The Effect of Yield Curve Differentials on the Bond Call Premium

Wesley M. Jones, Jr, The Citadel, Charleston, SC wes.jones@citadel.edu

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 being exercised by the bond issuer. This study examines the effect of the shape of the yield curve on 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 currently lower than they were at the time of the bond's issue, then 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 reduce the likelihood that a call would be exercised, reduce the call premium, and drive 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 increase the likelihood that a call would be exercised, increase the call premium, and drive 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 the act of 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 an individual to defer consumption to a future time. Additionally, compensating an investor for deferred consumption alone is insufficient for prompting investment. Purchasing power must also be preserved. For example, if an investor requires 3% to defer consumption for a year, and prices during the year rise by 3% then a 3% rate of return, which would cover the deferral of consumption, results in zero gain to the investor and they have essentially deferred consumption for nothing. Inflation is unknown until after the fact. Therefore, the extra amount required to compensate for inflation is based on the 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 that are 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 that 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.[1] 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 will examine the continuing effect of these contract elements on yield premia. 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, and the likelihood that the option will be exercised. 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 being exercises is essentially zero.

As 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.

$$OTY = \alpha + \sum \beta_i EV_i + \delta Slope$$

Where OTY is the off treasury yield (the difference between the bond's yield, and the contemporaneous yield on three month treasury bills) in basis points. "Off treasury" yield controls for the general level of interest rates and recognizes that potential investors have the option of "parking" their money in short term risk free assets in the event that other investment opportunities are perceived as less than optimal. The EV_i's represent a vector of explanatory variables included as the result of theory and prior empirical work. These explanatory variables include call protection, term to maturity, issue size, issue rating, presence of a conversion option and whether the issue is dually or split rated[1].

[1]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. It is assumed that a bond issuer would not exercise a call provision in an environment of higher interest rates than those that exist at the time the bond is 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.

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 will inform the results of this study and is included in the analysis because the ability to call an issue early represents an option to the issuing firm that has a positive value which will accrue from some other party, in this case, 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 grouping 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.

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 with term to maturity. Therefore, it is expected that longer term issues will have a higher required yield than shorter term issues to compensate for the additional interest rate risk. The model is tested with

both the nominal value in years for the term variable as well as the natural log of the term variable

Size is the proceeds of the issue in dollars. This variable is included 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. The model is tested with both nominal value in millions as well as the natural log of the size variable.

Default risk is proxied by the issue's Standard and Poor's rating. 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 the rating of Standard and Poor's, therefore, the S&P rating is used to categorized issues with respect to default risk. The issues are placed into one of four default risk groups. The four groups are: **Very High Grade** (AAA), **High Grade** (AA to A), **Medium Grade** (BBB) and **Speculative** (BB+ and lower). Three indicator variables are assigned a value of 1 or 0 depending upon in which category 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. Indicator variables are used as opposed to a continuous variable because the ratings represent categories of risk rather than a continuous risk measurement. That is that AA is not more risky that AAA by some fixed amount.

Split is an indicator variable set equal to one if the issue is rated differently by Moody's and Standard and Poor's and zero otherwise. 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 investor's perceive split rated issues as more risky than non split rated issues. It is therefore expected 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 that an investor would be willing to pay for a particular issue which would have the effect of lowering the required yield. Jones (2001) work supported this theoretical construct finding that in his sample convertible bonds had an average excess yield lower than non convertible bonds.

Data

The dataset for this study consists of 5,337 new corporate debt issues made between 1983 and 1993.[2] Information on the slope of the yield curve was derived from data downloaded from the Federal Reserve Board's H15 interest rate series.[3] A general description of the data is found in tables 1 and 2 below. Thirty-four % of the issues were callable, 7.8% were convertible, and 21.9% were split rated. All risk classifications were well represented. The average dollar value of the issues in the sample was $139.75 million and they ranged in size from $100,000 to $2.26 billion. The average issue had a yield of 9.62% and they yielded on average 369.37 basis points above the rate on contemporaneous 3-month treasury bills. The callable issues were on average

[2] This dataset was created originally by T. Opler from data acquired from the Federal Reserve Board of Governor's Capital Markets Division. The data was acquired by the author from the Fisher College of Business datafinder website in 1996. The dataset has subsequently been removed from that site.

protected from being called for a period of 1.35 years and this ranged from immediately callable to call protected for 20 years.

Table 1. Frequencies of Category 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					
	Range	Minimum	Maximum	Mean	Std. Deviation
SIZE	2259.9000	.1000	2260.0000	139.748698	122.0392763
Term	98.0000	1.0000	99.0000	14.882518	10.0015304
YLD	16.4400	3.4500	19.8900	9.621316	2.3004184
XYTB03 (%)	14.2700	.0000	14.2700	3.693705	1.9016415
CP	20.0000	.0000	20.0000	1.350009	2.5649064
Oty (basis points)	1427.00	.00	1427.00	369.3705	190.16415
Valid N (listwise)					

Results

Results will be provided at the conference.

[3] http://www.federalreserve.gov/releases/h15/update/

References

Allen, D.S., R.E. Lamy, and G.R. Thompson, 1990, "The Shelf Registration of Debt and Self Selection Bias," Journal of Finance 45(1), 275-287.

Altinkilic, O. and R.S. Hansen, 2000, "Are There Economies of Scale in Underwriting Fees? Evidence of Rising External Financing Costs," Review of Financial Studies 13(1), 191-218.

Billingsley, R.S., R.E. Lamy, M.W. Marr and G.R. Thompson, 1985, "Split Ratings and Bond Reoffering Yields," Financial Management 14(2), 59-65.

Blackwell, D.W., M.W. Marr, and M.F. Spivey, 1990, "Shelf Registration and the Reduced Due Diligence Argument: Implications of the Underwriter Certification and the Implicit Insurance Hypothesis," Journal of Financial and Quantitative Analysis 25(2), 245-259.

Capital Markets Division - Federal Reserve Board of Governors.

Chatfield, R.E., and R.C. Moyer, 1986, "Putting Away Bond Risk: An Empirical Examination of the Value of the Put Option on Bonds," Financial Management 15(2), 26-33.

Ederington, L.H., 1986, "Why Split Ratings Occur," Financial Management 15(1), 37-47.

Fisher, L., 1959, "Determinants of Risk Premiums on Corporate Bonds," Journal of Political Economy 67(2), 217-237.

Jewell, J. and M.B. Livingston, 1998, "Split Ratings, Bond Yields, and Underwriter Spreads," Journal of Financial Research 21(2), 185-204.

Jones, W. 1998, "The Effect of Split Ratings on Bond Yields and the Informational Quality of Rating Agencies," Southern Business Review 24(1), 17-24.

Jones, W. M. "The Effect of Underwriter Prestige on Offering Yield." ***Southwest Business and Economics Journal***. 9. 2000. pp. 23-30.

Jones, Wesley M., Jr., "The Effect of The Yield Curve on Bond Risk Premia," Proceedings, Southeastern Chapter of the Decision Sciences Institute, February 2002, pp. 73-75.

Jones, Wesley M., Jr., "The Effect of The Conversion Privilege on Offering Yield," Proceedings, Southeastern Chapter of the Institute for Operations Research and the Management Sciences, October, 2001, pp. 387-394

Liu, P. and W.T. Moore, 1987, "The Impact of Split Bond Ratings on Risk Premia," The Financial Review 22(1), 71-85.

Livingston, M. and R.E. Miller, 2000, "Investment Bank Reputation and the Underwriting of Nonconvertible Debt," Financial Management 29(2), 21-34.

Livingston, M., H. Pratt and C. Mann, 1995, "Drexel, Burnham, Lambert's Debt Issues," Journal of Fixed Income 4(4), 58-75.

Logue, D.E., and R.J. Rogalski, 1979, "Does It Pay to Shop Around for a Bond Underwriter?" Harvard Business Review 57(4), 111-117.

Moody's Bond Survey various editions.

Rogowski, R.J., and E.H. Sorensen, 1985, "Deregulation in Investment Banking: Shelf Registrations, Structure and Performance," Financial Management 16(1), 5-15.

Sorensen, E., 1979, "The Impact of Underwriting Method and Bidder Competition Upon Corporate Bond Interest Cost," Journal of Finance 34(4), 863-870.

The Wall Street Journal, various issues.

[1] 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."