THE VALUATION OF EXCHANGEABLE SECURITIES:

A PEDAGOGIC APPROACH

Delvin D. Hawley *
O. Felix Ayadi **

This study applies a variant of the Black-Scholes option pricing model to the valuation of exchangeable securities. An exchangeable security is a new hybrid bond which grants its holder the right but not the obligation to exchange the bond for the common stock of a firm other than the issuer. The results indicate that market prices of these securities deviate from their respective theoretical values but the deviation declines with time. This evidence supports the underpricing of initial public offering of securities already documented in the financial economics literature.

The securities market has in recent time been witnessing many developments in terms of the different packages of securities that are available to investors. In the bonds market for example, the familiar convertible bonds of the early 1960s have now been garnished to make them more appealing to investors. One variety of these instruments is the liquid yield option note (LYON) which Merrill Lynch introduced in 1985. A LYON is essentially a zero-coupon, convertible, callable, redeemable bond, whose callable and redeemable prices vary through time. Also, the bond contains a call protection for the investor because the issuer cannot call the bond for a prespecified period after issuance unless the issuer's stock price rises above a predetermined level.[1]

Another recent innovation in the securities market is the introduction of exchangeable securities. An exchangeable bond for instance, grants its holder the right but not the obligation

---

† *The authors appreciate the helpful comments of Michael Moghalu, two anonymous reviewers, editors, and participants at the 1996 Academy of Economics and Finance Conference.*

* *Delvin D. Hawley is an Associate Professor in the Department of Economics and Finance at the University of Mississippi, Mississippi.*

** *O. Felix Ayadi is an Associate Professor in the Department of Economics and Finance at Fayetteville State University, Fayetteville, North Carolina.*

Manuscript received, November, 1995, revised, August, 1996.

to exchange the bond for the common stock (or other securities) of a firm (called the convert firm) *other than* the issuer of the bond. For example, on May 15, 1986, National Distillers and Chemicals Corporation issued $49 million worth of exchangeable bonds due in 2011. Each exchangeable bond was convertible into the shares of Cetus Corporation (convert firm) at a conversion price of $49 per share. This new security is different from the traditional convertible bond that entitles the holder to convert the bond into shares of common stock of the issuing corporation according to certain terms and during a certain period.

There are several reasons why corporations issue exchangeable securities. Like convertible bonds, exchangeable bonds are issued as a substitute for common stock especially when the stock market is witnessing a downturn. A corporation will prefer to issue an exchangeable security than to issue common stock at low prices. Even when stock prices are not depressed, it has been argued that through some signaling mechanism, a new issue of common stock always results in depressing the price of outstanding common stock. More importantly, the "pecking order" theory of capital structure proposed by Myers (1984) and Myers and Majluf (1984) supports the view that corporations prefer to issue debt than common stock. Sometimes, corporations issue exchangeable bonds to avoid the prohibitive interest cost associated with the issuance of straight debt. Straight bonds bear a higher rate of interest relative to exchangeable bonds.

This financial instrument also offers unique tax benefits in the sense that it allows the issuing firm to defer the realization of capital gain on the convert's stock until the conversion is exercised. On the other hand, the issuing firm takes advantage of the tax deductibility of interest payment on exchangeables while at the same time receiving dividends from the convert firm. These dividends are subject to tax exclusion.[2]

The use of exchangeable securities is particularly important in mergers, acquisitions and divestitures. When a bigger firm takes over a somewhat weak one, the relative weakness can be overcome if the weak corporation can borrow under the cover of the parent firm. A corporation also can sell off its stake in another corporation without any unnecessary pressure on the stock price by issuing an exchangeable security. A perfect example is IBM's 6.375 1996 subordinated debenture (issued in 1986) that is exchangeable into capital stock of Intel Corp. Barber (1993) notes that firms issue exchangeable debt after a decision to divest of an intercorporate holding. He found this to be the dominant reason why firms issue exchangeables.

The objective of this paper is two-fold. First, the authors offer a valuation model which is an extension of the Black and Scholes (1973) contingent claims model. Leonard and Solt (1990) have argued extensively for the appropriateness of the Black-Scholes option pricing model to the valuation of warrants. In the case of exchangeable bonds, this model is more appropriate because no new shares are issued; the stocks into which the bonds are convertible have already been issued by the convert firm and held in escrow by the issuing firm.[3] Second, an attempt is made to apply the new model to real life data and observe the relationship between market prices of these bonds and their underlying theoretical values. In line with the above, this paper is organized as follows: Section 2 discusses the theoretical issues, and the pricing model is presented in the third section. The next part is the empirical application of the new model. The final section is the conclusion.

EXCHANGEABLE BONDS VERSUS CONVERTIBLE BONDS

The valuation of an exchangeable security is significantly different from the valuation of a regular convertible. An exchangeable bond grants the holder the right but not the obligation to exchange the bond for the common stock of a firm (hereafter referred to as 'convert' firm) other than the issuer of the bond. On the other hand a conventional convertible bond grants its holder the right to exchange the bond for the common stock of the issuing firm. In both cases the bond provides the investor with a fixed return. Also, the investor receives an implied warrant to convert the security into common stock and thereby participates in the possibility of capital gains associated with being a residual owner of a corporation. Convertible and exchangeable bonds are different to both holder and the issuer.

In terms of valuation, the value of an exchangeable bond to an investor is two-fold: its value as a straight bond, and its potential value as common stock. Like a convertible bond, investors obtain a hedge when they purchase an exchangeable bond. If the market price of the convert firm's stock rises, the value of the exchangeable security is determined largely by its conversion value.[4] But, if the stock of the convert firm turns down (or if the convert firm goes bankrupt) the investor still holds a bond whose value provides a floor below which the price of an exchangeable is not likely to fall.

The application of contingent claims analysis to valuation of conventional convertible bonds has been well documented in Ingersoll (1977), King (1984), Brennan and Schwartz (1977,1980), McDaniel (1983), Stover (1983), and Marr and Thompson (1984) among others. Brennan and Schwartz (1980) observe that an increase in firm market value volatility would decrease the value of the debt component of a convertible bond because this pushes the firm closer to bankruptcy. On the other hand, the Black-Scholes (1973) option pricing model (OPM) predicts a positive relationship between volatility and the option value. This argument about volatility also applies to the risk-free rate variable. In view of this, McDaniel (1983) remarks that "unavoidable interdependencies" exist between the Black-Scholes option pricing model variables and the variables that determine the straight debt value of a convertible bond. Thus McDaniel argues that the option pricing model may not be appropriate for valuing regular convertible bonds. But this argument is not valid for exchangeable bonds because the observed interdependencies do not exist. For example, the unavoidable "interdependencies" reported by McDaniel in the valuation of regular convertibles do not exist for exchangeables. This is because the underlying stock is not the common stock of the corporation that issues the exchangeables. Consequently, variables such as volatility and conversion value that determine the warrant value of the exchangeable relate to the convert corporation.

Another issue is the dilution-adjusted OPM that is used for valuing regular convertibles. Unlike convertible bonds, the conversion of exchangeable bonds does not result in new common stocks being issued that alter the capital structure of the firm. The exercise of warrants issued in the case of an exchangeable does not directly affect the capital structure of the target corporation. The underlying common stocks are already outstanding. Thus, the Galai and Schneller (1978) and Asquith and Mullins (1986) dilution-adjusted OPM which is used to value regular convertibles is not applicable to exchangeable bonds. These issues will be explored further in the next section.

THE MODEL

The objective of this section is to decompose the valuation of an exchangeable bond into both the straight debt value and a warrant which captures the potential common stock value of the security. In other words, one can evaluate this security as the equivalent of a straight bond with an attached implied warrant issued by the firm to exchange the straight bond for the shares of the target firm. Thus

$$V_{ex} = V_b + V_w \tag{1}$$

where,

V_{ex} = value of an exchangeable bond
V_b = straight debt or investment value
V_w = value of implied warrant

The option to exchange (exchange option) is like a nondetachable warrant, with the conversion price replacing the exercise price. The existence of the exchange option is the rationale for the relevance of the option theory to the valuation of an exchangeable security.

Investment Value of An Exchangeable Bond

As already discussed above, this type of bond has two basic characteristics: a claim on a predetermined stream of cash inflows from the issuing firm, and an implied warrant to exchange the security for the common stock of a convert firm. Therefore, the value of this type of security reflects these two components. The value of the straight bond characteristics is usually called the bond's investment value. This investment value represents the current value of the bond without any conversion option, inclusive of accrued interest. In other words, it is the present value of all future cash inflows from holding a straight bond, using an appropriate discount factor. That is:

$$V_b = \sum_{t=1}^{2N} \frac{\frac{1}{2}C_t}{(1+\frac{1}{2}r)^t} + \frac{M}{(1+\frac{1}{2}r)^{2N}} \tag{2}$$

where,

C_t = coupon payment on the bond in period t
M = maturity value of the bond
r = discount rate
N = maturity period of the bond

The investment value of a bond depends on the coupon rate and maturity as well as the risk of default that in turn reflects both the underlying asset risk of the issuing firm and the security provisions of the bond indenture. Brigham (1966) assumes that the bond value is a linear function of the years to final maturity. Thus, his valuation model does not allow for changes in the bond value because of changes in discount rates and default risk.

The implementation of the model represented by Equation 2 depends on the use of an appropriate discount rate. To get this we adopt the model in Billingsley, Lamy and Thompson [hereafter BLT] (1986). Their approach is based on market information and an appropriate discount rate that would exist for the issue if it were sold as straight debt. They define an appropriate discount rate as a linear function of bond rating, interest rate volatility, size of the issue, and the callable features of the bond issue. Their estimated regression equation is of the form:

$$\omega_i = .483 - .284A - .234Baa - .106Ba + 7.921\sigma - .013\psi + .039CALL$$

where,

ω_i = relative yield spread calculated as yield to maturity on issue I minus the yield on the 20-year constant maturity U.S. Treasury index on the date of issue divided by the yield on the 20-year constant maturity U.S. Treasury bond index;

RATING = zero-one variables for Moody's Investor Service rating (A, Baa, Ba, and B). B issues serve as the reference group in the regression;

σ = volatility in interest rates computed as the previous ten days' (from issue date) mean absolute variation in the 20-year constant maturity U.S. Treasury bond index;

ψ = the natural log. of the dollar size of the issue;

CALL = years to first call or refunding divided by the years to maturity.

The BLT model has been shown to possess a better predictive power compared to the Brennan and Schwartz (1980) model. Schadler and Dudley (1993) and Dudley and Schadler (1994) also confirmed the superiority of the BLT model over the Brennan and Schwartz model. Since the relative performance of the BLT model in predicting an appropriate risk-adjusted discount rate is acceptable, we adopt their model in this paper.

Value of Implied Warrant

The insurance value of an exchangeable bond is closer to a warrant than to a call option. Listed call options have expirations that do not exceed nine months, but warrants typically have expirations which far exceed nine months. However, one main distinguishing feature of warrants is that they result in dilution when exercised. In the special case of exchangeable bonds, dilution constitutes no problem because bonds are not convertible into the stocks of the issuing corporation.

In order to apply the Black-Scholes option pricing model, it is necessary to define the relevant boundary conditions as in Brennan and Schwartz (1977, 1980); Ingersoll (1977); and McConnell and Schwartz (1986). From the investor's standpoint, an exchangeable bond can be redeemed at a prespecified call price or converted into common stock. Rationality demands that the investor selects the more valuable option. On the other hand, the firm will find it optimal to adopt a call strategy that minimizes the value of the exchangeable bond.

If we assume away bankruptcy, the value of an exchangeable bond at maturity is the higher of the conversion value and the face value of the bond plus the terminal coupon. However, at any time during the life of the security, its value must be equal to or greater than its conversion value. It is irrational investment behavior to convert the bond when its market value exceeds the conversion value. Furthermore, the call condition is such that at any time the value of the exchangeable bond must be equal to or less than the greater of the call price and the conversion value. These are the call and conversion conditions that serve as boundaries for the pricing of all convertible and exchangeable bonds.

Given that the underlying stock price obeys a geometric wiener process with the usual no-arbitrage assumption, the value of an exchangeable bond must satisfy the following fundamental differential equation.[5]

$$\frac{1}{2}\sigma^2 S^2 \frac{\partial^2 H}{\partial S^2} + rS\frac{\partial H}{\partial S} + \frac{\partial H}{\partial t} - rH = 0 \tag{3}$$

Equation 3, together with the boundary conditions specified above, fully describe the warrant value of an exchangeable bond. The final equation is of the form:

$$V_W = S_0 e^{-\delta T} z(d_3) - X_0 e^{-R_f T} Z(d_4) \tag{4}$$

where,

$$d_3 = \frac{\ln(S_0/X_0) + R_f T - \delta}{\sigma\sqrt{T}} + \frac{1}{2}\sqrt{T}$$

$$d_4 = d_3 - \sigma\sqrt{T}$$

δ	=	the proportion of the convert firm's stock price that is paid out in dividend.
R_f	=	the risk-free rate
S_0	=	the market price of the shares of the convert firm that can be exchanged for a warrant
X_0	=	exercise price of the exchangeable bond
σ	=	standard deviation of the stock price of the convert firm
T	=	time to expiration/call
Z(.)	=	cumulative probability under the normal curve

Equation 4 assumes that dividends are a constant proportion of the stock price and are paid out continuously over the life of a warrant. Insofar as dividends have effect on the firm's market value, the stock price as well as the price of a warrant will be correspondingly affected.[6] In fact, when the underlying stock pays a dividend, an early conversion is highly likely.

Another significant feature of the Black-Scholes OPM implies simultaneous exercise of all options outstanding. According to Emanuel (1983), the differences that exist between warrants and options indicate that the simultaneous exercise may not be optimal if all the warrants are held by one investor. The reason is that the exercise of one warrant reduces the quantity of warrants in circulation and investors can use this to their advantage. So, it is argued that the differences between regular options and warrants render the Black-Scholes model inapplicable.[7] Spatt and Sterbenz (1986) and Constantinides (1984) disagree with this inference. Constantinides notes that when warrants are held by competing investors, the OPM is still applicable. Spatt and Sterbenz examine the interaction between optimal warrant exercise strategies, on the one hand, and the firm's capital structure, dividend and reinvestment policies on the other. They argue that the firm can follow policies that will eliminate any advantage to sequential exercise strategies (cf. Cox and Huang, 1989). The authors concur with the conclusion of Constantinides.

DATA AND METHODOLOGY

The original exchangeable bond sample used in this study includes seventeen bonds. For each bond, the issue date, conversion and call features, rating, maturity date and other features were obtained from *Moody's Bond Record, Moody's Bond Survey, Moody's Manuals,* and the *Wall Street Journal.* The sample size was made up of exchangeable bonds issued between January 1984 and June 1987. The minimum criteria for the selection of the final sample are as follows:

- the underlying common shares are publicly traded
- the exchangeable issues are also publicly quoted
- the value of the issue is at least $45 million
- data on the issue are available in *Moody's* and/or *Standard and Poor's* manuals
- the exchangeable bond is rated by one of the rating agencies
- the bond is not a Eurobond.

The rationale for imposition of the screening criteria are as follows: We were interested in getting data on these bonds both at time of issue and beyond. Moreover, we wanted to avoid running into the confounding impact of other influences such as foreign exchange rate implications of Eurobonds. An issue size of $45 million was used because of low level of market activity associated with these small issues. Moreover, most of the issues were prematurely retired. Thus, the above screening process produced a final sample of seven exchangeable securities.[8]

The U.S. Treasury 20-year Constant Maturity Bond Index and the risk-free rate were obtained from *Federal Reserve Statistical Release: Selected Interest Rates* for various years. The historical record of the convert firm stock price is obtained from *Standard and Poor's Stock Record.*

The investment value of each bond was calculated using Equation 2. The BLT model whose validity was also confirmed by Dudley and Schadler (1994) is used to determine the appropriate discount rate. The warrant value was obtained from the application of the option pricing model represented by Equation 4. The estimate of the underlying stock price volatility is based on instantaneous rate of return on the convert firm's weekly data twenty-four weeks prior to the valuation period. The adjustment for dividend payments is on the usual assumption of a constant dividend yield. The yield is the ratio of average dividend for two years before the exchangeables are issued to the current price. The investment and warrant values were summed together to obtain the value of each exchangeable.

RESULTS

The attempt in this section is to compare the prices generated from the model discussed above with the market prices of exchangeables. We also intend to proffer possible reasons for the divergence between market prices and their respective theoretical values.

Table 1 shows the theoretical prices of sampled exchangeable bonds at the time of issue. All the bonds are valued above their face values. The values range from $1079.40 to $1223.75. In all sampled bonds, the warrant portion of theoretical value is relatively small. The warrant value as a proportion of total value ranges from 9 percent for Panhandle Eastern Corp. to a high of 26 percent for Signal Companies.

Table 1

Theoretical Values of Exchangeable Bonds at Time of Issue

BOND	WARRANT VALUE ($)	INVESTMENT VALUE ($)	TOTAL VALUE ($)
General Dynamics	136.31	960.04	1096.35
Petrie Stores	174.43	904.97	1079.40
Signal Cos.	323.23	900.52	1223.75
IBM	162.74	968.38	1131.12
National Dist. & Chem.	241.32	916.39	1157.71
General Host Corp.	246.02	1031.05	12277.07
Panhandle East. Corp.	102.59	1037.32	1139.91

In Table 2, we compared both the theoretical values and market prices of the underlying exchangeable bonds. At the time of issue, all the exchangeable bonds in the sample are significantly underpriced in the market relative to theoretical values. The ratio of theoretical value to market price (column 2) ranges from 1.079 to 1.277. On average, an exchangeable bond is sold at about 86 percent of its theoretical value. This result corroborates the following observation by McGuire (1991 p.39): "As a general rule, the theoretical value of an equity warrant often substantially exceeds its market value. Sometimes investors pay as little as one-half to two-thirds of what the warrant in theory is worth."

In column 3 of Table 2, we show the relationship between theoretical values and market prices at the time first public listing of the bonds. Results show that the market still underprices exchangeables, because an average bond sells for about 90 percent of its theoretical price. However, by the third month in the market, both theoretical and market prices of exchangeable bonds begin to converge. At this time, about 75 percent of the bonds sampled are priced within 10 percent of their respective theoretical values. On average, the market price is 92 percent of the theoretical price. The t-statistic suggests convergence in both prices at the 5 percent level. A higher degree of convergence is also achieved after the securities had traded for twelve months (column 5). There is still a tendency for the average market price to rise above its respective theoretical value.

Two important trends are found in this paper. First, the market price of exchangeable bonds are significantly lower than their respective theoretical prices at the time of issue. Second, within a period of three months after these bonds become listed on an exchange, we tend to achieve convergence between market and theoretical prices. The obvious conclusion is that there is a sort of "learning" process in the market for these securities. The more time they remain in the market, the more investors know about them and the more accurate one is able to value them. Market illiquidity has also been identified by McGuire (1991) as a possible factor explaining why market prices deviate from their underlying theoretical values. McGuire noted that the convertible market is illiquid because there are few market makers, reduced investor interest, smaller market capitalization and less transparent methods of trading. Finally, the assumptions underlying the model discussed in this paper do not properly hold in practice. For example, dividend yield is not constant. Thus, the same types of bias found in the Black-Scholes OPM can be expected to occur in other applications of the OPM such as the one discussed here.

The pattern observed in this study is such that the trade in exchangeables bonds is continuous for an average of twelve months after they are listed. After this initial period, some do not record any trade for more than two years and thus result in an illiquid market. For example, exchangeable bonds issued by IBM in March 1986 was listed in the market in November 1986. It traded until (although not continuously) October 1987 and then recorded no further trade. Thus, the results obtained here confirm the view of McGuire (1991, p.48).[9] Kuhn (1990) also provides a good description of the relative under performance of convertibles, especially in the later part of 1985, This incidentally coincides with our sample period.

Table 2

Relative Performance of the Valuation Model

BOND	AT TIME ISSUED ($)	FIRST PUBLIC TRADE ($)	MONTH 3 OF PUBLIC TRADE ($)	MONTH 12 OF PUBLIC TRADE
General Dynamics	1096.35/ 996.00 (1.101)	1187.27/ 1085.00 (1.094)	1077.59/ 1145.00 (0.941)	1179.42/ 1145.00 (1.03)
General Host	1277.07/ 1000.00 (1.277)	1086.06/ 1020.00 (1.065)	1045.09/ 945.00 (1.106)	N.A
IBM	1131.12/ 1000.00 (1.131)	1322.29/ 1221.25 (1.083)	1369.56/ 1205.00 (1.137)	N.A
National Distillers & Chemicals	1157.71/ 1000.00 (1.157)	995.81/ 935.00 (1.065)	955.55/ 885.00 (1.080)	1001.95/ 1180.00 (0.85)
Panhandle Eastern Corp.	1139.91/ 1000.00 (1.140)	1155.12/ 1055.00 (1.095)	1225.01/ 1120.00 (1.094)	1440.56/ 1340.00 (1.08)
Petrie Stores	1079.40/ 1000.00 (1.079)	1291.31/ 1140.00 (1.133)	1226.00/ 1180.00 (1.039)	1199.94/ 1420.00 (0.085)
Signal Cos.	1223.75/ 1000.00 (1.224)	1085.55/ 875.00 (1.241)	1036.67/ 830.00 (1.249)	1151.54/ 1010.00 (1.14)
AVERAGE	1157.90/ 999.43 (1.159)	1160.49/ 1047.32 (1.108)	1133.64/ 1044.29 (1.086)**	1194.68/ 1219.00 (0.98)**

* In each cell, the numerator is estimated value of an exchangeable. The denominator is the quoted price of the security. The values in brackets represent the ratio of model values to actual market prices of the exchangeables.

** Both theoretical and market prices are not significantly different at five percent level N.A. means no trade in the bond for the month.

CONCLUSION

The nature of exchangeable securities makes the application of the Black-Scholes option pricing model most relevant. An exchangeable bond can be viewed as a combination of a straight debt and an implied warrant. Therefore, the Black-Scholes OPM can be applied to value the warrant portion of the package without running into the "interdependencies" observed by McDaniel (1983) when the Black-Scholes model is applied to the traditional convertible bonds.

Although the results in this study indicate that market prices of these securities deviate from their respective theoretical values especially at the time of issue, the deviation tends to decline with time. This suggests that it takes some time before investors get to understand these complex securities. Market illiquidity has been identified by McGuire as one of the factors why market prices deviate from underlying theoretical values. The pattern observed in this study is such that the trade in exchangeables is continuous for an average of twelve months after they are listed. After this initial period, some do not record any trade for more than two years. For example, exchangeable issued by IBM in March 1986 was listed in the market in November 1986. It traded until (although not continuously) October 1987 and then recorded no further trade.

Finally, the results in this study support the practical usefulness of the OPM and the BLT model in the valuation of exchangeable bonds. Both models are used to determine a reasonable estimate of equity and debt components of an exchangeable security at any point in time.

The pricing formula presented in this paper, like the Black-Scholes OPM could be sensitive to both the estimates of the discount rate obtained from the application of BLT model and the volatility of the underlying stock price. If these estimates are biased, one expects the theoretical values to be biased too. Some of the convert firms' stocks in our sample do not have options listed on them. Therefore, the only approach for estimating stock price volatility is the approach adopted in this study. However. it should be noted that the BLT model has been validated by Dudley and Schadler (1994). Based on the foregoing, the valuation model presented in this paper has promise.

NOTES

1. For a more detailed analysis of this type of security, refer to McConnell and Schwartz (1986), Noddings (1982), McGuire (1991) and more recently, Barber (1993).

2. Barber (1993) examines the different reasons why firms issue exchangeable debt and the relative validity of each reason.

3. For a more comprehensive survey of the features of this security, refer to Barber (1993).

4. The convert firm in this case is the firm whose common stock an exchangeable bond would be converted.

5. All the variables here are as originally defined in Black and Scholes (1973). However, the stock price, S (conversion value of an exchangeable) is adjusted for dividend. H is the hedged portfolio. For this derivation refer to Brennan and Schwartz (1977, p. 1704).

6. Refer to Beenstock (1982, p. 36) for a discussion of the effect of dividends on the value of an option.

7. More recently, Emanuel (1983) argues that the Black-Scholes option pricing model exhibits some biases when used to value American call options. These biases were found to be related to the exercise price, time to expiration and the stock's volatility. In the original OPM, out-of-the-money options are systematically underpriced while in-the-money options are overpriced. It is also reported that the Black-Scholes model underprices call options on low variance stocks and overprices options on high variance stocks.

8. There are only a few exchangeable bonds listed in the market. Even with the small size of the market for this security, many of them are not regularly traded. For a survey of the market for exchangeable, refer to Barber (1993).

9. Mcguire (1991) observed that: "Convertibles are complex securities whose price behavior requires more time and effort to understand than straight bonds and stocks, In addition, convertible portfolios need to be more actively monitored and traded than stock and bond portfolios. Furthermore, an unexpected rise in interest rates, or a takeover bid, or a decline in secondary market liquidity can lead to under performance of convertibles relative to bonds or stocks."

REFERENCES

Asquith, P. and Mullins, D.W. (1986). "Equity Issues and Stock Price Dilution." ***Journal of Financial Economics***, 15, January/February, 61-89.

Barber, Brad M. (1993). "Exchangeable Debt." ***Financial Management***, 22(2), 48-60.

Beenstock, M. (1982). "The Robustness of the Black-Scholes Option Pricing Model." ***Investment Analyst***, October, 30-40.

Billingsley, R.S, Lamy, R.E. and Thompson, G.R. (1986). "Valuation of Primary Issue Convertible Bonds." ***Journal of Financial Research***, 9(3), Fall, 251-259.

Black, F. and Scholes, M. (1973). "The Pricing of Options and Corporate Liabilities." ***Journal of Political Economy***, 81(3), 637-659.

Brennan, M.J. and Schwartz, E.S. (1977). "Convertible Bonds: Valuation and Optimal Strategies for Call and Conversion." ***Journal of Finance***, 32(5), 1699-1715.

Brennan, M.J. and Schwartz, E.S. (1980). "Analyzing Convertible Bonds." ***Journal of Financial and Quantitative Analysis***, 15(4), 907-929.

Brigham, E.F. (1966). "An Analysis of Convertible Debentures: Theory and Some Empirical Evidence." ***Journal of Finance***, March, 21(1), 35-54.

Dudley, L.W. and Schadler, F.P. (1994). "Reporting the Relative Equity Portion of Convertible Debt Issues." ***Journal of Accounting, Auditing and Finance***, 9(4), 561-577.

Emanuel, D. (1983). "Warrant Valuation and Exercise Strategy." ***Journal of Financial Economics***, 12(2), 211-235.

Galai, D. and Schneller, M. (1978). "Pricing of Warrants and the Value of the Firm." ***Journal of Finance***, 33, December, 1333-1342.

Gepts, Stefaan J. (1987). ***Valuation and Selection of Convertible Bonds***. New York: Praeger.

Ingersoll, J.E. (1977a). "A Contingent-Claims Valuation of Convertible Securities." ***Journal of Financial Economics***, 4, May, 289-321.

Ingersoll, J.E. (1977b). "An Examination of Corporate Call Policies on Convertible Securities." ***Journal of Finance***, 32, May, 463-478.

King, R. (1986). "Convertible Bond Valuation: An Empirical Test." ***The Journal of Financial Research***, 9(1), Spring, 53-69.

King, R.D. (1984). "The Effect of Convertible Bond Equity Values on Dilution and Leverage." ***The Accounting Review***, 59, July, 419-431.

Kuhn, Robert, L.(ed.) (1990). ***Corporate and Municipal Securities***. Homewood, IL: Dow Jones-Irwin.

Leonard, D. C. and Solt, M.E. (1990). "On Using the Black-Scholes Model to Value Warrants." ***The Journal of Financial Research***, 13(2), Summer, 81-92.

McConnell, J.J and Schwartz, E.S. (1986). "Lyon Taming." ***Journal of Finance***, 41, July, 561- 577.

McDaniel, W.R. (1983). "Convertible Bonds in Perfect and Imperfect Markets." ***Journal of Financial Research***, 6, Spring, 51-65.

McGuire, Simon R. (1991). ***The Handbook of Convertibles***. New York: Institute of Finance.

Myers, S. (1984). "The Search for Optimal Capital Structure." ***Midland Corporate Finance Journal***, 1, Spring, 6-16.

Myers, S. and Majluf, N. (1985). "Corporate Financing and Investment Decisions When Firms Have Information Investors Do Not Have." ***Journal of Financial Economics***, 13(3), 467-480.

Noddings, T.C. (1982). ***The Investor's Guide to Convertible Bonds***. London: Thomas C. Noddings.

Schadler, F.P. and Dudley, L.W. (1993). "A Market-Based Model for Determining Common Stock Equivalence Improves EPS Reporting." *Working Paper FINA 93-13*, East Carolina University, Greenville, NC.

Schwartz, E. (1977). "The Valuation of Warrants: Implementing a New Approach." ***Journal of Financial Economics***, 4(1), 79-93.

Spatt, C. and Sterbenz, F. (1989). "Warrant Exercise, Dividends and Reinvestment Policy." *GSIA Working Paper No 33-84-85*, Carnegie-Mellon University.

Stover, R.D. (1983). "The Interaction Between Pricing and Under-Writing Spread in the New Issue Convertible Debt Market." ***Journal of Financial Research***, 6, Winter, 323-332.