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EMPIRICAL CHARACTERISTICS OF DEBENTURE CONVERSIONS:
The Issue of Equivalency

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EMPIRICAL CHARACTERISTICS OF DEBENTURE CONVERSIONS:

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ABSTRACT

Stock market and corporate valuation decisions are often based on the earnings-per-share (EPS) figure. With the advent of a large number of different types of equity or semi-equity securities, the concept of common stock equivalency became essential. Despite extensive regulatory consideration, only arbitrary rules came into being in the assessment of this concept.

This paper empirically examines the conversion of debentures into common stock. This conversion process is divided into three types: (1) forced conversion, (2) semi-forced conversion, and (3) voluntary conversion. Non-parametric and discriminant analysis are used for hypothesis testing and conversion prediction.

Statistical analysis supports simple relationships between market values and convertible debenture characteristics which were found significant in all three types of conversion.

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1. BACKGROUND

1.1 Introduction

Earnings per share (EPS) is one of the most widely used items of accounting data today. A series of normative standards have been proposed for the measurement of earnings. Moreover, the number of outstanding shares to be considered may be calculated by different methods. The proliferation of types of convertible securities such as convertible debentures, convertible preferred stock, and stock options further complicates the problem.

The underlying question is: *When is convertible debt so close to being common stock that it should be classified as a common stock equivalent?*[1] According to the APB's Opinion No. 15 [1] and SFAS No. 55 [2], imminent conversion is strong evidence of equivalency, but is not by itself a *sufficient* criterion. These statutes provide a needed operational guideline for EPS calculation but offer little in the way of justification or sound basis for choice. As a sufficient condition, APB No. 15 uses the following: if the cash yield of the convertible security is less than 2/3 of the bank prime rate on the day of the issuance, then the security is a common stock equivalent. FAS No. 55 replaces the prime rate

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[1] A glossary of symbols used in this paper and their definitions can be found in Appendix I.

with the Aa corporate bond rate. In both cases these criteria are evaluated at only one point in time: the security's date of issuance. An evaluation based only on the date of issue lacks justification, given that convertible debt will normally be outstanding for 20 or 25 years [3,4]. Furthermore, if a security's market price impounds all currently available public information [5]; how can the equivalency valuation be based on market prices and conditions that existed as long as 25 years earlier? In addition, when almost all convertible debentures are either rated Ba or B, what relevance does the prevailing rate for the much less risky Aa class of bonds have? [2]

The primary objective of this study is to explore the relationship and interaction between convertible titles and certain security parameters. This leads to an empirically based increased understanding of the concept of common stock equivalency. Investor perception of convertible title value is the primary determinant of its probability of conversion and consequently its equivalency.

Based upon the research presented in this paper a number of criteria for predicting conversion and hence common stock equivalency were empirically tested. Each criterion was expressed as an inequality, which if true would result in a security's being predicted as a potential conversion. The most successful predictors of conversion, were found to be (1) the ratio of conversion value (the current market price of the common stock into which the debenture could be converted) to call price (the amount due the investor if the firm elects to call

3. MODELS AND RELATIONSHIPS

The key elements in the life of a debenture are its conversion threshold, where it starts to be converted at a significant rate, and the slope(s) of this conversion rate(s). In addition, there are features of certain convertible debentures which may further complicate this picture: an increase in conversion price, the expiration of the conversion privilege (the right of a bondholder to exchange the security for common stock), and a call . These events will cause discontinuities and substantial change in the shape of the curve, and will be treated separately. Debenture conversions may be classified into three general categories:

1. *Forced Conversion* -- The corporation deliberately forces conversion by calling the issue.
2. *Semi-Forced Conversion* -- Some bondholders decide to convert their holdings into common stock because of some impending change in the debenture.
3. *Voluntary Conversion* -- Some investors deliberately decide to convert their debentures into common stock.

The predominant conversion prediction arguments relate to two factors: (1) relationships of the conversion value of the title to its statutory value[3] and (2)

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[3] The statutory value could be represented by either of two variables, call price or face value, which were found in the current study to be highly correlated (.9997).

relationships of the interest being paid by the convertible security to the dividends on the underlying common stock and to certain general market rates of return. The goals of individual debenture holders are to maximize the value of their investment (in factor 1) and/or to maximize the proceeds from their investment (in factor 2). On the other hand, the company's motivation is to minimize its costs of capital and/or exchange debt for equity financing at an appropriate market price for common stock.

Table 1 summarizes the expected relationships, which rationale is developed next in this section, assuming a set of operational definitions and the different rates of taxation for individuals versus corporations.

Insert Table 1 here

3.1 Forced Conversion

This category designates debentures which are called in by the corporation. Given a "call", an informed investor -either corporate or individual- would be expected to convert if his revenue from so doing would be greater than the amount he would receive from turning in his debentures to the company. (Frank & Weygandt [26])[4] Consequently the first relationship being postulated entails:

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[4] It can be shown that this is another way of saying that companies set conversion price (face value divided by the number of common shares into which the security would convert) equal to the desired future issuing price of the common stock [27, 28].

$$\frac{CV}{CL} > 1 \tag{1}$$

A corporation would call in a bond issue for a variety of reasons. Only cases where the company's apparent intention (as evidenced by substantial subsequent conversion) was to exchange equity for debt were considered. The few cases where the company was, for example, calling in one debt issue in order to float another (Dietrich [29]), were ignored in the data studied.

A common scenario (Weston and Brigham [30]) is that the corporation's original intention was to finance with common stock, and debentures were used as a temporary stopgap. Brigham [27] found that 73% of the companies interviewed were primarily interested in raising equity capital when they decided to issue convertible debentures, even though they could have financed with either straight debt or straight equity. Such companies could be expected to force conversion once the market price of the common rises above the price specified by the indenture agreement - the conversion price - as equity financing would now be more favorable than debt. Thus, convertible debentures called by their issuing corporations would be expected to have conversion values exceeding their face values (FV). That is, conversion would be expected to occur when CV/FV>1. In this study, because of the high correlation found between this criterion and relationship (1) (CV/CL>1), the ratio $CV/FV>1$ was treated as an alternate form of the first relationship rather than a separate criterion.

The second relationship being examined, is the yield criterion of APB Opinion No.15 applied on a *current* market conditions basis instead of at the historical date of issuance. Relationship of the cash yield (CY) to the bank prime rate (BPR) was tested because the APB/FASB has long advocated it as a criterion, and because of its role in the FASB No. 55 yield test. However, since the application of this criterion on a historical basis has been shown to be fruitless (Frank & Weygandt [3]; Hofstedt & West [4]), this study evaluated this ratio on a current basis. The stated criterion for conversion is:

$$\frac{CY}{BPR} < \frac{2}{3} \qquad (2)$$

3.2 Semi-Forced Conversion

The semi-forced conversion category includes debentures that are converted because of an expected impending change in the debenture (operationally defined as within 1 year). Expected changes are those written into the indenture agreement, such as the expiration of the conversion privilege or an increase in the conversion price at a specified date.[5] The imminent expiration of the conversion privilege would force the investor to convert to avoid a loss of wealth if the value of the underlying common stock (conversion value) exceeds the debenture's investment value (the market value of a comparable security with no conversion feature).

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[5] Semi-forced conversion may also be thought to include the actual maturation of the convertible debenture. The relevant relationship, not tested due to lack of adequate sample, would be $CV/FV > 1$.

$$\frac{CV}{IV} > 1 \qquad (3)$$

Where IV stands for investment value. Because of the high collinearity found between: (1) this ratio and the ratio of conversion value to call price and (2) between conversion value to investment value and conversion value to face value, [6] it can be seen that these other ratios would also be good indicators of conversion.

That is,

$$\frac{CV}{CL} > 1 \quad \text{and} \quad \frac{CV}{FV} > 1$$

The step-up of the conversion price at certain intervals is a feature of some debentures apparently serving the purpose of accelerating conversion. In this instance, an investor would be expected to convert if he anticipates that the market value (MV) of the debenture after the rise in conversion price will be less than its present conversion value. This relationship can be seen to describe debt whose market value is almost entirely determined by its stock value rather than its investment value. Several different variables are characteristic of such debentures. These are shown in relationships (4), (5) and (6).

$$\frac{(MV - IV)}{IV} \quad is \quad High \qquad (4)$$

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6. Respectively r = .9470 and r = .9485 for this sample.

$$\frac{(MV - CV)}{CV} \quad is \ Low \qquad (5)$$

$$\frac{MV}{CV} \approx 1 \qquad (6)$$

A convertible debenture's investment value premium as in the literature (premium over investment value) is a measure of how much extra an investor is willing to pay for the conversion feature. In the case of debentures whose market price would drop significantly after a rise in the conversion price, this amount should obviously be greater than zero. Whether 10%, 25% or 50% is sufficient is left as an empirical question of interest. This is an alternate form of the market parity or conversion parity test from the APB Exposure Draft of 1968. (Watkins [31] and Longfield [32])

The conversion value premium (premium over stock value) is a measure of the additional amount over conversion value an investor is willing to pay for the investment feature of the convertible debenture - the fact that it pays a given rate of interest yearly and will pay the face value at maturity. This would be low for those debentures which would be significantly affected by an increase in the conversion price.

The sixth relationship says that in the case of a debenture whose conversion value dominates its investment value, the market value should approximately equal the conversion value, or that the above stated ratio should be approximately 1. A value much greater than 1 would indicate the security's market price was largely dependent upon its investment value. (Bierman and

risky debentures (i.e: Baa, A), voluntary conversion would be expected to be greater among risk seekers that would convert from risky bonds to even riskier shares (all other factors being equal).

The last relationship tested was the APB criterion based on the *current* market conditions instead of the date of issuance conditions. Investments showing a cash yield less than a market benchmark - in this case 2/3 bank prime rate - would be inclined to convert.

$$\frac{CY}{BPR} < \frac{2}{3} \tag{13}$$

4. METHODOLOGY

The relationships postulated in the above section were empirically examined through the selection of a set of debentures at two points in time. These points had to provide (1) reasonably similar macroeconomic climates, (2) a restricted set of types of convertible securities and, (3) data availability.

The postulated relationships were examined in the form of hypotheses comparing the frequencies of predicted conversion with the frequencies of actual conversion within the sample. Once the relationships were examined in order to formulate the basic rules for conversion behavior, a second part of the analysis attempted - through naive models and discriminant analysis - to predict conversion.

4.1 Structural Relationships

Two samples of convertible debentures were selected from *Moody's Convertible Bonds List.* One sample consisted of all of the debentures on the December 20, 1965 list. The second sample consisted of all the debentures on the December 21, 1970 list which had not appeared on the former list. For firms whose fiscal year was the calendar year, variables were evaluated at the sample date and at the subsequent December. The economic period subsequent to 1965 and the economic period following 1970 are very similar in nature. With the oil crisis at the end of 1973, the second oil shock of 1979, and the subsequent worldwide recession of the early eighties no other similarly stable and more recent macroeconomic comparison periods existed. Therefore somewhat dated data were used to avoid more recent but "polluted" macroeconomic periods.

The sample-selection procedure ordinarily yielded two debenture-year observations for each debenture in either of the two samples. For various reasons, data were not always available for two years for every debenture. These reasons included: debentures were called during the first of the two years, corporations were reorganized under Chapter XI, the information in the 10-K's and the annual reports was insufficient to determine whether and/or how much voluntary conversion had occurred. Altogether 365 debenture-year observations were obtained for the 1965 sample and 686 for the 1970 sample.

Thirteen relationships were examined using selected parts of the complete data base of 1051 convertible debenture observations. This was done by comparing the group of the appropriate type of conversion with a control group. For the forced and voluntary conversion relationships, the control group consisted of the 689 debentures which showed "no" conversion (operationally defined as less than .1% conversion). For the semi-forced conversion relationships, the control group consisted only of the few debentures which possessed the relevant change in convertibility features (conversion privilege expiring or conversion price rising) and showed no or low conversion during the year examined. The chi-square statistic was used to test all of the forced conversion relationships. The small sample sizes for the semi-forced conversion relationships required the use of the Fisher exact probability test and the F statistics, while the voluntary conversion hypotheses were tested by the use of the Student's t test and chi-square statistics.

4.2 Conversion Prediction

Common-stock equivalency criteria were chosen based on two overriding factors: that they were (1) simple prediction models based on previously analyzed relationships, and (2) that the criterion be as easy to obtain and to calculate as possible. The first factor led to the usage of four prediction methods: (1) the earlier analyzed relationships as naive prediction models, (2) these same models with revised parameters, (3) stepwise multiple discriminant analysis, a statistical method that generates rules for classifying items into groups, e.g. conversion and non-conversion, and (4) bivariate prediction models. The specific criterion used, with discriminant analysis, was to select the variable which yielded the longest Mahalanobis distance (greatest difference) between the two groups. In all cases only the 1965 sample was used to generate the discriminant function, while the 1970 sample was used to test the function so calculated.

The postulated relationships and the discriminant analysis provided the cutoff thresholds. For example, the $CV/CL > 1$ criterion was tested, as was an empirically determined criterion based on the 1965 sample $CV/CL > .8625$. The comparison of the predictive performance of the original criteria cutoffs and the revised ones provides a method of empirically determining equivalency thresholds.

Results were analyzed in two ways: (1) the percentage of debentures correctly classified and (2) the prediction of the number of actual conversions. These results are discussed in the next section.

5. RESULTS

5.1 Hypothesis Testing

Table 2 illustrates the specific analysis for relationship #1 where $Conversion\ Value/Call\ Price > 1$ is shown to be a significant criterion in the prediction of conversion. The relationship predicted correctly the behavior of 708 out of 766 debentures.

Insert Table 2 here

The same type of specific analysis was performed for all postulated relationships leading to the summary displayed in Table 3. For the Forced Conversion Case. Relationships #1 and #2 were significant at the .01 level. All the semi-forced conversion relationships were found supported at a significant level. Relationships #7, 8, 9, 10, 11 and 13 for the Voluntary Conversion Model were all supported, while results were inconclusive for Relationship #12 (Risk Class). Although different distributions were observed by risk class, overall predictive ability was not improved by segregating debentures by class; however, further research is warranted.

Insert Table 3 here

5.2 The Naive Predictive Models

In addition to hypothesis testing, each single criterion was tested as a naive prediction model. Furthermore, using Morrison's [25] estimation procedure, the thresholds were modified for a revised prediction model.

When each single criterion was tested in its original form on both the 1965 and 1970 samples, the overall performance of the Frank and Weygandt/Ingersoll criterion tested the best:

$$\frac{Conversion\ Value}{Call\ Price\ (or\ Face\ Value)} > 1$$

This criterion correctly classified 81.24% of the entire sample of 1970 convertible bonds. Table 4 summarizes the results of testing the different criteria on the new (1970) sample.

When the cutoff of each criterion was adjusted for the true proportion of conversions in the 1965 sample and this adjusted criterion was tested on the 1970 data, the same two highly correlated relationships ($CV/CL > 1$ and $CV/FV > 1$) proved superior. For example the $CV/CL > 1$ criterion when applied to the 1965 data predicted only that 146 debentures would convert when actually 179 converted. Lowering the cutoff to .8625 predicted the correct number (179) of conversions (although did not always project the correct debentures as converting).

Overall, adjusting the cutoffs slightly improved the percentage correctly classified while also better approximating the number of debentures that actually converted. Since accountants are more interested in identifying common stock equivalents (those securities likely to convert) than in correct classification *per se*, this latter finding is of importance. Were this not so, the Maximum Chance Criterion of predicting no common stock equivalents would correctly classify 79% of the debentures. This is included in Table 4 as an interesting benchmark.

The $ConversionValue/CallPrice > .8625$ (or $CV/FV > .9$) criterion performed best, correctly classifying 86.89% of the debentures. The modified APB Criterion with an adjusted cutoff of .82367 correctly classified 80.71% of the new sample. It is of interest that this empirically generated cutoff is very close to the 5/6 suggested by Gibson and Williams [34].

The number of conversions forecasted on the basis of each of these three criteria was virtually identical to the number of conversions which actually

insight into the voluntary conversion phenomenon. Normally, dividends on common stock increase over time. Therefore, the x-axis may be perceived as being in backwards chronological order. This means that during the life of a convertible debenture (Barring a premature "death," caused by a call) there would be two peaks in voluntary conversion. First corporate bondholders would be motivated to convert when dividends on the underlying stock reach 58% of interest income (Formerly 56% with a 48% maximum tax rate for corporations) due to the tax advantage afforded by the dividend exclusion. Later, individual bondholders would tend to convert as soon as dividend income exceeds interest income.

Although conversion may be much more likely to happen in periods of strong economic growth than in a recession, no attempt was made to correlate conversion with any variables descriptive of the market place as a whole (other than the bank prime rate). Instead, it is assumed that the market is efficient in the semi-strong sense, and thus the market price of the common stock and consequently the conversion value and the market price of the debenture already impound all known information about the current and future states of the economy.

This paper represents an advancement upon preceding research into the question of the common stock equivalency issue in the calculation of earnings per share. First, it proposes an overall framework of forced conversion, semi-forced conversion, and voluntary conversion in which to test the various hypotheses. These hypotheses are shown to be the logical consequences of the different reasons for conversion.

Second, this paper proposes and tests several new rationales for voluntary conversion dependent upon the prevailing maximum federal income tax rate for corporations and the risk class of the debentures. This analysis is based upon a far more extensive data base than that used in prior studies.

New accounting standards to govern the determination of common stock equivalents may be required. The findings of this study should be useful in the formulation of such standards, particularly in determining the equivalence criteria to be applied and in the timing of that equivalence test.

Appendix I
LISTING OF ABBREVIATIONS AND SELECTED DEFINITIONS

BI	Dollar value of bond issue outstanding
BPR	Bank prime rate = the short-term interest rate commercial banks charge their best customers.
CL	Call price = the amount the firm must pay the investor when a bond is called. Generally the call price starts at a value above the face value and decreases annually until is exactly face value at maturity. For this study; call price was operationally defined as the lowest call price in effect during the next 12 months.
CP	Conversion price = the price per share of common stock specified by the convertible debenture's indenture agreement. When the market price of common stock is at the conversion price, the conversion value of the debenture will equal $1000 (or face value).
CSE	Common stock equivalent = a convertible security which is treated by the marketplace as being virtually identical to its underlying common stock.
CV	Conversion value = the market value of the common stock which could be obtained by converting a convertible debenture.
CY	Cash yield = annual cash rate of return on the market value of the security. For a bond, the annual interest paid divided by its current market value.
Div	Dividend on one share of the underlying stock
EPS	Earnings per share
FV	Face value
Int	Coupon rate of return on bond
IV	Investment value = a convertible debenture's value as a straight debt instrument. Equal to the face value plus its interest payments to maturity discounted by a discount rate based on its risk
I	Amount of interest to be paid annually on each debenture
MP	Market price
MCC	Maximum Chance Criterion = predicting that all of a population will belong to the largest component of the population. For example, predict that all voters in Louisiana are Democratic.
MV	Market value of one convertible debenture
NI	Net income
OS	Number of outstanding shares of common stock

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TABLE 4. Summary of the Results of Testing Criteria on the New (1970) Sample to Predict Conversion Either Forced or Voluntary"

	Original Criteria				Revised Criteria			
Criterion	Cutoff	# Correctly Pred.*	#Pred. Conv. **	% Correct	Cutoff	# Correctly Pred.*	#Pred. Conv. **	% Correct
Naive Models								
CV/CL	> 1	582	73	85.71	> .8625	590	141	86.89
CV/FV	> 1	584	91	86.01	> .9	589	142	86.75
CPxINT/DIV	< 1.78	499	160	73.49	<1.68	502	155	73.93
CV/IV	> 1	455	334	67.01	>1.025	469	316	69.07
(MV-INV)/INV	> 1	569	36	83.80	> .21	402	373	59.20
(MV-CV)/CV	< 0	572	65	84.24	< .154	550	233	81.00
CY/BPR	< 2/3	572	47	84.24	< .824	548	137	80.71
Discriminant Model								
DISC.FUNC.	>1.026	542	241	79.82	>1.023	536	247	78.94
Dual Criterion Models								
CV/FV>.9 & CY/BPR<2/3						589	148	86.75
CV/CL>.8625 & CY/BPR<2/3						589	146	86.75
Maximum Chance Criterion								
MAX.CHANCE	N/A	539	0	79.38	N/A	539	0	79.38

* Out of a total sample of 679.

** 140 out of 679 actually converted.

FIGURE 1
Voluntary Conversion Percentage Converted vs.
Conversion Price x Bond Coupon Rate / Dividend
(Only Debenture-Years with Dividends > 0)
(1970 data)