The Coastal Business Journal

Volume 9 | Number 1 Article 1

May 2010

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ABSTRACT

Much of today's corporate debt is callable, and the value of the call provision attached to a corporate debt instrument is a function of the likelihood of the call provision's being exercised by the bond issuer. This study examines the effect of the shape of the yield curve on the value of the call premium placed on callable bonds over similar non-callable bonds. Since a bond issuer will only call a bond when interest rates are lower than they were at the time of the bond's issue; the likelihood of a call being exercised will increase as interest rates are expected to decline over time. The market conveys its expectations about the future direction of interest rates by the way it prices fixed-income securities. This expectation is reflected in the shape of the yield curve on government debt. If the yield curve is upward sloping, then the market is conveying its expectation that, over time, interest rates will rise. This would represent a set of expectations that reduces the likelihood that a call would be exercised, reduces the value of the call premium, and drives the price of the callable issue closer to the price of similar non-callable issues. Conversely, if the yield curve is downward sloping, then the market is conveying its expectation that, over time, interest rates will decline. This would represent a set of expectations that increases the likelihood that a call would be exercised, increases the value of the call premium, and drives the price of the callable issue below the price of similar non-callable issues.

INTRODUCTION

Corporate bond yields are a function of several factors generally assumed to be additive in nature. First, bonds yields compensate investors for deferring consumption today in favor of increased consumption at some later time. Investors will not defer consumption today in return for the same consumption at a later time. It is only the expectation of greater future consumption that will prompt individuals to defer consumption to a future time. Additionally, compensating investors for deferred consumption alone is insufficient for prompting investment. Purchasing power must also be preserved. For example, if investors require a 3% return to defer consumption for a year, and if prices rise by 3% during the year, then a 3% rate of return on the investment (which would cover the reward for deferral of consumption) results in zero gain to investors; so they would have essentially deferred consumption for free. Investors have no way of knowing what future inflation rates will be that the time they invest; therefore, the extra return required to compensate for inflation is based on their expectation of the average level of inflation over the corresponding holding period. This inflation premium is common to all securities.

Bond contracts often contain various codicils designed to benefit one party or the other to the agreement. Most indenture provisions are designed to make the bond more attractive to the bondholder and thus enhance the price and lower the yield. For example, the imposition of restrictions on the firm such as a non-subordination provision will cause the market to perceive the bond as less risky, more attractive, and thus more valuable. This results in downward pressure on the interest rate that the issuer will be required to agree to over the life of the bond. [Jones (1998)]

Another contract element one might find in a bond contract is the conversion right. The conversion right gives the bondholder the option to convert the bond into a specified number of shares of the company's stock. This has the theoretical effect of a call option to the bondholder on the company's stock and allows the bondholder to participate in share price appreciation resulting from the company's investments, if they so desire. For example: A bond is sold in the primary market for its face value of $1,000; at the time the bond is issued, the issuing company's stock is trading for a price of $40 per share. The bond contains a conversion privilege that allows the bond holder to convert the bond to 20 shares of stock (the conversion ratio). Since this conversion ratio remains constant, the bondholder now has a call option on the company's stock at a strike price of $50 per share ($1,000/20 = $50), and the option is currently out of the money (strike price > market price).

Most convertible bonds are issued with the conversion option "out of the money" for obvious reasons. If the bond were issued with the conversion option "in the money," then investors would buy the bond and convert it to stock and make a riskless profit. This would drive the price of the bond up until the conversion call option is approximately "at the money." However, if the market believes that price appreciation in the company's stock is likely to occur, then the value of the conversion option will increase the value of the bond. This will lower the yield that the market requires on the convertible bond. (Jones 2001)

The call provision, which allows the issuer to redeem the bond early in the event of a lower interest environment, has been associated with lower bond prices and higher yields. [See for example: Allen, Lamy and Thompson (1990), and Jones (2001)]. The current study examines the continuing effect of these contract elements on yield premiums. Since the value of the call option on the bond accrues to the borrower (issuer), it is exacted from the lender (bondholder). If the value of the option increases, then the value of the callable bond declines in similar fashion. For example, if we compare two bonds that are identical in every aspect except that one is callable and one is not, then the difference in their market values must be attributable to the call option. However, the value of the call option actually has two components: the dollar value of the option (intrinsic value), and the likelihood that the option will be exercised (time value). As noted earlier, the call option is only valuable to the issuer when interest rates are lower than they are currently paying. Therefore, the expected value of the call option will increase as current interest rates differ on the low side from the interest rate on the bond. This is why finance professors often note to students that bonds that are trading at a discount to face value (i.e., market rates are above the coupon rate) are not likely to be called. In this instance, the value of the call option is essentially zero, because the likelihood of the option's being exercised is essentially zero.

If the market expects interest rates over time to decline (as indicated by a downward-sloping yield curve), then the likelihood of a future call increases, and the price of the callable bond should fall below that of the otherwise identical non-callable bond.

THE MODEL

To examine the effect of the shape of the yield curve on bond yield, the following model is specified:

$$YLD = \alpha + \sum \beta_i CV_i + \delta Slope$$

where YLD is the yield on the issue reported on the issue date. The CV_i's represent a vector of control variables included as the result of theory and prior empirical work. These control variables include call protection, term to maturity, issue size, issue rating, presence of a conversion option, and whether the issue is dually-rated or split-rated. For example, see Allen, Lamy, and Thompson (1990); Altinkilic and Hansen (2000); Billingsley, Lamy, Marr, and Thompson (1985); Blackwell, Marr, and Spivey (1990); Chatfield and Moyer (1986); Ederington (1986); Jewell and Livingston (1998); Liu and Moore (1987); Livingston, et al. (1995); Logue and Rogalski (1979); Sorensen (1979); Rogowski and Sorensen (1985); and Livingston and Miller (2000).

The **slope** variable is the slope of the characteristic line through the yield curve on the day the bond was issued. This variable is used as a proxy for the likelihood of a bond call being exercised by the issuer. We assume that a bond issuer would not exercise a call provision in an environment of interest rates higher than those that existed at the time the bond was issued and, conversely, that conditions of falling interest rates will increase the likelihood that a call option will be exercised. In this case, the bond issuer would be able to exchange higher interest cost for lower interest cost. The slope variable is determined exogenously to this model by using linear regression on the yield on treasury securities against their respective terms to maturity on the issue date of the bond issue. The slope coefficient of this regression model is used as a proxy for call likelihood. A steeper slope should result in a lower risk of the bond being called, and consequently a lower required yield, and vice-versa.

If the issue is callable prior to maturity, a binary indicator variable (**Callable)** is given a value of 1; otherwise, it is set to zero. The interaction of the call variable and the yield slope variable is important for this study, because the ability to call an issue early represents an option to the issuing firm that has a positive value which will accrue from the purchaser of the bond. In addition, the ability to call the issue early raises the possibility that under conditions of falling market rates, the very condition under which the holder of the bond will want to keep it, the bond issue may be prematurely recalled, forcing the holder to reinvest at a lower rate (reinvestment rate risk). These arguments suggest that the relationship between the call indicator variable and a bond's excess yield should be positive. The greater the likelihood that the bond will be called, the higher the return required by the investor interested in buying the issue. At the same time, the length of time that an issue is protected from being called should mitigate this impact. The model includes the length of time that an issue is call-protected (in years) by subtracting the issue year from the year that the issue is first callable (**CallProt**). The sign of this variable in the model should be negative; that is to say that the longer the issue is call-protected, the lower the required offering yield, other things equal.

Term is the number of years to maturity of the issue. This variable is included as a proxy for interest rate risk. Interest rate theory suggests that interest rate risk rises as term to maturity increases. Therefore, we expect that longer-term issues will have a higher required yield than shorter-term issues in order to compensate for the additional interest rate risk. We test the model with both the nominal value in years for the term variable and the natural log of the term variable.

Size is the proceeds of the issue in dollars. We include this variable as a proxy for the liquidity risk of the issue. Fisher (1959) suggests that the amount of debt issued will have an impact on the liquidity risk of the issue. This impact can be either positive or negative. Larger issues may be traded more frequently, thus reducing the liquidity risk of the issue; or a large issue may have a negative price impact, increasing liquidity risk. We test the model with both nominal value in millions and the natural log of the size variable.

We use the issue's Standard and Poor's rating as a proxy for default risk. While each issue in the sample has a rating from both Moody's and Standard and Poor's, previous work by Jones (1998) suggests that the market places greater weight on Standard and Poor's rating; therefore, we use the S&P rating to categorize issues with respect to default risk. We place the issues into one of four default risk groups: **Very High Grade** (AAA), **High Grade** (AA to A), **Medium Grade** (BBB), and **Speculative** (BB+ and lower). We assign three indicator variables a value of 1 or 0, depending upon the category in which the issue's S & P rating falls. The Speculative grade issues will have a value of 0 for all three, Medium grade would be coded as 0,0,1; High grade as 0,1,1; and very high grade as 1,1,1. We use indicator variables rather than a continuous variable because the ratings represent categories of risk rather than a continuous risk measurement. In other words, AA is not more risky than AAA by some fixed amount; rather, AA (or any rating class, for that matter) represents a broad category of issues which are similar, but not identical.

Split is an indicator variable set equal to 1 if Moody's rates the issue differently than Standard and Poor's or 0 if the two ratings are the same. Billingsley et. al. (1985) examined 258 bonds issued between January 1977 and June 1983, 12.9% of which were split rated. Their study found that investors perceive split-rated issues as more risky than non-split-rated issues. We therefore expect that split-rated issues will have a higher yield than non-split-rated issues [See also Ederington (1986), Liu and Moore (1987), and Jones (1998)].

Conv is an indicator variable that will have a value of one if the issue is convertible prior to maturity at the option of the holder and zero otherwise. The option to convert the bond into shares of stock acts fundamentally the same as a call option on the issuer's stock at a strike price equal to the conversion price of the bond. Jones (2001) examined whether or not the bond purchaser places a value on the conversion option. Theory suggests that the added option value of the conversion privilege would increase the price an investor would be willing to pay for a particular issue, which, in turn, would have the effect of lowering the required yield. Jones' (2001) work supported this theoretical relationship, finding that in his sample the average excess yield for convertible bonds was lower than the average excess yield for non-convertible bonds.

DATA

The dataset for this study consists of 5,337 new corporate debt issues made between 1983 and 1993. (This dataset was created originally by T. Opler from data acquired from the Federal Reserve Board of Governors Capital Markets Division. The data were acquired by the author from the Fisher College of Business datafinder website in 1996, and additional data points have been added since that time. The dataset has subsequently been removed from that site.) We derived information on the slope of the yield curve from data downloaded from the Federal Reserve Board's H15 interest rate series, which can be found at http://www.federalreserve.gov/releases/h15/update/. A general description of the data is shown in Tables 1 and 2 below. Thirty-four percent of the issues were callable, 7.8 percent were convertible, and 21.9 percent were split rated. All risk classifications were well represented. The average dollar value of the issues in the sample was $139.75 million, and the issues ranged in size from $100,000 to $2.26 billion. The average issue had a yield of 9.62 percent, and they yielded on average 369.37 basis points above the rate on contemporaneous 3-month Treasury bills. The callable issues were on average protected from being called for a period of 1.35 years, with a range of immediately callable to call-protected for 20 years.

Table 1. Frequencies of Categorical Variables N=5337		
Variable	Number	%
Callable	1816	34.0%
Convertible	415	7.8%
Split	1169	21.9%
Very High Grade	269	5.04%
High Grade	2769	51.88%
Medium Grade	1126	21.10%
Speculative Grade	1173	21.98%

Table 2. Descriptive Statistics of Continuous Variables N=5337				
	Minimum	Maximum	Mean	Std. Deviation
SIZE (million of $)	.1000	2260.0000	139.748698	122.0392763
Term (years)	1.0000	99.0000	14.882518	10.0015304
YLD (%)	3.4500	19.8900	9.621316	2.3004184
XYTB03 (%)	.0000	14.2700	3.693705	1.9016415
CallProt	.0000	20.0000	1.350009	2.5649064
Oty (basis points)	.00	1427.00	369.3705	190.16415
Slope	-.00962	.15260	.0774309	.03842598

RESULTS

The offering yields on each of the 5,337 issues were regressed on the explanatory variables noted in the Model Description section above using the SPSS statistical analysis package. Based on the discussion above, the expected sign of each of the explanatory variables is presented in Table 3 below.

Table 3. Expected Sign of the Coefficient of Each Explanatory Variable	
Variable	Effect on Yield
Callable (b)	+
Size (c)	-
Term (c)	+
Convertible (b)	-
Split Rated (b)	+
Call Protection (c)	-
Credit Quality (b)	-
Yield Curve Slope (c)	-

The results of the regression are provided in table 4 below.

Table 4. Results of Linear Regression of the Model $YLD = \alpha + \sum \beta_i CV_i + \delta Slope$						
Variable	Expected Sign	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta	B	Std. Error
(Constant)		12.871	.092		140.152	.000
Callable	+	1.032	.078	.212	13.195	.000
CONV	-	-4.172	.096	-.486	-43.410	.000
CP	-	-.043	.013	-.048	-3.238	.001
Split	+	.318	.056	.057	5.653	.000
Vhigh	-	-.024	.108	-.002	-.218	.827
High	-	-.618	.060	-.133	-10.340	.000
Med	-	-2.377	.075	-.428	-31.665	.000
Slope	-	-14.870	.627	-.248	-23.712	.000
SIZE	-	-.001	.000	-.034	-3.355	.001
Term	+	.011	.003	.047	4.330	.000
			R	R Square	Adjusted R Square	Std. Error of the Estimate
			.682(a)	.465	.464	1.68379

Note that the signs for all explanatory variables are as expected, and that the model has an adjusted R^2 of 0.465. The only variable that does not present as statistically significant is the indicator variable for very-high-grade debt. Recall from the model discussion above that the credit quality indicators are additive in nature; an additional indicator is affixed above the baseline of speculative grade, and this indicates the average additional reduction in required yield attendant with the increase in credit quality. On average, Medium-grade issues have a required yield 238 basis points lower than Speculative-grade; High-grade issues have a required yield 62 basis points lower than Medium-grade issues, and Very-High grade issues have a required yield only 2 basis points lower than High-grade issues. The model does not provide evidence to support the notion that the two-basis-point difference is statistically different from zero. This result is consistent with the result found in Jones (2000). Perhaps the market is either unable or unwilling to differentiate between high-grade debt and very-high-grade debt. The remaining explanatory variables are all significant with the expected sign and will therefore not be further discussed here.

CONCLUSIONS

The explanatory variable of particular interest in this study is the slope coefficient of the Treasury yield curve on the issue date for each bond issue. The interpretation of the results relative to the coefficient of the slope variable depends upon a number of assumptions discussed or alluded to above, and restated here.

1. The slope of the Treasury yield curve is a proxy for the market's expectation of the future direction of interest rates. For example, a positive slope suggests that the market expects future interest rates will be higher than current interest rates.

2. Because bond issuers would be foolish to call an existing bond issue and replace it with a higher-interest-rate issue, bonds are only likely to be called when interest rates are lower than when the issue was originally floated.

3. The slope of the yield curve serves as a proxy for the likelihood that a bond will be called. The greater the likelihood (i.e., the more negative the slope), the greater the required premium and the lower the likelihood (i.e., the more positive the slope), the lower the required premium.

The results support the assertion that the likelihood of a bond call can impact a bond's required yield at the time of issue, and consequently, its issue price. The results indicate that a one-percent increase in the slope of the yield curve results in a decrease in the bond's offering yield of approximately 14.9 percent. This number seems staggering until we look at the average slope over the 30-year yield curve. The average slope was only 0.08 percent, and the maximum estimated slope was only 0.15 percent. At the maximum, the slope of 0.15 percent would result in a 2.2 percent reduction in the bond's offering yield, and the average slope of 0.08 percent would result in a 1.2 percent offering yield reduction.

Simply put, the results of this model seem to suggest that the slope of the yield curve can serve as a proxy for the call risk on a callable bond. Bond issuers should perhaps pay attention to movements in the yield curve when determining when to float an issue. Issuing callable debt in an environment of low-to-negative-sloping yield curves may save the issuer something in offering yield.

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