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Municipal Strategy Note

Pricing and Strategy for Muni BMA Swaps

BMA Basis Swaps:
- **Can be used to trade the relative value of Libor against short maturity tax exempt bonds.**
- **Imply future tax rates and can be used to take positions on tax views.**

BMA Fixed Rate Swaps:
- **Can be used to adjust the duration of tax exempt portfolios.**
- **Can be used to target specific maturities on the muni cash market yield curve to profit from changes toward a smooth spline curve.**

Introduction

The Muni BMA Index, formerly known as the PSA Index, is a weekly high grade market index comprised of 7-day tax exempt variable rate demand notes produced by Municipal Market Data (MMD). It is a yield quoted each Wednesday. BMA stands for Bond Market Association. The BMA is the shortest end of the muni curve so it generally exhibits low yield ratios to treasuries.

The Muni BMA Basis swap came into question as a potential tool for executing a crossover trade from the core active fixed account into the municipal market. The Basis swap is an exchange of yield on the BMA Index for that on 3 month Libor. The crossover trade becomes attractive any time the expected yield of the BMA Index exceeds the expected yield of the 3 month Libor (Times a factor). The cash market is too illiquid to be useful for a crossover. BMA swaps are more liquid and allow an investor to exchange the BMA muni index yield for a percentage of Libor or for a fixed rate. The BMA Index swap has the added advantage of allowing a municipal account access to attractive returns in the taxable market without selling municipals (and without realizing gains). BMA Swaps are subject to counterparty risk.

Defining the Swaps

The BMA Basis swap is defined as:
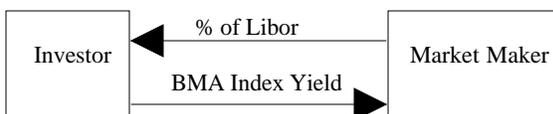
We would receive a % of Libor and pay the BMA Index yield. The percentage is defined by market conditions and fluctuates over time. At settlement, the percentage is set and remains constant for the life of the swap. Cash flows are made and taxable in net. Shorting the swap has the opposite cash flows.

The BMA fixed rate swap is defined as:
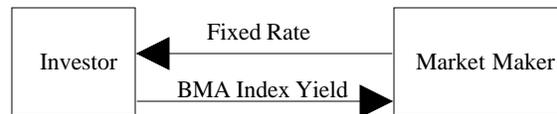
We would receive a fixed rate and pay the BMA Index. Similarly, the fixed rate is defined by market conditions and fluctuates over time. It generally fluctuates such that it is a percentage of the fixed rate swap for 3 month Libor. This percentage must always approximate the BMA ratio in order to eliminate an arbitrage opportunity. Because of the bid/ask spreads on the three swaps, the relationship is not perfect, but it is close. At settlement, the fixed rate is set and remains constant for the life of the swap. Again, cash flows are made and taxable in net.

Background to the BMA Index and Swap Market

Natural users of muni swaps are municipalities with tax-exempt liabilities and investors with municipal bond portfolios. Other taxable investors use the muni swap market as an alternative to cross-over trades in the cash or futures market.

Average volume is about $1BB/mo and the average trade size is about $30-50MM. Swaps of 5 years and less can be traded to about 150MM before moving the market. 10 & 15 years are less liquid and transactions of 100MM may move markets. Beyond 15 years is very illiquid and should be avoided.

The relationships between swap characteristics and those of the municipal market are important if the BMA Index based swaps are to be used to exploit forecasts in the municipal market. Some important questions are:

- How closely does the basis swap ratio curve track the muni/Tsy ratio curve?
- How closely does the fixed rate swap curve track the municipal rate curve?
- For what maturity of the municipal market is the BMA Index a good Proxy?

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Daniel Von Kohorn (1-212) 837-2699

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- How correlated are 3 month Libor and Tsy movements?
- Can you get out of the swap prior to maturity without putting on the opposite trade?

The data for determining these relationships was taken monthly from Jan. '91 to Sep. '97. It should be noted that this data includes general tightening of credit spreads and a new pricing of risk with respect to future tax rates. These changes should not be seen as trends but rather as shocks or adjustments to equilibrium levels. In other words, forward looking overlays should be added to the statistics in order to better represent expectations about future performances.

The muni basis swap ratios (% of Libor) *do not* track closely the muni/Tsy ratios, especially in the long end. The correlations of the different ratios at corresponding maturities over the past 6 years are:

1 Year	74.8%
3 Year	69.7
5 Year	43.9
10 Year	29.7
15 Year	23.7

These correlations are not consistent over time nor do they tend to be increasing with any regularity. The implication of the low correlation is that we cannot use BMA basis swaps to position to profit purely from a view on the ratio to Tsy rates.

The fixed leg of the BMA fixed rate swaps *do* track closely the muni rates in the cash market. The correlations of the fixed rate leg of the fixed rate swap with the cash muni yields at corresponding maturities are:

1 Year	95.9%
3 Year	94.7
5 Year	91.9
10 Year	83.5
15 Year	81.2

These correlations are fairly well behaved. They were high, generally increasing, and exhibited low volatility until January 1996.   Since then, they have dropped an average of 24% and have increased a bit in volatility.

The BMA Index is comprised of 7-day tax exempt variable rate demand notes. These notes are on the shortest end of the municipal rate curve. Correlations of the index with muni rates at longer maturities can be seen to fall off quickly and even touch negative:

|	
1 Year	58.1%
3 Year	36.0
5 Year	16.7
10 Year	0.0
15 Year	-2.3

Three month Libor is very well correlated with the short end of the Tsy yield curve but can be seen to fall off as maturity increases. The correlation does not fall as quickly as with the seven day BMA versus the muni curve:

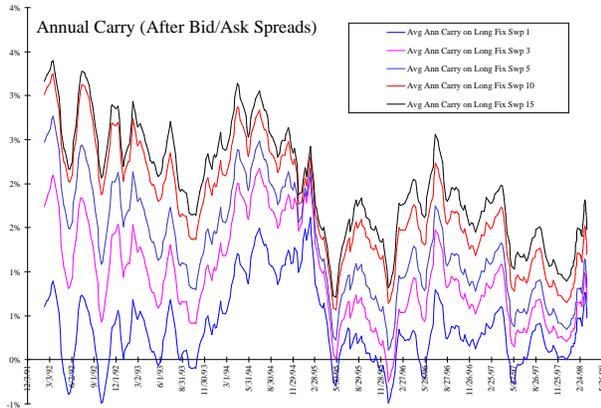|	
1 Year	96.1%
3 Year	83.8
5 Year	63.4
10 Year	33.7
15 Year	26.9

Fixed rate swaps

The BMA Fixed rate curve has flattened as the Tsy curve has flattened and fallen. 10 and 15 year swap rates are at their low since the middle of '94 and 1 and 3 year rates are close to their two year averages. The points to notice from the following graph are two: The slope of the fixed rates from the long term swaps to the short term swaps is flat relative to history and the fixed rates fluctuate over time. The fixed rate curve is almost always higher than the BMA Index's 3 month average. If the fixed rate leg of the BMA swap were less than the 3 month moving average for the BMA Index, it would be an indication that this portion of the municipal curve was inverted.

Chart 1
Fixed Swap Rates, Historically
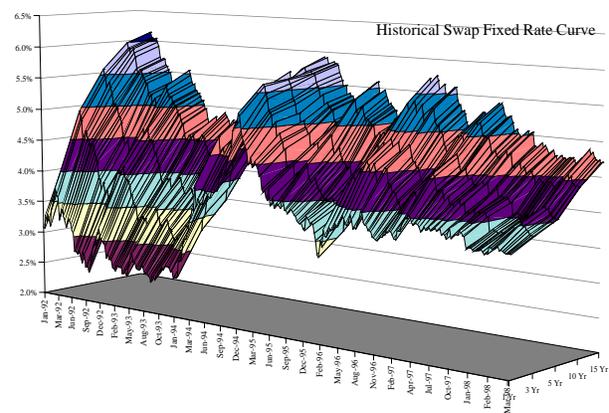
Because of the flattening of the fixed rate curve, expected gains from rolldown on the fixed rate curve are not very attractive on a historical basis, especially in the short end. This has had a downward effect on possitive carry for fixed rate swaps of all terms. After accounting for the bid/ask spread and using a one year holding period, the carry for a long position in fixed rate swaps are:

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Chart 2
**Annual Carry on Fixed Rate Swaps**

Duration on the fixed rate swaps is well behaved and rolls down in a similar manner to that of a bond.

Basis swaps

The Ratio curve has changed a lot in the last few years. Two years ago, the market began to price in much more uncertainty about future tax rates. Uncertainty about future tax rates comes in the form of a premium (lower implied tax rate) on swaps further out in the future. As this happens, the slope of the ratio curve steepens. A sharp increase in steepness at the beginning of '95 can be seen here.

Chart 3
Basis Swap Rates, Historically
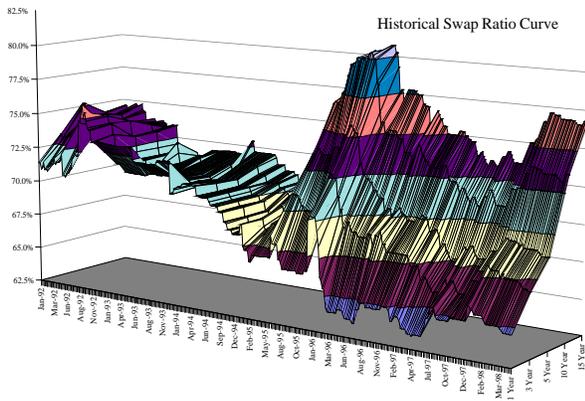
A steeper (positively sloped) ratio curve implies a steeper (negative sloped) implied future tax rate curve.

The slope of the ratio curve is the sum of the slopes of the component barbells. These slopes are significantly higher in the last two years than in the prior data, but there is little relationship between the individual slopes. They have an average correlation of 66%. And an average volatility of 1.54%, higher on the shorter end than the longer end.

Chart 4
Slopes of the Components of the Ratio Curve
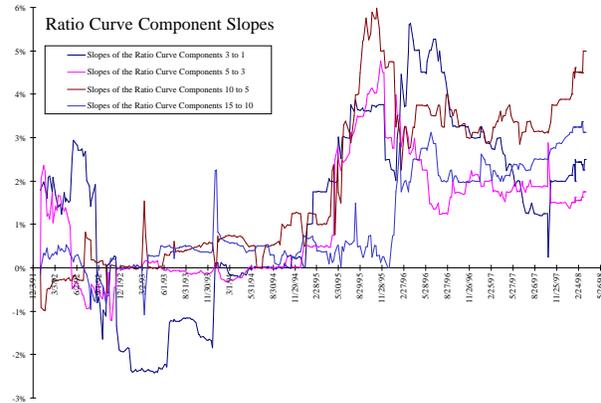
Ratio slopes are historicly high right now on the longer term components. The shorter term slopes are also higher than their historical averages but they have fallen in the last two years.

How the Value of a Swap Changes

BMA swaps involve contracted future payments and have zero market price at settlement. Being long a BMA basis swap generates positive carry as the BMA liability stream is less than the %Libor asset stream. At settlement, the percentage of Libor on the receivable side of the swap (hereafter referred to as the ratio) becomes fixed for the life of the swap. After settlement, the market ratio can change and with it, the value of the preexisting swap. Generally, the ratio on shorter term swaps is lower than that of longer term swaps.

As the ratio falls over time or due to market changes, the newly contracted swaps pay less of Libor than the existing swaps and the value of the existing swaps increases. Similarly, as the ratio increases, the value of existing swaps decreases. This sensitivity to the underlying ratio at which the swap can be unwound will be the "Ratio duration", where:

$$\%P = -(D_{ratio})(Ratio)$$

This sensitivity is instantaneous and does not include the effect of rolldown on the ratio curve. Ratio duration is a function of the term of the swap and of Libor. Specifically, ratio duration is the % difference in the present value of all future Libor payments when the underlying ratio changes by 1%. The underlying ratio is the ratio of the swap contract needed to unwind the swap in question.

When Libor is 6%, the ratio durations of swaps are as follows:

1 Yr:	0.057
3 Yr:	0.163
5 Yr:	0.256

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10 Yr: 0.446
15 Yr: 0.588

These numbers indicate that when the ratio increases by 1%, the value of the swap drops by the given amount as a percentage of the notional principal, and vise versa.

Rolldown along the ratio curve indicates that ratios generally fall after settlement. The ratio curve as of 12/30/97 was:

1 Yr: 65%
3 Yr: 66.99
5 Yr: 68.49
10 Yr: 72.38
15 Yr: 75.37

If ratios were held constant, an investor could enter into a 15 year swap and find that 5 years later, they hold a ten year swap paying 75.37% of Libor when the market prices ten year swaps at a ratio of 72.38. This trade could be unwound (short the 10 year swap at 72.38%) and the profit stream is locked in at 2.99% of Libor for ten years. The value of the swap is determined by the Present value of the cash flows if the swap were to be unwound.

The same is true for BMA fixed rate swaps, but in this case the cash flows after unwinding are represented by the difference in the available fixed rate. Fixed rates also tend to fall as the term of the swap decreases. The fixed rate curve as of 12/30/97 was:

1 Yr: 3.85%
3 Yr: 4.06
5 Yr: 4.19
10 Yr: 4.50
15 Yr: 4.74

If the fixed rate curve were held constant, the short term value of carry is quite clear. The difference in rates is the profit locked in when unwinding the trade. For example, a 15 Year swap held for five years and then unwound at the current 10 year rate would lock in a 24 bp cash flow for the following 10 years. The sensitivity to the underlying fixed rate at which the swap can be unwound will be called the "fixed rate duration". The fixed rate durations as of 12/30/97 were:

1 Yr: 0.957
3 Yr: 2.711
5 Yr: 4.272
10 Yr: 7.460
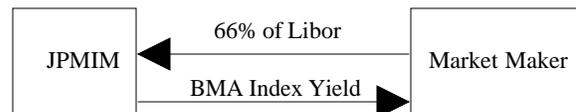15 Yr: 9.840

Trading Strategies and Timing

I.

Account	Muni accounts
Timing	When the short end of the muni yield curve is cheap relative to 3 month Libor
Implementation	Go long the BMA Basis swap: Pay the BMA Index yield and receive a % of Libor.

The simplest strategy with a BMA basis swap is to go long when you think BMA ratios vs. Libor are going to fall. This creates a trade where there is positive carry, positive capital gain from rolldown, and positive capital gain if the ratio falls. This trade is sensitive to shifts in the ratio curve which can be caused by supply/demand or changes in the tax regime. In an environment where the benchmark is Tsy yield-based instead of Libor-based, this trade is also sensitive to the tracking error between Tsys and Libor (Ratios versus Tsys might be indicating one thing while ratios versus Libor might not).

For Example:

On Feb. 3, say the 1yr muni yield looks rich relative to taxables,


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                    66% of Libor
 ┌─────────┐  ◄──────────────────  ┌──────────────┐
 │ JPMIM   │                        │ Market Maker │
 └─────────┘  ──────────────────►  └──────────────┘
                  BMA Index Yield
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We profit (are able to unwind and lock in gains) if the "ask" ratio falls to less than 66%* .

The 1 year BMA basis swap rate is trading at 66% of Libor on the bid side. The 1 year BMA basis swap ratio has a 74.8% correlation with the muni/Tsy ratio. The bid/ask spread is typically one ratio. (1% of Libor 6 bps)
The small positive carry on this trade is the difference between the bid side of Libor and BMA as a percentage of Libor (62.76%) This difference is 3.24% of Libor (18 bps per Year at constant Libor)

The equivalent alternative to this trade in the cash market, in terms of exposures, involves buying 1yr munis and shorting 1yr Tsys. Both trades are sensitive to the relative yields of munis and the taxable market. 3 Month Libor has a 96.1% correlation with 1yr Tsys.

II.

Account	Muni accounts
Timing	When you want to add duration to municipal portfolio or when a portion of the muni yield curve is cheap and liquidity prevents buying that maturity
Implementation	Go long the BMA Fixed Rate swap for the term matching that of the relatively cheap municipals: Receive a fixed rate and pay the BMA Index

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3yr BMA fixed rate swaps for adding duration
This trade effectively adds duration to a municipal portfolio where the fixed rate used for unwinding the trade is correlated 94.7% with this portion of the muni market. If you wanted to add half a year of duration to a $50MM portfolio, it could be added and removed with 3yr BMA fixed rate swaps for about $5503, but the longer it was held, the less it would cost because it has positive carry of about $27,517 per year.

$$(.5yrs)($50MM) = $25MM \text{ dur } $s$$

$$\text{$notional face} = ($25MM \text{ dur } $s) / (\text{dur per $notional face})$$

This calculation determines the notional face of the swap and each swap has a bid/ask spread of about 6 bps (round trip)

The equivalent alternative to this trade in the cash market, in terms of exposures, involves buying 3yr munis. Both trades are sensitive to the yield changes in the 3yr portion of the muni market, but there is another way to adjust duration: using Tsy futures. Tsy futures are very liquid with a bid/ask spread of about $15 per contract. The 30yr contract, for example, has a duration of 9.53 and a notional face amount of $100,000 making it a cheap way to add duration. One risk is that the duration it adds is to the long end of the taxable market. Under a parallel yield curve shift and constant muni ratios to treasuries, however, this risk is not important.

30yr Treasury Futures for adding duration
If you wanted to add half of a year of duration to a $50MM portfolio, it could be added and removed with 30yr Tsy futures for about $339.00, but the longer it was held, the less it would cost because it has positive carry of about $15,740 per year.

$$(.5yrs)($50MM) = $25MM \text{ dur } $s$$

$$\text{# of contracts} = $25MM \text{dur } $s / (\text{hedge price per contract}) / (\text{duration per contract})$$

Each contract costs about $15.00 (Round trip)

Long the fixed rate swap when you think the fixed rate curve is going to fall. This creates a trade where there is positive carry, positive capital gain from rolldown, and positive capital if the fixed rate falls (The rate for which the trade can be unwound). This trade is sensitive to shifts in the fixed rate curve which can be caused by changes in the BMA index yields, supply/demand, and changes in the tax regime. This trade is not dependent on Libor. This trade adds duration and has positive carry, but the bid/ask spread is the transaction cost.

For Example:

On Feb. 3, say the 3yr muni yield looks rich,

JPMIM ← 3.83%, Fixed — Market Maker
JPMIM → BMA Index Yield — Market Maker
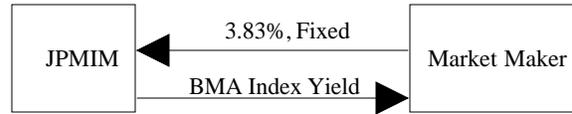
We profit (are able to unwind and lock in gains) if the "ask" fixed rate falls to less than 3.83%* .

The 3 year BMA fixed rate swap rate is trading at 3.83% on the bid side.
The 3 year BMA fixed rate swap ratio has a 94.7% correlation with muni rates.
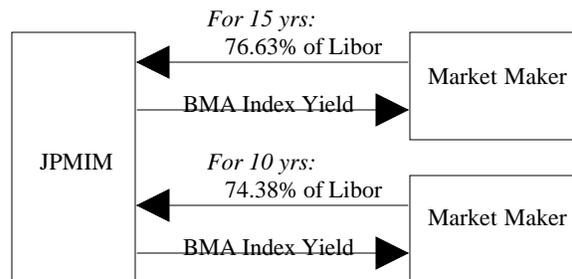The bid/ask spread is typically 6 bps
The small positive carry on this trade is the difference between the fixed leg and the BMA yield (Currently 30 bps) The carry is sensitive to the yield of the BMA Index. If the index yield increases to more than the fixed rate, the carry will become negative.

III.

Account	Muni accounts, relative value accounts
Timing	When the ratio curve seems too steep*
Implementation	Simultaneously short a shorter term swap and long a longer term swap to profit from flattening of the ratio curve (lowering of implied future tax rates) and vice-versa.

For example:

On Feb. 3, suppose the implied future tax rate for the 5yr period 10yrs from now is 19% and we expect this to rise.

For 15 yrs:
JPMIM ← 76.63% of Libor — Market Maker
JPMIM → BMA Index Yield — Market Maker
For 10 yrs:
JPMIM ← 74.38% of Libor — Market Maker
JPMIM → BMA Index Yield — Market Maker

We profit (are able to unwind and lock in gains) if the slope of the ratios at which we can unwind the trade (15yr ask - 10yr bid) falls to less than the difference between the contracted ratios (2.25%)** .

The 15yr BMA basis swap is trading at 76.63% on the bid side.
The 15yr BMA basis swap is trading at 74.38% on the ask side.
The bid/ask spread on each of the swaps is typically 1 ratio (1% of Libor is 6 bps)

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Simultaneously put on a short 10yr and long 15yr swap. The net effect is:

The small positive carry on this trade is the difference between the ratios (Currently 2.25% of Libor or 13 bps) The carry is locked in for the first ten years of the trade. After ten years, hold a 5yr basis swap at 76.63% when the ratio to unwind a five year BMA swap has averaged 71.53% and has not been more than 76.25% in the period from Jan. '92 to Feb. 3, '98. The 5yr bid is now 69.88%. Position to mark unrealized capital gains from flattening of the ratio curve (lowering of implied future tax rates) Remain nearly insensitive to parallel shifts in the ratio curve. Ratio durations add linearly and in this case can offset each other if long and short sides are weighted properly. The twist ratio duration is what captures the flattening.

The most significant risk associated with this trade is that the ratio curve will steepen further in which case there can be unrealized capital losses. A severe parallel shift up could also produce unrealized capital losses. There also remains the issue for accounts managed against an index of the tracking error between Libor and the benchmark. It is possible that an investor could be right about a movement in ratios relative to treasuries, but find that there is an opposite ratio shift relative to Libor.