



**2016 ANNUAL CONFERENCE**  
**Hotel Monteleone—New Orleans**  
**October 5–7**

**Everything You Always  
Wanted to Know about  
Bond Structuring,  
But were Afraid to Ask**

(maybe not *everything* – just what will  
fit in the hour we have)

**Lori Raineri, Moderator**  
**Shelley Aronson, Speaker**  
**Dave Abel, Speaker**  
**Win Smith, Speaker**

# Resources

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## Relevant Articles from *The Bond Buyer*

[The Allure of 5% Bonds: Coupon Levitation Creates Magical Savings](#)

Andrew Kalotay, Friday, January 27, 2012

[With Premium Callables, Worst-Case Metrics No Longer Work](#)

Peter Orr, April 26, 2016

[Issuers Structure Deals to Meet Retail Demand for Lower Coupons](#)

Christine Albano, August 18, 2016

[Taming Premium Bonds](#)

Winthrop Smith, August 10, 2016

# Resources – Conceptual Glossary

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The following Glossary is intended to help build your understanding of key concepts. The definitions are not necessarily standard or complete, but they are the sole responsibility of Win Analytics LLC.

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# Glossary – Pricing 1/3

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## Price

The bond price for an actual or hypothetical transaction is set by a mechanical process – it is the present value of the bond’s expected future cash flows, discounted at a pricing yield. The higher the yield, the lower the price. The yield reflects market conditions, the characteristics of the bond and the issuer, the needs and perceptions of those trading the bond, and tax considerations. There can even be feedback from the price back to the yield. For example, if high yields drive the price down far enough, market discount tax treatment may force the yield even higher to compensate for tax effects.

Price and yield are two sides of the same coin. This can be confusing: if a headline says T-Bills are up, is that referring to prices or yields?

## Pricing Yield

The pricing yield on a bond is the rate of return that the bond’s cash flows must generate, relative to some price, so that a buyer and seller can agree to trade. If the bond is callable, more than one cash flow scenario must be considered, and the pricing yield will correspond to the scenario that generates the price-to-worst. The yields listed on the cover of an official statement are pricing yields. Note that “pricing yield” is not part of standard terminology, but we use it here to distinguish it from yield-to-call and yield-to-worst.

## Premium

If a bond pay an interest rate, or coupon, higher than the pricing yield, it is worth more than a similar par bond. The excess of its price over par is the premium.

# Glossary – Pricing 2/3

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## Discount

If a bond pay an interest rate, or coupon, that is less than the pricing yield, it is worth less than a similar par bond. The excess of par over the bond price is the discount.

## Price-to-maturity

This is an *intermediate* price which sets the ultimate price if it is the lowest of all intermediate prices. It indicates the present value of the cash flows in the scenario in which the bonds run to maturity without being called early. The present value is discounted at the pricing yield. If the price-to-maturity is much higher than some price-to-call, the issuer will likely call the bonds to avoid delivering valuable cash flows at a bargain price.

## Price-to-call

There is a price-to-call for every potential call date. It is the present value of the cash flows, discounted at the pricing yield, assuming that the bond is called on that date. The ultimate price on the bond equals the price to a particular call date if it is lower than the prices to all the other call dates, and lower than the price-to-maturity. If the bonds are callable at par on every call date, premium bonds will price to the first call date and discount bonds will price to maturity. When there is a redemption penalty for a particular call date, the price to that call date includes the present value of that penalty.

# Glossary – Pricing 3/3

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## Price-to-worst

MSRB rules set bond prices to the lowest of the price-to-maturity and every price-to-call. The buyer benefits by paying for the least valuable of the possible scenarios for the bond cash flows. For premium bonds with a par call, the least valuable scenario is to call the bonds on the first call date, and for discount bonds it is to run the bonds to maturity. Absent a shift in interest rates, any other scenario will be a bonus for the buyer and an injury to the issuer. Most issuers avoid such injury by refunding callable premium bonds.

## Yield-to-call

Given the price, the yield-to-call measures the return on investment if the bond is called. As with price-to-call, there is a yield-to-call for every possible call date, but if the calls are at par we are likely to be concerned only with the yield to the first call. A premium bond that is callable at par is priced to the first call date, and the yield-to-call matches the pricing yield. A discount bond is always priced to maturity; its yield-to-call cannot be observed directly, but it does indicate investor's return if the bonds are called.

## Yield-to-maturity

Given the price, the yield-to-maturity measures the return on investment if the bond runs to maturity. A discount bond is always priced to maturity, with the yield-to-maturity matching the pricing yield. A premium bond that is callable at par is priced to the first call date. In this case, the yield-to-maturity, or "kick yield", represents a bonus to the investor if the issuer fails to call the bonds.

# Glossary – Duration

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## Duration

Duration is the Swiss Army Knife of bond finance. It simultaneously measures the time span of a bond's cash flows and its sensitivity to changes in interest rates. For fixed cash flows, duration is the average time to the cash flows, weighted by their present value. In contrast to average life, which only considers principal payments, duration includes both principal and interest. Investors are more protected from upward shifts in interest rates if they hold short duration bonds. However, declines in interest rates can drive large gains for holders of long duration bonds.

## Modified Duration

The technical term for the duration of fixed cash flows, when used to measure the sensitivity of price to changes in interest rates, is modified duration. Modified duration takes simple duration, also known as Macaulay duration, and applies a slight adjustment. As an example, consider a ten-year zero coupon bond priced at 67.297 to yield 4%. The Macaulay duration is 10 (there is a single cash flow at ten years) and the modified duration is about 9.8. If the yield drifts up by 0.10%, the price falls by about  $9.8 \times 0.10\% \times 67.297$ , which is about 0.007.

## Effective Duration

The cash flows on a callable bond are not fixed. The concept of effective duration takes into account the perceived likelihood of alternative cash flow scenarios. The effective duration on a bond that is very likely to be called in a year is close to a year.

# Glossary – Options 1/2

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## Call Option

A call option, established at the time of bond issuance, gives the issuer the right, but not the obligation, to take back a bond at specified dates and prices. Bonds are often sold with a ten-year par call, meaning that the issuer can redeem the bond after ten years by paying the holder a call price of 100 and accrued interest. Bonds are typically callable on any interest payment date after the initial call date. Sometimes the first call price is at a premium, say 103, with declining prices for later call dates.

## Option Value

It is difficult to exactly specify the value of a bond option because the option is not priced or traded separately from the bond in which it is embedded. The value can be inferred using theoretical models, but there is no universal agreement on these models or the assumptions fed into them. Fortunately, all agree that option value has two parts: intrinsic value and time value.

## Intrinsic Value

At any point in time, the intrinsic value of an option is the value of exercising the option under current market conditions. If the bond is currently callable, this corresponds to the present value savings that a current refunding would generate. If the bond is not yet callable, the intrinsic value is the present value savings an advance refunding would generate. The intrinsic value cannot drop below zero because the issuer is not forced to exercise a costly option.



# Glossary – Options 2/2

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## **In-the-Money/Out-of-the-Money**

An option is in-the-money to the extent it has positive intrinsic value. In this case, the bond can be refunded for some savings by replacing high coupons with lower yields in the current market. If a refunding would increase the issuer's debt service, the option is out-of-the money.

## **Time Value**

The time value of a call option is created by future refinancing possibilities. Even an option with no intrinsic value can have some time value based on a probability that future markets could shift the option into the money. For a bond call option, the time value relates to the possibility that interest rates might decline in the future.

# Glossary – Refunding 1/2

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## **Advance Refunding/Escrow/Defeasance/Negative Arbitrage**

*Advance refundings* allow new bonds to replace outstanding bonds by means of an *escrow* account holding government securities. The escrow trustee must apply the cash flows generated by the securities to pay interest on the refunded bonds until their call date. On the call date, the escrow pays for principal and any redemption penalty. If the escrow is properly constructed with appropriate securities (usually from the U.S. Treasury), the old bonds are considered to be *defeased*, meaning that the issuer can generally treat them as if they are not a liability. The combined yield of the escrow securities is limited to the arbitrage yield. The escrow is economically irrelevant if it has efficient cash flows and it earns the arbitrage yield (in that case, nothing matters but the characteristics of the old bonds and the new bonds). At present, unfortunately, advance refundings usually suffer from *negative arbitrage* because Treasury yields for escrow securities fall short of the arbitrage yield. The cost of negative arbitrage is the excess of the escrow cost over an ideal escrow earning the arbitrage yield.

Not all tax-exempt bonds are allowed to be advance-refunded. Eligibility for advance refunding depends in part on how the proceeds of the original bonds were spent and on whether the bonds have been advance-refunded before.

An advance refunding allows the issuer to exploit a call option without waiting for the call date to arrive. The potential to advance refund supplements a one-time call option with what has been termed the “advance refunding option” that can be exercised any time before the call date. The question of when to refund bonds is one of the most important decisions faced by issuers and their advisors.

# Glossary – Refunding 2/2

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## **Current Refunding**

A current refunding occurs within 90 days of an existing bond's call date. Bonds that cannot be advance-refunded are generally permitted to be current-refunded. Current refundings usually involve escrows. The negative arbitrage cost from a current refunding escrow can be modest because the escrow securities underperform the arbitrage yield for only a short period.

## **Arbitrage Yield**

The arbitrage yield on a bond issue is calculated at the time of issuance according to IRS regulations. It limits the earnings on the investment of bond proceeds, so that issuers do not abuse the tax exemption on bond interest. It is similar to the TIC except in its treatment of upfront costs and callable bonds. For premium bonds that are callable at par, the arbitrage yield calculation assumes that the bonds are called on the first call date.

# Glossary – Taxes

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## Market Discount Tax Treatment

For bonds acquired in the secondary market at a price below the de minimis threshold, the market discount is generally the difference between par and the purchase price (the calculation is modified for bonds with original issue discount). The market discount is taxable as ordinary income, undercutting the rationale for buying tax-exempt bonds and making the bond unattractive to typical tax-exempt investors.

## De Minimis Threshold

Investors in the secondary market are subject to market discount tax treatment if they purchase bonds at a price below the de minimis threshold. For bonds originally issued at par or at a premium, the threshold is determined by taking the remaining whole number of years to maturity, multiplying by a quarter point, and then subtracting this amount from par. The threshold for a bond with twenty years remaining to the maturity is  $100 - 20 * 0.25 = 95$ . An investor purchasing this bond for 94 in the secondary market be subject to market discount tax treatment. Note that the threshold is not directly relevant to the original purchaser if they hold to maturity – they will not be subject to adverse tax treatment. However, if the original purchaser later brings the bond back to market, and its price has fallen below the threshold, the bond's marketability will be impaired by its exposure to the market discount rules. For this reason, many investors prefer high coupon bonds which will only cross the de minimis threshold if the market yield climbs somewhat higher than the coupon.