random variable:[6]

$$z = \sqrt{N}(\text{ACSAR}_{a,b}). \tag{7}$$

C. *Stock Price Behavior around Call Announcements*

In table 2, we present cumulative daily average abnormal returns (from eq. [3]), test statistics (from eq. [7]), and the numbers of positive and negative observations for various periods of time relative to the announcement calling for the redemption of an outstanding convertible security. The results in table 2, panel A, were generated using the *after-event* estimation period, $t = +181$ to $t = +360$, relative to CED+20, while those in table 2, panel B, are based on the *before-event* estimation period, $t = -360$ to $t = -181$, relative to AD.

In table 2, panels A and B, results for the combined sample are presented in column 1, the convertible bonds in column 2, and the convertible preferred stocks in column 3. Price behavior before the announcement date (AD) during the period AD-60 to AD-2 is similar for the combined sample, the bonds only, and the preferred stocks only, regardless of the choice of estimation period. In all cases, there is a statistically significant positive CAAR, ranging from .047 (Z = 3.319) for bonds only, using before-event estimation, to .094 (Z = 4.387) for preferred stocks only, using after-event estimation. For the full sample, using after-event estimation, 119 observations have positive cumulative abnormal returns (CARs) compared to 50 with negative CARs.[7] The preannouncement run-up reaffirms that documented by Mikkelson (1981).

6. Since the same point estimates of the market model parameters are used to calculate all of the elements of the time series of abnormal returns for a given security, the independence of AR_{jt} and AR_{js}, $s \neq t$, may not hold. The abnormal return series for each security was tested for first-order autocorrelation, and in only six cases out of the combined sample of 169 securities was the correlation estimate significant at the 5% level.

7. The probability of drawing at least 119 positive CARs in a sample of 169 given that positive and negative CARs are equally probable is less than .001.

TABLE 2 Cumulative Average Abnormal Returns (CAAR) for Selected Intervals Surrounding Convertible Security Calls

Interval	Combined Sample (N = 169) (1)	Convertible Bonds (N = 111) (2)	Convertible Preferred Stocks (N = 58) (3)
A. Market Model Parameters from After-Event Estimation Period			
AD-60 to AD-2:			
CAAR	.090	.088	.094
t-statistic	(6.838)	(5.268)	(4.387)
pos/neg CARs	119/50	77/34	42/16
AD-1 to AD:			
CAAR	−.018	−.012	−.015
t-statistic	(−8.740)	(−7.484)	(−5.863)
pos/neg CARs	44/125	28/83	16/42
AD+1 to CED:			
CAAR	.022	.022	.022
t-statistic	(2.717)	(2.044)	(1.805)
pos/neg CARs	108/61	69/42	39/19
CED+1 to CED+20:			
CAAR	.001	.004	.005
t-statistic	(.169)	(.358)	(−.198)
pos/neg CARs	85/84	58/53	27/31
AD+1 to CED+20:			
CAAR	.022	.026	.016
t-statistic	(2.119)	(1.717)	(1.249)
pos/neg CARs	94/75	61/50	33/25
B. Market Model Parameters from Before-Event Estimation Period			
AD-60 to AD-2:			
CAAR	.052	.047	.064
t-statistic	(4.353)	(3.319)	(3.073)
pos/neg CARs	107/62	70/44	37/21
AD-1 to AD:			
CAAR	−.019	−.021	−.015
t-statistic	(−9.420)	(−7.639)	(−5.514)
pos/neg CARs	43/123	26/85	17/41
AD+1 to CED:			
CAAR	.004	.002	.010
t-statistic	(1.348)	(.653)	(1.397)
pos/neg CARs	95/74	63/48	32/26
CED+1 to CED+20:			
CAAR	−.012	−.013	−.010
t-statistic	(−1.866)	(−1.601)	(−.951)
pos/neg CARs	78/91	50/61	28/30
AD+1 to CED+20:			
CAAR	−.008	−.012	−.000
t-statistic	(−.234)	(−.632)	(−.476)
pos/neg CARs	82/87	53/58	29/29

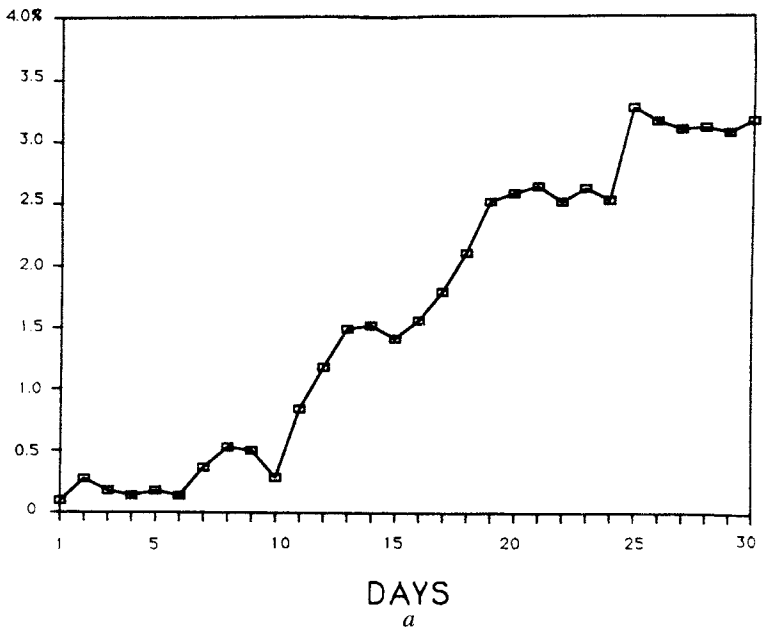
NOTE.—The announcement date is denoted by AD; CED denotes day conversion ends. The designation pos/neg CARS = number of positive cumulative abnormal returns (CARs)/number of negative CARs.

The 2-day announcement-period results are also consistent across samples and for both estimation periods. For the combined sample using before-event estimation (table 2, panel B), the CAAR is −.019 (Z = −9.420), and using after-event estimation (table 2, panel A), the CAAR is −.018 (Z = −8.740). For the full sample, using after-event estimation, 44 CARs are positive compared to 125 negative CARs. The probability of drawing a sample of at least 125 negative CARs is less than .0001 (see n. 6 above). Thus, there is evidence of a significant negative average price reaction to calls of convertible securities, regardless of the choice of estimation period, and the result extends to the subsamples of bonds and preferred stocks. The finding of a negative valuation effect for convertible bond calls is consistent with the results of Mikkelson (1981, 1985), Ofer and Natarajan (1987), and Singh, Cowan, and Nayar (1991). The negative wealth effect for convertible preferred calls reaffirms the finding of Mais, Moore, and Rogers (1989).

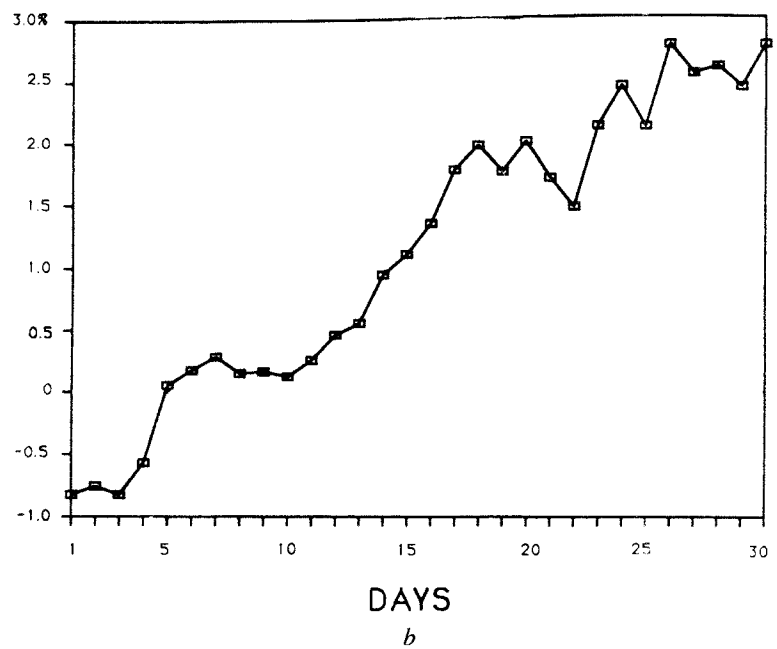
In each of the panels of table 2, CAAR values are also reported for the period following announcement to the day conversion ends (AD+1 through CED), the 20-day period following the day conversion ends (CED+1 through CED+20), and the total period AD+1 through CED+20. Use of after-event estimation (table 2, panel A) reveals significant positive average abnormal returns during AD+1 through CED for the combined sample as well as for each subsample. The full sample exhibits a CAAR of .022, significant at the 1% level. Positive CARs outnumber negative CARs 108 to 61. Results are similar for the convertible bonds and preferred stocks analyzed separately.[8] This finding suggests that the negative announcement effect is not entirely permanent and is consistent with the liquidity-based explanation. When the period is extended to AD+1 through CED+20, the CAAR for the full sample (.022) is positive and significant at the 4% level (Z = 2.119). The bond subsample CAAR is .026, significant at the 5% level (Z = 1.717) under the one-sided alternative. The result for the preferred subsample is weaker (CAAR = .016) and significant only at the 11% level (Z = 1.249) using a one-tailed test.

Stock price behavior during the conversion period is described visually by graphing CAAR values beginning the day following announcement (AD+1) and extending to AD+30, approximating the average interval from announcement to the end of conversion. This is done in figure 1, panels *a* and *b*, for the convertible bond calls and the convertible preferred stock calls, respectively. The patterns are quite similar for the two types of security calls. In both cases, CAAR values appear

8. For the preferred calls subsample, CAAR = .022 and Z = 1.805, significant at the 4% level under the one-sided alternative. Positive CARs outnumber negative CARs 39 to 19; the probability of drawing at least 39 positive CARs in the sample is .006.



a



b

FIG. 1.—Cumulative average abnormal returns on common stocks for 30 trading days following calls of convertible bonds and convertible preferred stocks; *a*, Convertible bond calls ($N = 111$); *b*, Convertible preferred stock calls ($N = 58$).

to be such that prices have recovered substantially by the end of the approximate conversion period. The magnitude of postannouncement abnormal performance is particularly sensitive to whether preannouncement (table 2, panel B) or postannouncement returns (table 2, panel A) are used to estimate the market model parameters. The sensitivity of the results in the case of convertible bond calls has been pointed out by Campbell, Ederington, and Vankudre (1991) and Cowan, Nayar, and Singh (1990), and the latter study suggests that the use of preevent parameter estimates is biased.

Using preevent estimation for the postannouncement analysis (table 2, panel B) leads to weaker results. For the period AD+1 through CED, the full sample has a CAAR value of .004 ($Z = 1.348$), significant at only the 9% level using a one-tailed test. However, positive CARs outnumber negative CARs 95 to 74; the probability of drawing at least 95 positive CARs in this sample is .045. The bond subsample CAAR (.002) is not significant at any reasonable level ($Z = 0.653$), while the preferred subsample has a CAAR value of .010, significant at the 8% level ($Z = 1.397$). Positive CARs for the bond sample outnumber negative CARs by 63 to 48, and for the preferred stock sample positive CARs outnumber negative CARs by 32 to 26.[9] Thus, even though the parametric results are weak because of the possible bias of preevent parameter estimates, the nonparametric results show modest support for positive average abnormal price performance during the period of conversion (AD+1 to CED). All of the analyses and tests presented in table 2 were repeated using the mean-adjusted returns model. The results were parallel to those reported in table 2 for the combined, convertible bond, and preferred stock samples for both the after-event and before-event estimation periods. Thus, the sensitivity of the results is confined to the choice of estimation period, and not to the choice of return generating models.

Previous studies of convertible security calls that report abnormal stock returns immediately subsequent to announcement vary as to their conclusions. Mikkelson's (1981) data reveal positive cumulative raw returns of .88% during the 30-day period following convertible bond calls, and 1.05% for the same period following convertible preferred calls. Campbell, Ederington, and Vankudre (1991) report cumulative average abnormal returns of 1.939% for the 40-day period following convertible bond calls using after-event estimation of the market model. With before-event estimation they find a cumulative average abnormal return of −1.10%. Singh, Cowan, and Nayar (1991), using after-event estimation of the market model, find a cumulative average abnormal return of 3.62% for the 60-day period following nonunder-

9. The probabilities of drawing at least 63 positive CARs in the bond sample and at least 32 positive CARs in the preferred stock sample are .064 and .179, respectively.

written calls of convertible bonds, though their finding is not statistically significant ($Z = 1.09$). For their sample of underwritten calls, they find a 4.26% cumulative abnormal return that is significant at the 8% level ($Z = 1.75$).[10] The tests we have presented should be more powerful tests of the conversion-period price behavior because we use the date conversion ends for each firm.[11]

IV. Tests of the Liquidity Hypotheses

To the extent that the negative price reaction on the announcement date is due at least partially to selling pressure, a rebound should be in evidence; that is, prices that decline the most should recover the most. To examine this we follow Hansen (1988) and estimate the following model:

$$CAR_{j,+1,END} = \beta_0 + \beta_1 CAR_{j,-1,0} + \epsilon_j. \quad (8)$$

In equation (8), $CAR_{j,+1,END}$ is the cumulative abnormal return for security j during the period $t = AD+1$ through $t = CED$, the end of the conversion period, and $CAR_{j,-1,0}$ is measured over the 2-day announcement period.

The model (8) is estimated for the convertible bond calls and the preferred stock calls, and the results are reported in table 3. The parameters β_0 and β_1 in equation (8) are estimated by weighted least squares (WLS), with weights corresponding to the inverse of the standard deviation from the return-generating model. The CAR values in table 3 that are used to estimate equation (8) are from the market model using postevent parameter estimates. For convertible bond calls the sign of the estimated slope coefficient ($\hat{\beta}$) is $-.606$, significant at the 1% level ($t = -2.551$; $R^2 = .084$). This suggests that a 1.0% abnormal decline in price upon announcement is followed by a recovery of about .6%. We interpret these findings as convincing support for the liquidity hypothesis; that is, stock prices that decline the most

10. Ofer and Natarajan (1987) report significant negative price performance for the year following convertible bond calls, consistent with the signaling theory of Harris and Raviv (1985). We replicated their analysis using the sample described in their article, and, using *before-event* estimation as they did, we find the CAAR for months +1 through +12 to be $-.101$ ($Z = -3.307$), consistent with their findings. Using *after-event* estimation we find a CAAR of .032 ($Z = .401$). Thus, the evidence in support of negative signaling vanishes when after-event estimation is used. See Cowan, Nayar, and Singh (1990) for a more elaborate test that establishes the same finding.

11. We use the date conversion ends as the last inclusive date for the recovery period because it is precisely identifiable. Ideally, we would use the last day on which *liquidation* of new shares ends, and this likely occurs after the conversion period ends. This date is not observable; however, we repeated the analysis using arbitrarily chosen terminal dates CED+5 and CED+20. The point estimates of the CAAR values remain approximately the same.

TABLE 3 **Price Recovery Tests Based on the Model:**

$$CAR_{j,+1,END} = \beta_0 + \beta_1 CAR_{j,-1,0} + \epsilon_j$$

	$\hat{\beta}_0$	$\hat{\beta}_1$	R^2
Convertible bonds (N = 111)	.002	−.606	.084
	(.245)	(−2.551)	
Preferred stocks (N = 58)	.032	.739	.100
	(2.352)	(1.751)	

NOTE.–The cumulative abnormal return during conversion period = $CAR_{j,+1,END}$; $CAR_{j,-1,0}$ = cumulative abnormal return during announcement period. Parameter estimates ($\hat{\beta}_0$,$\hat{\beta}_1$) are determined by weighted least squares. Numbers in parentheses are t-statistics. The CAR value are from the market model with after-event parameter estimates.

because of convertible bond calls recover the most by the time conversion ends.

The results for the preferred stock sample are not consistent with the liquidity hypothesis. For example, using mixed estimation period parameters we find $\hat{\beta}_1$ = .599 with a t-statistic of 1.194. The sign is opposite of that predicted.

Since $CAR_{j,+1,END}$ is measured over a considerable amount of time for the preferred stock calls (average 26.5 days) and the bond calls (average 27.5 days), the price rebound tests may be distorted by firm-specific developments that occur during the notice period. Removal of observations having other *Wall Street Journal* announcements during the notice period results in a severe reduction in sample size, particularly in the case of preferred stock calls. Thus, we report two additional tests using the full samples that may be less subject to distortion by extreme observations. The first employs Kendall's test of concordance between $CAR_{j,-1,0}$ and $CAR_{j,+1,END}$. The results are similar to those in table 3. For the bond sample (N = 111), Kendall's "tau" statistic is −.167 using after-event estimation, significantly different from zero at the 10% level using a two-tailed test. For the preferred stock sample (N = 58), the statistic is .117 for after-event estimation and is not significantly different from zero at the 10% level using a two-tailed test.

The final test involves ranking the announcement-period abnormal returns ($CAR_{j,-1,0}$) and grouping the conversion-period abnormal returns ($CAR_{j,+1,END}$) according to quartiles of the distributions of $CAR_{j,-1,0}$. Stocks that suffer the sharpest announcement-period decline should exhibit the largest recovery. The results are reported in table 4.

The results in table 4 are generally consistent with those in table 3. Using after-event estimation, convertible bond calls exhibiting the sharpest announcement-period stock price decline (quartile 1) show an average CAAR over the conversion period of approximately 5%.

TABLE 4 **Conversion-Period Cumulative Average Abnormal Returns for Each Quartile of Announcement-Period Abnormal Returns**

Quartile of $CAR_{j,-1,0}$ Distribution	Combined Sample (N = 169) (1)	Convertible Bonds (N = 111) (2)	Convertible Preferred Stocks (N = 58) (3)
1 (lowest)	.02	.05	−.03
2	.03	.03	.04
3	.01	.01	.04
4 (highest)	.03	.00	.05

NOTE.–The CAR values are from the market model with after-event parameter estimates.

Those that exhibit the next largest decline (quartile 2) have an average CAAR over the conversion period of 3%. Those that exhibit the smallest decline (and in some cases positive abnormal returns) are in quartile 4 and the conversion-period CAAR is approximately zero. The results for convertible preferred stock calls are not consistent with a price rebound. Thus, the results of this analysis are broadly consistent with the results in table 3.

V. Summary and Conclusions

Calls of in-the-money convertible securities are voluntary steps taken by managers, which have been shown to cause negative common share price reactions upon announcement. We have argued that the observed stock price response may be explained in part by a liquidity cost argument similar to that made by Hansen (1988) in the case of rights offers. Hansen argues that rights offers leave current shareholders with portfolio imbalances that appear to be corrected by selling the new shares. Concentrated selling pressure forces a *temporary* price decline, and this represents an additional cost of marketing new shares. Thus, it is not clear that rights offerings are truly less costly than general cash offers; therefore managerial behavior cannot be judged to be irrational.

We have made a similar argument in the case of convertible security calls, and our argument supplements others such as that made by Harris and Raviv (1985). The evidence is for the most part consistent for calls of convertible bonds and partially consistent for preferred stock calls. Calls of both types of securities result in significant negative announcement effects, regardless of the choice of estimation period.

Using an after-event estimation period for market model parameters, we find significant positive cumulative average abnormal returns (CAARs) during the conversion period for the combined sample as well as the bonds and preferred stocks separately. Using before-event estimation, which, it has been argued, may be biased, the CAARs

during the conversion period are positive but not statistically significant.

For the sample of convertible bond calls, stock prices are found to rebound during the conversion period. But the rebound test fails in the convertible preferred stock sample, regardless of the choice of estimation period.

For convertible bond calls the weight of the evidence supports the liquidity-based explanation we have set forth. While these findings cannot rule out other explanations advanced and supported in previous research, they are clearly consistent with predictions of the liquidity-based explanation, which do not arise in the other explanations. The evidence on calls of convertible preferred stocks is mixed, thus our findings are not judged fully conclusive for these types of securities.

References

Asquith, P., and Mullins, D., Jr. 1986. Equity issues and offering dilution. *Journal of Financial Economics* 15 (January/February): 61–89.

Barclay, M., and Litzenberger, R. 1988. Announcement effects of new equity issues and the use of intraday price data. *Journal of Financial Economics* 21 (May): 71–99.

Brealey, R., and Myers, S. 1991. *Principles of Corporate Finance*. New York: McGraw-Hill.

Brennan, M., and Schwartz, E. 1977. Convertible bonds: Valuation and optimal strategies for call and conversion. *Journal of Finance* 32 (December): 1699–1715.

Brennan, M., and Schwartz, E. 1980. Analyzing convertible bonds. *Journal of Financial and Quantitative Analysis* 15 (November): 907–29.

Campbell, C.; Ederington, L.; and Vankudre, P. 1991. Tax shields, sample selection bias, and the information content of conversion-forcing bond calls. *Journal of Finance* 46:1291–1324.

Constantinides, G., and Grundy, B. 1987. Call and conversion of convertible bonds: Theory and evidence. Unpublished manuscript. Chicago: University of Chicago.

Cowan, A. R.; Nayar, N.; and Singh, A. K. 1990. Stock returns before and after calls of convertible bonds. *Journal of Financial and Quantitative Analysis* 25 (December): 549–54.

Garman, M. 1976. Market microstructure. *Journal of Financial Economics* 3 (June): 257–75.

Grossman, S., and Miller, M. 1988. Liquidity and market structure. *Journal of Finance* 43 (July): 617–37.

Hansen, R. S. 1988. The demise of the rights issue. *Review of Financial Studies* 1 (Fall): 289–309.

Harris, M., and Raviv, A. 1985. A sequential signalling model of convertible debt call policy. *Journal of Finance* 40 (December): 1263–81.

Ho, T., and Stoll, H. 1981. Optimal dealer pricing under transactions and return uncertainty. *Journal of Financial Economics* 9 (March): 47–73.

Ingersoll, J. 1977*a*. A contingent-claims valuation of convertible securities. *Journal of Financial Economics* 4 (May): 289–321.

Ingersoll, J. 1977*b*. An examination of corporate call policies on convertible securities. *Journal of Finance* 32 (May): 463–78.

Jaffee, D., and Shleifer, A. 1990. Costs of financial distress, delayed calls of convertible bonds, and the role of investment banks. *Journal of Business* 63 (January): S107–S123.

Kraus, A., and Stoll, H. 1972. Price impacts of block trading on the New York Stock Exchange. *Journal of Finance* 27 (June): 569–88.

Mais, E. L.; Moore, W. T.; and Rogers, R. C. 1989. A reexamination of shareholder

wealth effects of calls of convertible preferred stock. *Journal of Finance* 44 (December): 1401–10.
Mikkelson, W. 1981. Convertible calls and security returns. *Journal of Financial Economics* 9 (September): 237–64.
Mikkelson, W. 1985. Capital structure changes and decreases in stockholders' wealth: A cross-sectional study of convertible security calls. In B. M. Friedman (ed.), *Corporate Capital Structure in the United States*. Chicago: University of Chicago Press for National Bureau of Economic Research.
Mikkelson, W., and Partch, M. 1985. Stock price effects and costs of secondary distributions. *Journal of Financial Economics* 14 (June): 165–94.
Mikkelson, W., and Partch, M. 1986. Valuation effects of security offerings and the issuance process. *Journal of Financial Economics* 15 (January/February): 31–60.
Moody's Investors Service. 1963–88. *Moody's Industrial Manual*. New York: Moody's Investors Service.
Ofer, A., and Natarajan, A. 1987. Convertible call policies: An empirical analysis of an information-signalling hypothesis. *Journal of Financial Economics* 19 (September): 91–108.
O'Hara, M., and Oldfield, G. 1986. The microeconomics of market making. *Journal of Financial and Quantitative Analysis* 21 (December): 361–76.
Roll, R. 1984. A simple implicit measure of the bid-ask spread in an efficient market. *Journal of Finance* 39 (September): 1127–59.
Singh, A.; Cowan, A.; and Nayar, N. 1991. Underwritten calls of convertible bonds. *Journal of Financial Economics* 29:173–96.
Stoll, H. 1978. The supply of dealer services in securities markets. *Journal of Finance* 33 (September): 1133–51.
Stoll, H. 1989. Inferring the components of the bid-ask spread. *Journal of Finance* 44 (March): 115–34.