# Insuring Callable Bonds: Selecting the Right Payment Plan

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Bond insurance is frequently employed by municipal and corporate borrowers to reduce the cost of debt. Investors will pay a higher price (or equivalently, accept a lower yield) for an insured bond, because of its guaranteed interest and principal payments. Insurance also enhances distribution—because certain investors are restricted to bonds rated at least AAA, less creditworthy issuers can tap this market by insuring their bonds.

While commonplace for tax-exempt bonds (about 50% of the new issues are insured, by companies such as AMBAC and MBIA), insurance is less widely used for taxable bonds. Among the latter, those targeting retail investors are often insured.

The insurance premium depends on the perceived default risk of the issuer as reflected in part by the issuer's credit rating. The lower the rating, the higher is the premium. But judging by the popularity of bond insurance, the interest savings clearly outweigh the premiums paid as observed by Angel [1994] among others. This article focuses on identifying which of the two commonly offered premium plans for callable bonds is the more cost effective, assuming the decision to insure has already been made.

## ALTERNATIVE PREMIUM PLANS

From the perspective of the borrower an "upfront-only" payment structure has the major drawback that there is no rebate for the unutilized portion of the insurance when the bonds are retired prior to maturity. When no alternative payment plans were available, periods of intensive refinancings precipitated by declining interest rates brought windfall profits to the insurance companies. Issuers would occasionally be able to negotiate some concession by the insurer towards a policy on a new issue but this was by no means something to be counted on.

Eventually competition bred innovation and insurers began to offer an alternative plan for callable bonds. Today an issuer has a choice of paying upfront only (as before) or a smaller initial amount followed by level periodic premium installments from the first call date until the bond is retired.

Earlier this year, for example, a corporation considered insuring a $100 million taxable BBB+ rated 30-year retail issue with a 6.875% coupon, callable at par after five years. The single upfront premium quoted by the insurer was 1.43% of total debt service (or 4.38% of face value). The "pay-as-you-go" plan had an upfront premium of 1.59% of debt service through the first five years (2.14% of face value) and 0.42% of face value per year thereafter.

If the bonds are called after five years, the pay-as-you-go plan would clearly have the lower cost. But if the bonds remain outstanding for 30 years, the (present value adjusted) cost of the 0.42% annual payments, at around 4.13% of par, added to the initial 2.14% of par payment would amount to 6.27% of par, and would exceed the 4.38% of par payment of the "one-time" plan. The challenge of identifying the plan with the lower expected cost arises from the fact that the life of a callable bond depends on the course of interest rates.

## REFUNDING OF CALLABLE BONDS

The answer to the challenge posed above lies in the understanding of when bonds are called. While there are various reasons for retiring bonds prior to maturity, the most common by far is refunding when interest rates are low.

Variations on the theme of calling and refunding include repurchasing not-yet-callable bonds or defeasing such bonds to the first call date. In the case of municipal bonds, "advance refunding" may also be permitted.

This allows the issuer to lock in interest savings prior to the initial call date by defeasing the bonds with an escrow consisting of U.S. Treasury obligations. For example, if interest rates decline steeply after issuance, a 30-year bond callable in 10 years could be advance refunded after one year, i.e., nine years prior to the initial call date and 29 years prior to maturity. While the bonds would remain outstanding until the initial call date, insurance is no longer required, because the U.S. Treasury obligations constituting the escrow are default-free.

Exactly how low rates should decline to trigger a refunding is a matter of some complexity. Merely establishing that there are savings from refunding is insufficient; one should also determine the value of the option being forfeited. Boyce and Kalotay [1979] proposed the analytical framework to make the right call (pun intended). The decision should be based on *refunding efficiency*, which they define as:

$$\textit{Refunding Efficiency} = \frac{\textit{Present Value of Cashflow Savings}}{\textit{Value of Call Option}}$$

In essence, a bond should be refunded only if the savings represent close to 100% of the forfeited option value (Howard and Kalotay [1988]). Since the savings from option exercise cannot exceed the value of the option, refunding efficiency cannot exceed 100%.

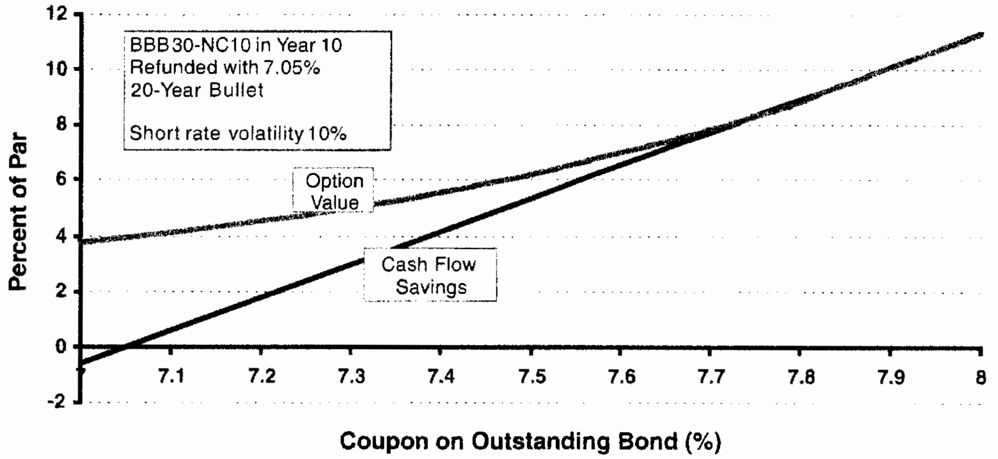
While calculating the cashflow savings is straightforward, valuing the call option requires specialized expertise and computing power (Kalotay, Williams, and Fabozzi [1993]). Critical inputs, in addition to the terms of the bond, include the issuer's current borrowing rate, interest rate volatility, and transaction costs.

With municipal issues eligible for advance refunding, a further complexity is introduced. The mechanics of advance refunding are somewhat different from calling and refunding (also known as current refunding). Nonetheless, the notion of refunding efficiency still applies. The only difference is that the value of the advance refunding option is incorporated into the analysis together with the value of the call option (Kalotay and May [1998]).

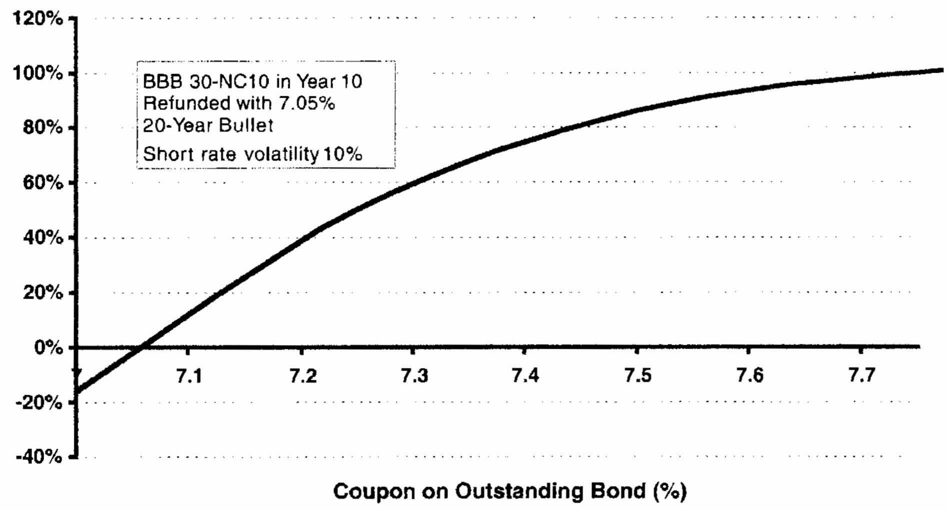
Exhibits 1 and 2 illustrate the application of refunding efficiency. We assumed that the optionless 20-year (taxable) rate is 7.05%, the yield curve is typically upward sloping, and interest rate volatility is 10%. This last input is required

# EXHIBIT 1

**Inputs into Call Decision 30-NC 10 in Year 10 Refunded with 7.05% 20-Year Bullet**



## EXHIBIT 2
**Refunding Efficiency**




for calculating option values, but does not affect cash flow savings. The bonds considered for refunding have 20 years left to maturity and they are currently callable at 100.

For bonds of this structure whose coupons range from 7% to 8%, Exhibit 1 shows the savings from refunding at 7.05% and the option value. As expected, the higher the coupon, the greater are both the savings and the option value. But while savings can be negative and increase linearly, option value is always positive and does not increase at the same rate unless it is deep in the money. As the coupon increases, savings and option value approach each other asymptotically.

Exhibit 2 displays the corresponding refunding efficiencies. Clearly the higher the coupon, the higher is the efficiency. When the coupon is relatively low, the efficiency is well below 100%; in fact, when the savings are negative so is the efficiency. But at a coupon of roughly 7.70% the efficiency reaches 100%. We conclude that if the coupon is higher than 7.70%, the bond should be called immediately. A similar pattern would emerge if we fixed the bond's coupon and gradually lowered interest rates.

### THE REFUNDING DECISION APPLIED TO INSURED BONDS

When considering whether or not to refund a callable bond, sunk costs such as insurance premiums paid and underwriting fees are irrelevant (except possibly for tax purposes, which are not considered here) and should have no bearing on the refunding decision. So a bond insured with a single upfront premium should be analyzed in the manner described above, *without consideration of insurance*.

The analysis of a bond insured with a pay-as-you-go plan is fundamentally different because it must incorporate the ongoing premiums. These premiums should be added to the actual coupons to determine the effective interest cost beyond the non-callable period. Because of its higher prospective cost, it is clear that a bond with a pay-as-you-go plan is a better candidate for refunding than one with an upfront-only payment.

For analytical purposes, the payments under the pay-as-you-go plan can be represented as a step-up coupon bond, where the coupon steps up at the expiration of the call protection period. In other words, the bond pays the stated coupon during the non-callable period and a higher coupon (stated coupon plus ongoing insurance premium) thereafter.

### SELECTING THE RIGHT PAYMENT PLAN

While upfront premiums do not figure in refunding decisions, they do when comparing alternative payment plans at the time of issue, because they affect the amount of cash the issuer gets in hand. For instance, in the upfront-payment-only plan, the proceeds to the issuer are less than

## EXHIBIT 3

**Comparison of Alternative Premium Payment Plans**
($100MM 30-Year 6.875 Retail Issue Callable at Par After Five Years)

| | Item | Premium Plan: Upfront Premium Only | Premium Plan: Pay-As-You-Go |
|---|---|---|---|
| 1 | Price to Public (% of Par) | 100.000 | 100.000 |
| 2 | Upfront Premium (% of Par) | 4.379 | 2.137 |
| 3 | Underwriting Fee (% of Par) | 3.150 | 3.150 |
| 4 | Proceeds (% of Par) *(1) – (2) – (3)* | 92.471 | 94.713 |
| 5 | Expected Cost* of Debt (% of Par) | 92.884 | **94.790 |
| 6 | Expected Cost Per $100 Raised ($) *(5) / (4) x 100* | 100.447 | 100.081 |

* *short rate volatility 10%.*
** *Bond modeled as a callable step-up paying 6.875% initially and 7.295% after five years.*

those under the pay-as-you-go plan. However, this is only part of the picture, because the prospective cost of the pay-as-you-go structure will be higher after the bond becomes callable.

To line up both plans in an apples-to-apples fashion, we bring proceeds and expected cost together and compare their *expected cost per dollar raised*. This measure is given by:

$$\textit{Expected Cost per Dollar Raised} = \frac{\textit{Expected Cost of Future Cashflows}}{\textit{Proceeds}}$$

In calculating expected cost, the appropriate discount rate is the issuer's uninsured borrowing rate (its marginal cost of debt), independent of whether or not the bonds are insured. The plan that results in the lower expected cost per dollar raised is the more cost effective.

Let us revisit our real-life example, a $100 million 30-year 6.875% retail issue callable at par after five years. To calculate the expected cost of the bond under the two different payment plans, we assumed a short-term interest rate volatility of 10% and that interest rates follow a random walk according to the industry-standard lognormal process.

We model the bond under the pay-as-you-go plan as a callable step-up coupon bond that pays 6.875% during the first five years and 7.295% (6.875% + ongoing premium of 0.42%) thereafter. Under each "state of the world" the decision whether to call the bond or not is made in the manner described earlier.

The results of our analysis are in Exhibit 3. The issuer receives less (92.471% of face amount) under the first plan after deducting the upfront premium and underwriting fee than under the second (94.713%). But the expected cost of future cashflows under the pay-as-you-go plan is higher (94.790%) than that under the upfront-payment-only plan (92.884%). The 1.906% difference is the expected cost of the periodic premium payments. Adding that to the 2.137% upfront premium gives us a total expected insurance cost of 4.043% of face under the pay-as-you-go plan, making it the cheaper alternative by 0.336% (4.379% – 4.043%) or $336,000 for the $100 million bond issue.

## CONCLUSION

We have developed an option valuation framework to compare the cost of the two commonly available payment plans for insuring callable bonds. The cost of the first —the single upfront premium—is straightforward. The cost of the second, which involves a smaller initial premium followed by level periodic payments from the call date, cannot be obtained directly.

We model the bond, in this latter case, as a callable step-up and value it accordingly. Using the measure of "expected cost per dollar raised" we compare the two plans to determine which is the more cost effective. Insurers could also use this approach to calibrate their pricing.

## REFERENCES


Angel, J.J. "The Municipal Bond Insurance Riddle." *The Financier*, Vol. 1, No. 1 (1994), pp. 48-63.

Boyce, W.M., and A.J. Kalotay. "Optimum Bond Calling and Refunding." *Interfaces*, November 1979, pp. 36-49.

Howard, C.D., and A.J. Kalotay. "Embedded Call Options and Refunding Efficiency." *Advances in Futures and Options Research*, Vol. 3. Greenwich, CT: JAI Press Inc., 1988, pp. 97-117.

Kalotay, A.J., and W.H. May. "The Timing of Advance Refunding of Tax-Exempt Municipal Bonds." *Municipal Finance Journal*, Vol. 19, No. 3 (1998), pp. 1-15.

Kalotay, A.J., G.O. Williams, and F.J. Fabozzi. "A Model for Valuing Bonds and Embedded Options." *Financial Analysts Journal*, May/June 1993, pp. 35-46.