Life Without Advance Refunding

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The elimination of advance refunding following the passage of the new tax law will have staggering effects on the municipal market. In recent years most municipal bonds aimed at institutional investors carried an above-market 5% coupon and had a 10-year call. Due to the overwhelming popularity of this structure, municipal benchmark curves represent the yields of AAA 5% NC-10 bonds.

The 5% NC-10 structure had wide appeal for a variety of reasons, a primary one being their eligibility for advance refunding. Below, we will discuss in detail the appeal of this feature. For now, we simply observe that 5% bonds used to be routinely advance-refunded well before the initial call date in Year 10, to the benefit of issuers, investors, and the various intermediaries who facilitated such transactions.

In the absence of advance refunding, the 5% NC-10 structure will lose much of its appeal. As a consequence, we expect structural changes in the municipal market. In particular, bonds callable in less than 10 years, with coupons below 5%, are likely to emerge. Because such bonds cannot be priced using 5% NC-10 yield curves, there will be demand for new benchmark curves.

Issuers and their financial advisors will have to identify the most cost-effective funding alternative from among issues with different coupons and call provisions. A rigorous approach to determining the optimal time to call and refund will be another unfamiliar task. Meeting these challenges will require training in contemporary fixed income analysis, replacing the current ad hoc approaches to debt management.

The Way We Were

In order to appreciate the impact of the elimination of advance refunding under the recent tax act, it is useful to understand the rationale for prior standard practices.

Why 5% coupon?

Because investment-grade tax-exempt rates have been well below 5%, bonds with 5% coupons came to market at prices substantially above par. The premium is a 'cushion' to institutional investors. When rates rise, bond prices decline in general, but those purchased at a high premium outperform those purchased near par. This is because the prices of bonds purchased near par fall into discount territory, where secondary market tax effects exacerbate the price decline. The reason for this is that the marginal buyer of a discount bond is taxed on the resulting gain at maturity. If the discount is substantial (non-*de minimis*), the gain is taxed as ordinary income, which has a punitive effect on the market price (Ang, et. al., 2010). Thus, institutional investors, whose performance is based on mark-to-market, are loath to purchase or hold bonds close to par. In fact, many of them routinely sell off premium bonds at about 102, lest they be exposed to a decline below par.

As an illustration of the underperformance of par bonds, consider two 10-year bonds, with coupons of 3% and 5%, when the 10-year rate is 3%. The 5% bond would be worth 117.17, and the 3% would be 100. If the 10-year rate rose to 4%, the 5% bond's price would decline to 108.18 (a 7.8% change), while the 3% bond would fall to 89.31 (a 10.7% change). The disproportionately larger decline in the price of the latter bond is due to the 4.28 point tax hit at 40% on the 10.69 point gain incurred by the marginal buyer at maturity. (One can verify that the after-tax yield at the price of 89.31 is 4%.)

Note that an investor who purchased a bond above par is not subject to tax at maturity even if its market price declines below par. For this reason the 'hold value' of the bond, i.e., the value to the current holder, can exceed the market price, possibly by a wide margin (Kalotay, 2016). But for reporting purposes the hold value is irrelevant — institutional investors are required to mark to market. On the other hand, retail investors, who don't mark to market, do not have an obvious preference for premium bonds. This is a partial explanation for the bifurcation of municipal bond distribution: institutional investors prefer premium bonds, retail investor tend to buy par bonds.

The potential for tax loss harvesting is another, albeit less compelling, consideration in favor of premium bonds. When bond prices decline due to a general increase in interest rates, those purchased near par are unsuitable for tax-loss harvesting, because holding them provides greater value than the after-tax proceeds from selling (Kalotay forthcoming, Landoni forthcoming).

Why callable?

Before 5% became the norm, munis used to be issued near par with 10-year calls at 101 or 102. The call option enabled issuers to take advantage of *declining* interest rates, i.e. reduce the debt service by advance or current funding. However, this is not the case with bonds issued with above-market coupons. If a 30-year bond is issued with a 5% coupon when the long-term rates are about 3.5%, *rates could rise as much as 1%* and the bond would still be refunded. In other words, a 5% callable bond is *almost certain to be refunded*.

The revenue stream flowing from the resulting churning was obviously welcomed by the infrastructural food chain of refunding transactions, which includes underwriters, financial advisors, legal counsel, rating agencies, etc.

Institutional investors in general have no objection to fairly priced callable bonds. In the case of munis, they actually prefer them, for two reasons. First, issuers tend to refund prematurely— they like the optics of showing savings to their constituents. Premature refundings transfer value from issuer to investor. Secondly, an advance refunded issue automatically becomes AAA-rated, resulting in an appreciation of its market price. From the perspective of the investors, the only shortcoming of the prevalence of high-coupon callable bonds is the scarcity of long duration (as opposed to long maturity) bonds.

While the call option provides financial flexibility to issuers, the *above-market coupon* also appeals to them for cosmetic reasons. Although even at the time of issuance 5% bonds are acknowledged as 'maturing' on the call date, nominal savings from advance refundings, which can be substantial, are based on cashflows to maturity (Kalotay, *Bond Buyer,* January 27, 2012).

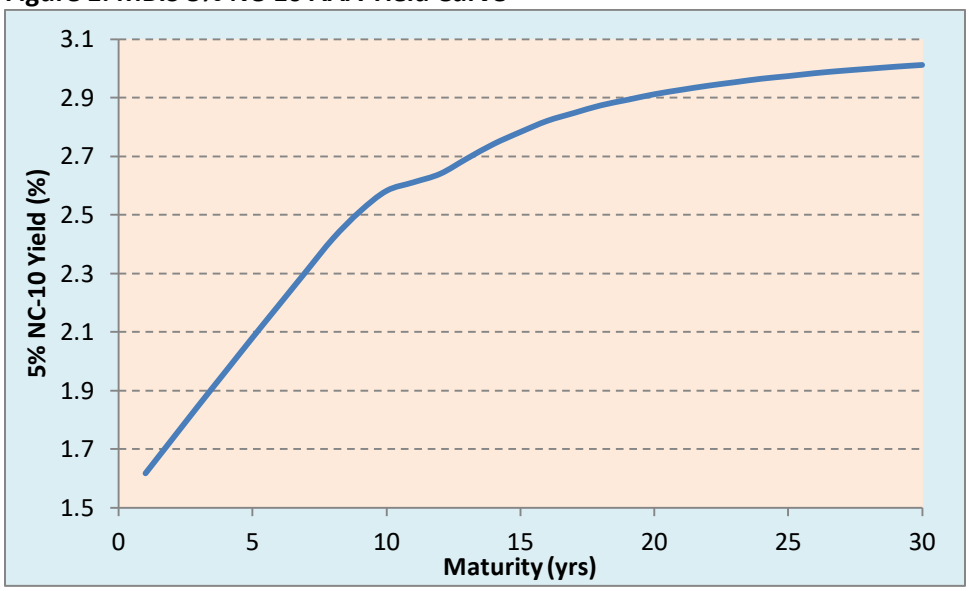
We note that issuers were not charged for the advance refunding option; it was a 'free lunch'. (Of course, they *were* charged for the call option, whether they knew it or not.) Yet the advance refunding

option had value, estimated at between 1% and 2% of the principal for long maturity bonds (Kalotay and Raineri, 2016).

Why 5% NC-10 yield curve?

Due to the prevalence of 5% NC-10 bonds, the benchmark municipal yield curves are represented by the yields of AAA NC-10 bonds. Several vendors provide such benchmark curves, including MMD, MMA, Bloomberg, and MBIS (Kalotay, 2017). A recent MBIS curve is shown in Figure 1. The yields up to Year 10 correspond to optionless 5% bonds, while those beyond Year 10 represent yields-to- call.

Figure 1: MBIS 5% NC-10 AAA Yield Curve



Source: MBIS, May 29, 2018.

Debt management

The standard measure used by municipalities to select from among different new issue proposals is TIC (True Interest Cost). The emergence of some calls shorter than 10 years and coupons other than 5% even before the tax law change precipitated the need for option-adjusted TIC, or TIC+ (Ramage, *Bond Buyer,* April 11, 2013).

Most municipal bonds were eligible for advance refunding. The original intent of this feature was to enable the municipalities to lock in interest savings prior to the call date if rates declined, the implicit assumption being that the bonds were issued at par. But such was not the case with the 5% bonds: advance refunding could create 'magical savings' even if interest increased, say from 3% to 3.5%. As a result, advance refunding became the norm for qualifying bonds; virtually all were refunded prior to the call date in Year 10. In fact, 'refunding' has been commonly understood to mean 'advance refunding', in contrast to 'current refunding' (calling).

Advance refunding was a de facto option exercise. Determining the value of the advance refunding option was complicated, because it depended on the correlation of the issuer's borrowing rate and US Treasury rates. Not surprisingly, instead of rigorous option valuation to determine 'when to pull the trigger', issuers usually relied on rules of thumb based on present value savings and negative arbitrage

thresholds. Little if any attention was paid to the value of the forfeited refunding option, not to mention the value of the option acquired in the replacement issue (Kalotay, *Bond Buyer,* March 25, 2011). Under the simplifying assumption that there is no negative arbitrage, Kalotay and May (1998) demonstrated how the optimal refunding strategy can be determined by option-based analysis.

Advance refunding was also an enigma to some academics, who at one point mistakenly claimed that it should never be exercised (Ang et al., 2013). However, when the error was brought to their attention (Kalotay, *Bond Buyer*, September 10, 2013), they corrected this mistaken assertion (Ang et al, 2017).

Anticipated structuring changes

Shorter calls

The elimination of advance refunding reduces the volume of tax-exempt debt, because there will be only a single issue corresponding to a qualified project. Previously, an advance refunded issue would remain outstanding to the call date, defeased by a portfolio of Treasuries. Less volume will result in lower revenues for the primary market infrastructure. In order to compensate for the loss of revenues, underwriters will be promoting bonds with calls shorter than 10 years. The resulting flexibility will appeal to issuers — they won't have to wait for 10 years to refund if rates decline. But shorter calls will come at a higher cost, causing a rude awakening (Kalotay, *Bond Buyer*, April 24, 2014)

Bonds with shorter calls have been around in the taxable markets; many corporate bonds are callable in 5 years, and agency bonds are sometimes callable in less than a year. Shorter calls are particularly desirable for asset-liability management of financial institutions.

Make-whole calls will also gain popularity. Many Build America Bonds contained a make-whole provision, instead of a conventional call. Make-wholes enable issuers to retire bonds prior to maturity or conventional call date, but they are unlikely to provide interest savings. They cost little, and they provide commensurately low value (Kalotay, *Bond Buyer,* May 11, 2009).

Lower coupons

As discussed above, under the current practice, 5% bonds are highly likely to be called in Year 10. In financial jargon, 'the call option is deep in the money'. Shorter call protection would further increase the probability of call, because interest rates would have even less time to rise above 5%. For example, in order for a 5% 10-year NC-6 *not to be called*, the 4-year rate, which is currently roughly 2%, would have to rise above 5% 6 years from now.

Because 5% bonds with short calls are all but certain to be called, the obvious alternative would be to issue optionless short-term bonds, and thus avoid the usual refunding hassle. However, bonds with short maturities would not provide acceptable funding for long-term projects.

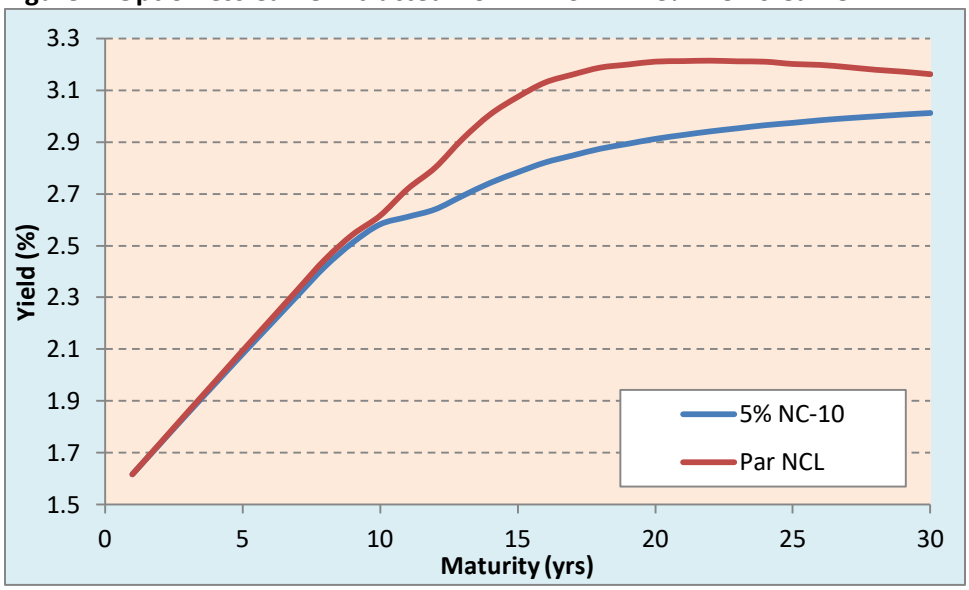
The solution is to lower the coupon below 5%, while still keeping it above market. A 20-year 4% NC-6 bond issued when the 20-year rate is 3% is still likely to be called in Year 5, but with lower probability than would be the case for a 20-year 5% NC-6 bond.

New yield curves

Currently the standard benchmark yield curves depict the yields-to-call of 5% NC-10 bonds. These benchmark curves are used primarily as a reference for pricing new 5% NC-10 bonds, rather than to analyze secondary market prices. The pricing of new issues is straightforward: determine their yields by adding credit-specific spreads to the benchmark curve, and converting the resulting yields into dollar prices. Although a 5% NC-10 curve is of little help in pricing a 5% NC-6 bond, the abundance of seasoned 5% callable bonds can facilitate the exercise. But how do we determine the fair price of a new 4% NC-6 bond?

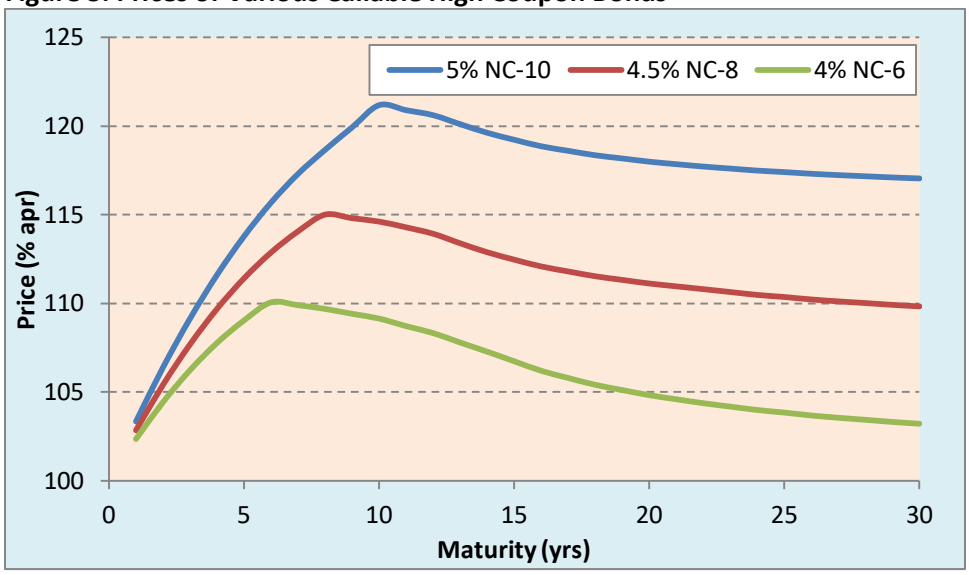
With the help of option-based analytics, it is possible to estimate 4% NC-6 yields from 5% NC-10 yields. The approach entails solving for par non-call life rates by stripping out the call options from the NC-10 bonds, as shown in Figure 2. We use a 15% interest rate volatility here and for the rest of the paper — in line with the level used by sophisticated issuers (Burton, *Bond Buyer*, April 26, 2013).

Figure 2: Optionless Curve Extracted from MBIS' AAA 5% NC-10 Curve



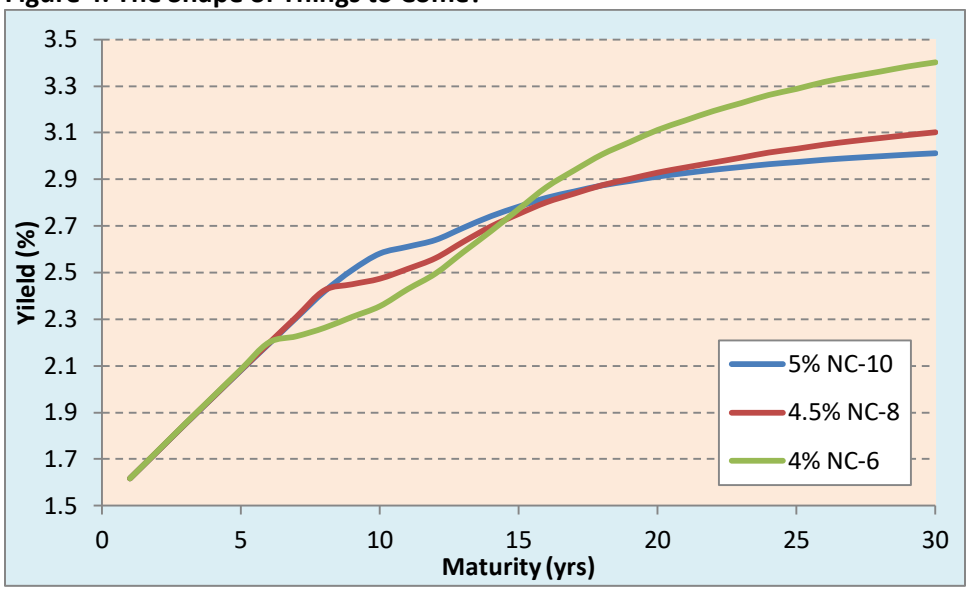
From these NCL rates we can determine the fair values of bonds across all maturities with specified coupons and call provisions, such as 4% NC-6's or 4.5% NC-8's, as shown in Figure 3. Not surprisingly, higher coupons and longer call protection result in higher prices. This approach was used to determine the prices of 5% bonds with shorter calls in Kalotay (Bond Buyer, April 21, 2014).

Figure 3: Prices of Various Callable High Coupon Bonds



Finally, the desired yield curves can be obtained by converting the prices displayed in Figure 3 into yields; the results are shown in Figure 4.

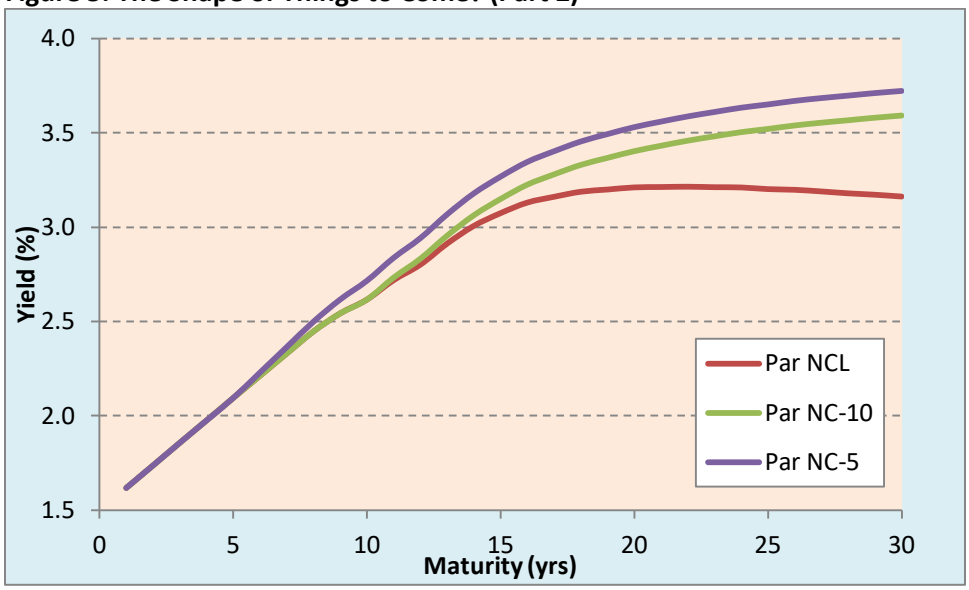
Figure 4: The Shape of Things to Come?



From Figure 4, it is evident that there is no reason to expect a yield curve that consists of a combination of yields-to-maturity and yields-to-call to be smooth. However, current benchmark 5% NC-10 curves are consistently smooth, implying an artificial kink in the related optionless par yield curve. This phenomenon is discussed in more detail in Kalotay (2017).

Optionless rates can also be used to derive yield curves for par bonds with various call protection periods. As shown in Figure 5, the shorter the time to call, the higher the yields, which are the same as the coupon for par bonds. This is because investors charge more for options that can be exercised earlier, all other things being equal.

Figure 5: The Shape of Things to Come? (Part 2)



Implications for debt management

Cost of debt

As discussed in Kalotay and Raineri (2016), for a long-maturity NC-10 issue the theoretical value of the advance refunding option was approximately 1 point, depending on market conditions (in particular US Treasuries, which determined the yield of the escrow portfolio). If prudently exercised, this option would reduce the cost of long-term debt by roughly 3 bps per year (obtained by amortizing the value over 20 years). Stating it differently, the elimination of advance refunding will increase the cost of long-term tax-exempt debt by roughly 3 bps per year.

There will surely be various creative attempts to restore the flexibility provided by advance refunding. According to Squire Patton Boggs (2018), these include advance refunding with taxable bonds, using forward-starting swaps to lock in savings, issuing forward-delivery bonds, and refunding with 'Cinderella' bonds, which pay taxable interest until the call date of the refunded bond and switch to tax-exempt interest after that.

However, the full financial benefit of advance refunding cannot be recovered, because it was derived from using Treasury bonds to fund the escrow. Despite strong lobbying efforts, Humpty Dumpty can't be put back together again (Friedlander, *Neighborly Insights*, May 23, 2018, Pierog, *Reuters*, February 13, 2018, Tumulty, *Bond Buyer,* May 16, 2018).

Selecting the best deal: option-adjusted TIC

The challenge at issuance will be how to identify the most attractive deal. Should it be 5% NC-10 bonds or 4% NC-6 bonds? How to compare these alternatives, with very different prices? The current industry-standard TIC calculation will not be of help when both the coupons and call protections differ; option-based analytical tools will be needed.

The diverse call features will expose the fact that options come at a cost. All else being the same, bonds with shorter calls will sell at lower prices. Under the current 5% NC-10 regime, few market participants are aware of the true cost an option. For example we estimate that the price of a 5% 20-year NCL bond would sell at about 8 points higher than a like NC-10.

Borrowers will be able to identify the best deal based on the option-adjusted TIC measure (also known as TIC+), which enables them to compare alternatives on an apples-to-apples basis (*IPREO Newsletter,* June 2012).

In Table 1 below, we see how three 20-year bond structures compare using TIC and TIC+. If the former is the criterion, the 4.5% NC-8 has the highest cost (3.732%) and the 4% NC-6 has the lowest (3.657%). However, when adjusted for optionality using TIC+, the 5% NC-10 is the most attractive (3.164%).

Table 1: Comparing Alternative Structures

20-Year Bonds	Price (% par)	Yield to Call (%)	TIC (%)	TIC+ (%)
5% NC-10	117.727	2.912	3.716	3.164
4.5% NC-8	110.750	2.980	3.732	3.212
4% NC-6	105.000	3.081	3.657	3.200

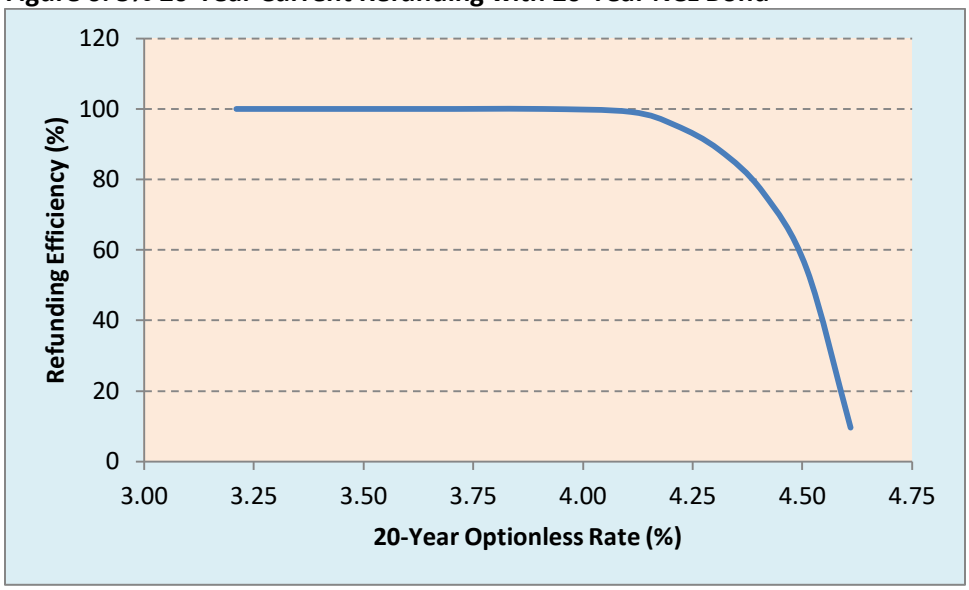
Optimal calling and refunding

Under the new regime, the refunding decisions will undoubtedly be subject to considerably more scrutiny. Debt managers will have to become familiar with concepts that have been routinely used for decades for taxable bonds (Boyce and Kalotay, 1979). There will be no justification to continue practicing the ad hoc approaches currently in vogue, with the excuse that 'munis are different'. Issuers will have to explicitly consider option values, and the more discriminating will be making call decisions based on generalized refunding efficiency (Kalotay, et al., 2007)

$$Refunding\ Efficiency = \frac{PV(Savings)}{Net\ Loss\ of\ Option\ Value}$$

In Figure 6, we see refunding efficiency in action — a currently callable 5% 20-year bond refunded with a maturity-matched optionless bond. The savings are calculated by discounting difference between outstanding cashflows and replacement cashflows. In this example the denominator in the formula reduces to the value of the forfeited option of the outstanding 5% bond. Evidently the 5% bonds should be called provided that the optionless 20-year rate is below 4.20%. Note that if the replacement bond were callable, its option value would also have to be taken into account.

Figure 6: 5% 20-Year Current Refunding with 20-Year NCL Bond



As an aside, when it comes to refundings, municipal issuers could learn from the practices of taxable corporations. In particular, tax-exempt pollution control bonds, which were never eligible for advance refunding, are managed in a manner consistent with the issuer's taxable bonds (Kalotay and Williams, 1994).

Analytics

With few exceptions, municipal debt managers lack the analytical know-how commonly used by their counterparts in the corporate world for decades (Kalotay, *GFOA Today*, May 23, 2011). In light of the emergence of structures other than 5% NC-10, option-based analytics will become essential. The so-called option-adjusted spread (OAS) methodology has been around since the mid 1980's, and it is hard to understand why municipal debt managers have largely disregarded it, in favor of questionable seat-of-the-pants methods.

The OAS approach is included in introductory textbooks on fixed income, and OAS-based calculators are available on standard analytics platforms, with the caveat is that for discount munis the standard OAS approach must be modified, in order to correctly handle the so-called *de minimis* effect (Kalotay, 2014).

Summary

Advance refunding was a free option for issuers. The value of this option in a long muni, conservatively estimated, was about 1% of principal. Without advance refunding the cost of long-term municipal debt will increase by roughly 3 basis points annually. Attempts to synthetically restore the advance refunding feature will entail cost and risk. They may enable issuers to lock in interest savings prior to the call date, but they cannot restore the option value lost as a result of the new tax law, and the commensurate savings it could generate.

The new regime will witness major changes in the municipal capital market. We will see a wide range of bond structures, other than the currently dominant 5% NC-10. For a proper analysis of these varied structures, new benchmarks yield curves will be needed. The 5% NC-10 will be of little use to directly

price bonds with shorter calls and lower coupons. As in the rest of the fixed income world, a non-callable par curve could provide a solid foundation to price structures with various coupons and lockouts.

The demands of professional debt management will make it imperative that issuers and their financial advisors employ option-based analytics, instead of relying on rules of thumb. These analytics will be critical for identifying the best deal from among alternative structures, and for determining the optimal time to call and refund. Needless to say, there will be a steep learning curve, which will be more challenging to some than to others. But municipal practitioners can take heart from the fact that option-based analytics have been in use in the taxable world for decades. It is time to dispense with the spurious claim that “munis are different”.

Regulators should be cognizant of these developments, in order to adapt the certification requirements for municipal financial advisors and to monitor and regulate emerging practices.

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