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Track 1 – Issues in Capital Markets and Credit

Managing the Advance Refunding Option

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When and When Not to Advance Refund

Background

- There exists a call option value that is unique to the Tax-Exempt Municipal sector
- Its value arises from funding a tax-exempt bond call at higher taxable (Treasury) yields
- Called the “Advance Refunding Option” or “**ARO**”, it is available on a ONE-TIME Basis
- Until now not well defined or measured, it has financial and strategic value
- The value of the ARO can be easily and unintentionally misspent
- Preservation of the ARO has not typically appeared in most debt policies

Immediate Goals

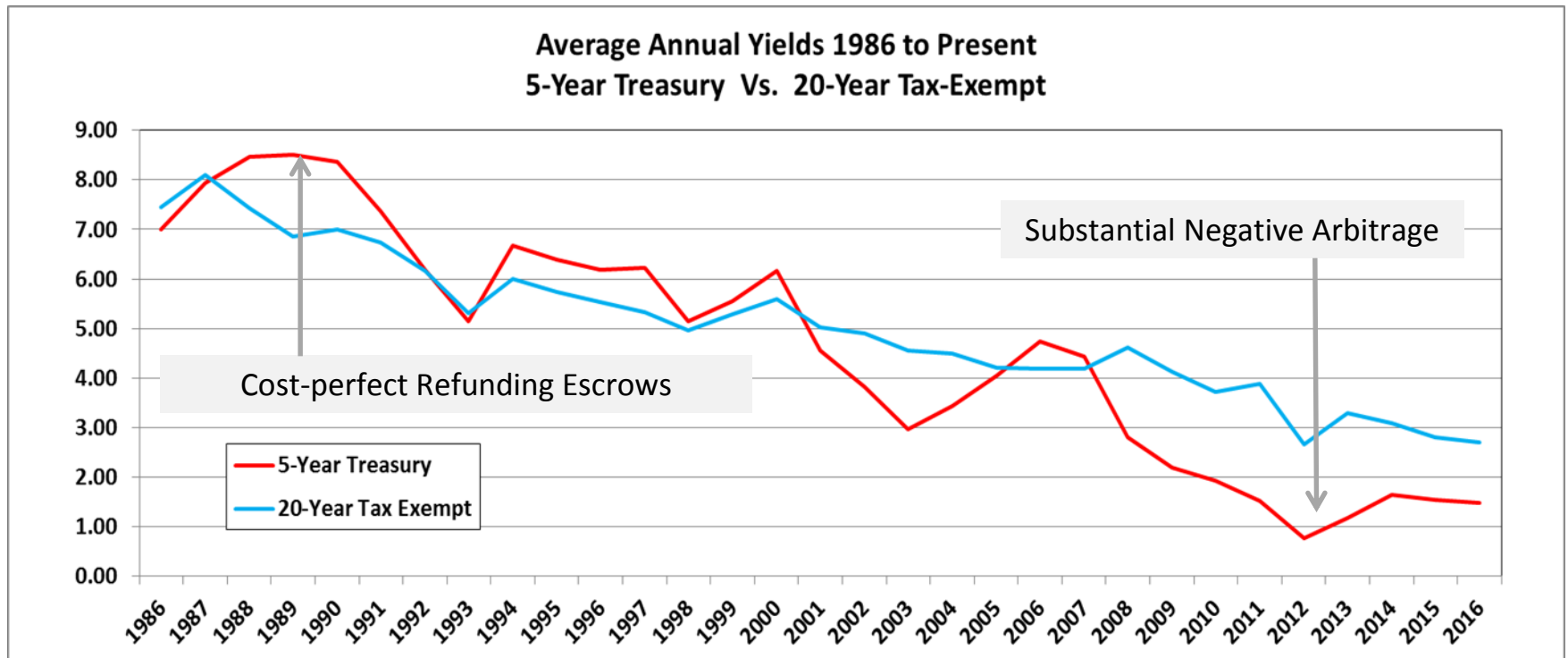
- Develop estimation approaches for the ARO as a concept distinct from option value
- As a work in progress, some threshold observations could be considered in debt policy now

When close to the current call date – consider waiting, a hedge or a forward

Why is this more relevant now?

Market Fundamentals Changed

- For the last 30 years, the fixed-rate asset class has been generally rising (rates glacially falling)
- At virtually every point along the way, participants believed fixed rates at a “new low” trough
- Rates were always expected to rise, and minimal nod was to the value of aging yield curve slope
- Advance refunding was a value opportunity, and a risk-reducing decision to go sooner than later



ARO Compares Market Acquisition Cost to Escrow cost

Maturity (Years)	1	2	3	5	10	15	20	25	30
5% NC-10 Yield	0.50	0.81	1.09	1.40	2.15	2.62	2.91	3.10	3.19
Treasury Yield	0.58	1.03	1.30	1.74	2.25	2.50	2.66	2.89	3.00

NO NEGATIVE ARBITRAGE

Old Bond at 5-year Yield in Secondary Market
 Old Bond Funded to 5-Year Call at New Bond Yield
 PV% Value of the ARO - No Negative Arbitrage

117.325	117.325	117.325	117.325	117.325
113.442	111.085	109.660	108.737	108.304
3.883	6.240	7.665	8.588	9.021

ESCROW at MARKET

Old Bond at 5-year Yield in Secondary Market
 Old Bond Funded to 5-Year Call at 5-Year Treasury
 PV% Value of the ARO - Escrow at 5-Year Treasury

117.325	117.325	117.325	117.325	117.325
115.546	115.546	115.546	115.546	115.546
1.779	1.779	1.779	1.779	1.779

First look at the ARO

- Positive ARO if a bond can be discharged at a lower cost (through an escrow) than its alternative cost at fair market value.
- The ARO has time value. Market relationships change as the bond ages toward its call date.
- Green = Theoretical available yield at the Refunding Bond Yield (no negative arbitrage)
- Red = Actual available yield for an escrow investment to fund the call in 5 years

Methodology Strengths and Difficulties

Strengths

- **Funding of a call has different economics than the market acquisition cost of the refunded bond**
- **Negative arbitrage is the cost difference between “allowable vs. available” escrow yield**
- **Municipal practitioners can replicate this calculation using standard excel finance functions**

Complexities

- **Comparison of “escrow cost” to “market acquisition cost” has calibration difficulty**
 - **Reliance on the 5-year tenor of a 15-year callable in 5 years is not certain until the bond is actually called**
- **Transactions are done in Bond Series rather than as individual maturities**
 - **Short maturities bias down the long maturities, and long maturities bias up the short maturities.**
 - **ARO might be better measured by an “exclusion delta” rather than by each maturity as a stand-alone**
- **YTC as the Refunding Replacement Yield -- may not reflect the Issuer’s real borrowing cost**
 - **The Issuer’s terminal cost of replacement funds relies the refunding bond ALSO BEING CALLED.**
 - **Market practice has been to discount cash-flow savings at the YTC (new bond yield) for PV Savings purposes**

Market Signals

Presumption that the market always charges for a call option

- Recently inverted relationship – price resistance, market discount rule, anticipated refunding
- Absent specific structural goals such as TOB program seeking long-dated tax-exempt cash-flow, non-callable bonds have been pricing wider than their callable equivalent Yield to Maturity.

Buyers commonly anticipate an advance refunding

- Should be a pricing difference for Advance Refundable vs. Non-Advance refundable bonds.
- Advance refunding can deliver a credit-pickup windfall much sooner than a current refunding.
- Current refundable-only bonds introduce a “European” edge to the “American Option”

Issues with the market give an advance refunding preference at time of pricing

- Formal reliance on tax purpose designations for mixed refunding and new money
- Tax regulation change risk

Refunding Efficiency Methodology

$$\text{Refunding Efficiency} = \frac{PV(\text{Savings})}{\text{Option Value}'_{old} - \text{Option Value}'_{new}}$$



Callable Advance Refunding Bonds

- Creates a new option exercisable only at the call date, exclude ARO

Callable Current Refunding Bonds (and not previously an advance refunding)

- Creates a new option exercisable in advance and including the call date
- Add 2% of refunded bond principal as an “ARO Proxy” to this term

Outcome:

- Loss of optionality reduces, ratio increases, in favor of a current refunding

Efficiency = Ratio of “Savings Captured” to “Reduction in Option Value”

Efficiency Ratio as a “Directional Indicator”

- **Biases down for negative arbitrage**
 - Absolute savings (numerator) decreases – ratio falls.
 - Negative arbitrage = Actual Escrow Cost --minus-- Cost at the “allowable bond yield”
 - Option-rich refunding structures tend to have lower bond yields (therefore less negative arbitrage)
- **Bias up for option-rich refunding structures**
 - 4-coupon refunding which Y-T-M is “just inside” the 5-Coupon Y-T-M
 - Option(new) goes down, net reduction to optionality in whole goes up, efficiency ratio falls
- **Injecting the ARO component**
 - Nearing the call date, ARO on the old bonds is low (the left term stays higher)
 - Nearing the call date (but still advance), ARO on the new bonds is zero (denominator increases)
- **Refunding Bonds are non-callable**
 - If the market charges or doesn’t charge for a call feature, the ratio will show it
- **Discount rate for PV Savings**
 - Market tradition uses the “yield to call” on the new bonds – requires option exercise to be real?
 - Kalotay research supports using a “term structure of interest rates” (vs. TIC) to avoid distortions.

Shadow ARO by Estimating its Cost of Preservation

Now 07/01/17	MMD 5% NC-10 Plus 100	Forward Premium Per Month	Refunded Call Date: 01/01/19 Refunding Call Date: 01/01/27				Coupon: 5.000	Current Ref
Maturity			07/01/17	10/01/17	01/01/18	04/01/18	07/01/18	10/01/18
01/01/18	1.52	7	(0.5)	(0.3)				
01/01/19	1.59	7	2.8	2.9	0.7	0.9	(1.0)	(0.6)
01/01/20	1.66	7	5.9	5.9	3.5	3.6	1.4	1.7
01/01/21	1.75	7	8.7	8.6	6.1	6.0	3.6	3.7
01/01/22	1.86	7	11.3	11.0	8.3	8.0	5.5	5.5
01/01/23	1.98	7	13.4	13.1	10.2	9.8	7.1	6.9
01/01/24	2.06	7	15.6	15.1	12.1	11.5	8.6	8.3
01/01/25	2.14	7	17.5	16.9	13.7	12.9	10.0	9.4
01/01/26	2.22	7	19.2	18.5	15.2	14.2	11.1	10.4
01/01/27	2.31	7	20.6	19.9	16.3	15.2	11.9	11.1
01/01/28	2.41	7	19.6	18.9	15.4	14.4	11.1	10.3
01/01/29	2.45	7	19.3	18.6	15.1	14.0	10.8	10.0
01/01/30	2.50	7	18.8	18.1	14.7	13.6	10.4	9.6
01/01/31	2.55	7	18.3	17.7	14.2	13.2	10.0	9.3
01/01/32	2.59	7	17.9	17.3	13.9	12.9	9.7	9.0
01/01/33	2.64	7	17.5	16.9	13.5	12.5	9.3	8.6
01/01/34	2.69	7	17.0	16.4	13.0	12.1	8.9	8.2
01/01/35	2.74	7	16.5	16.0	12.6	11.7	8.5	7.8
01/01/36	2.78	7	16.2	15.6	12.3	11.3	8.2	7.5
01/01/37	2.82	7	15.8	15.3	11.9	11.0	7.9	7.2
Attainable Escrow Yield			0.50	0.45	0.40	0.35	0.30	0.25
Average Forward Premium (BPs)			0	14	35	56	77	98
Avg PV% Loss to Preserve ARO			7.79%	7.31%	4.16%	3.42%	0.49%	0.00%

Getting within 3 months to a current refunding call date, sacrificing 0.5% PV savings as a forward to preserve the ARO, could be a successful argument.

Closing remarks

Concept is timely and relevant

- Relationship between the municipal curve and the Treasury curve couples and decouples quickly on macro economic drivers
- Call features are increasingly preferred by buyers (impact of market discount rule)
- Commonly avoidable situations in which the ARO is spent for too little value

Refinements to methodology

- Alternative market cost leg – perhaps cede that the old call date is the invested tenor
- Refunding replacement cost of funds – requires the refunding option to be exercised
- New ARO calculation, revisit when advance refunding is better than current refunding
- Efficiency ratio works as a directional signal; but not yet as an absolute decision metric

Supplemental to the economic discussion

- Tactical reasons apart from efficiency to preserve the ARO – tax caps and revenue limits
- Policy driven ARO might reduce incidence of taxable refunding for restructuring purposes
- When Treasury market furnishes high yield, escrow cost is limited by Section 148. The new refunding optionality now bears more directly in the form of increased escrow cost.