

MUNICIPAL BOND MARKET INNOVATION

TRENDING TOPICS IN PORTFOLIO MANAGEMENT, TRADING & RISK

Webinar: May 2019



KalotayAnalytics

FIXED INCOME INNOVATION, PRECISION & PERFORMANCE

Agenda



Automated Trading in the Municipal Market

Martin Mannion, President

Headlands Tech Global Markets



Evolution of Municipal Bond Market Technology

David Stryker, Principal, Markets

Greenwich Associates



Market Implied Benchmark Yield Curves & Volatility

Leslie Abreo, Director of Product Development

Kalotay Analytics



Integrating Tax-Aware Analytics and Bond Data

Jeff Walker, President

Thomas Kokoska, Chief Technical and Financial Engineering Officer

Accendo Strategies

Thanks to our
data providers:

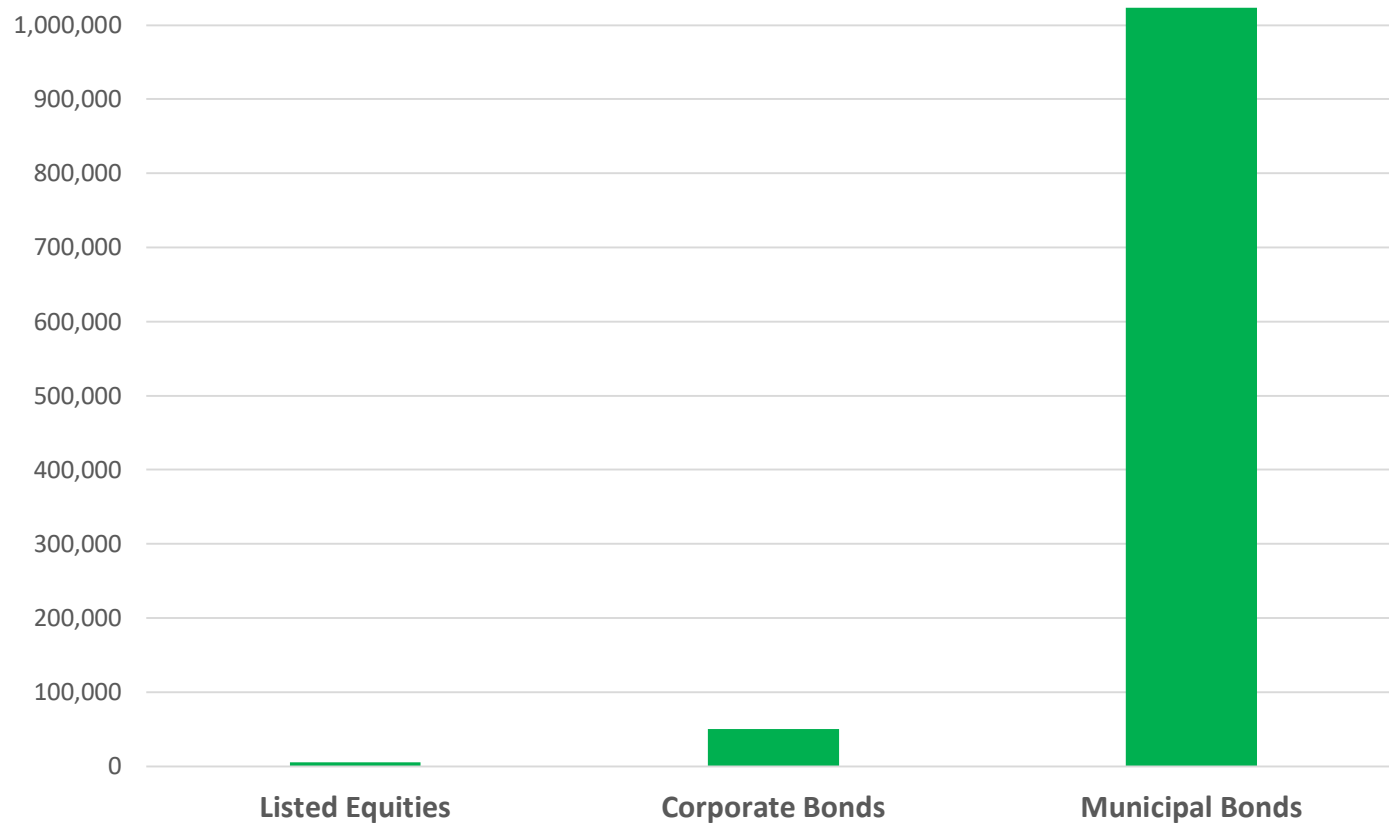


Headlands Tech Global Markets:

Automated Trading in the Municipal Market

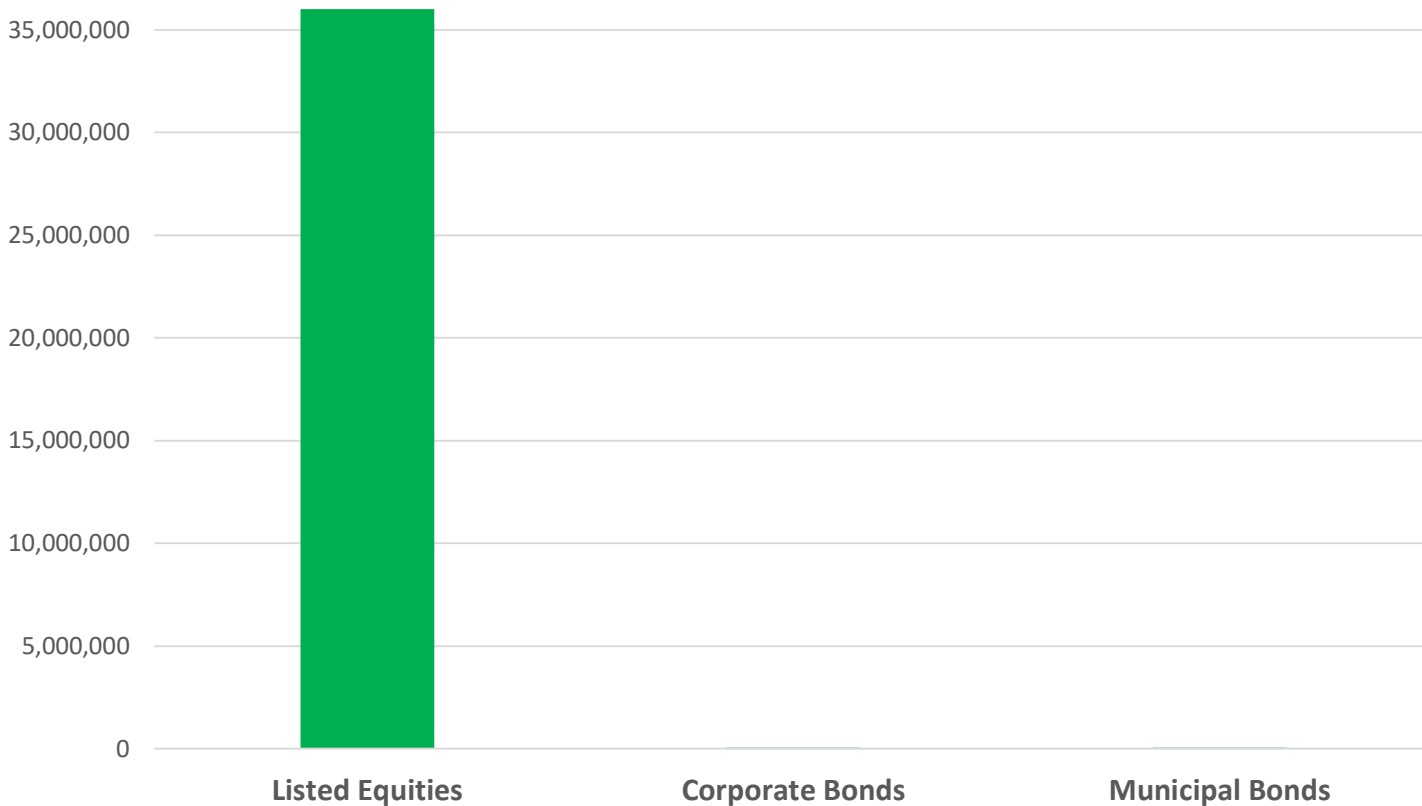
Tradable Issues by Asset Class

Over a million municipal issues are eligible to trade



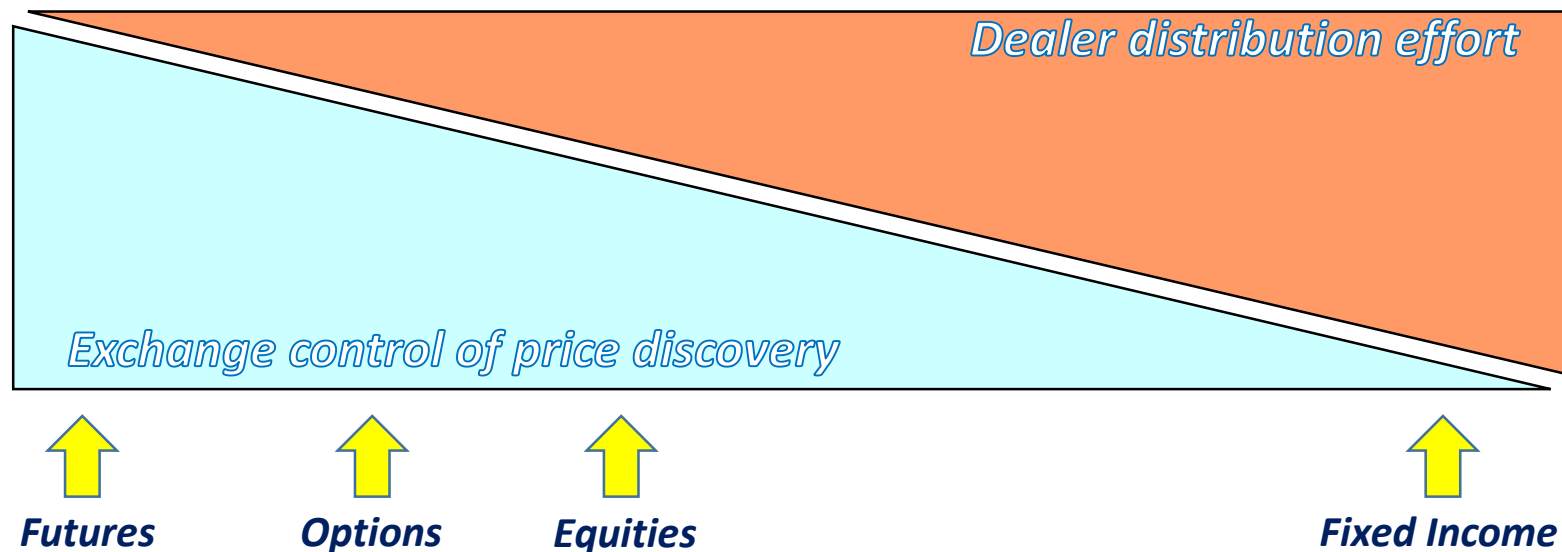
Daily Trades by Asset Class

But relatively few trades are spread out over all of those issues



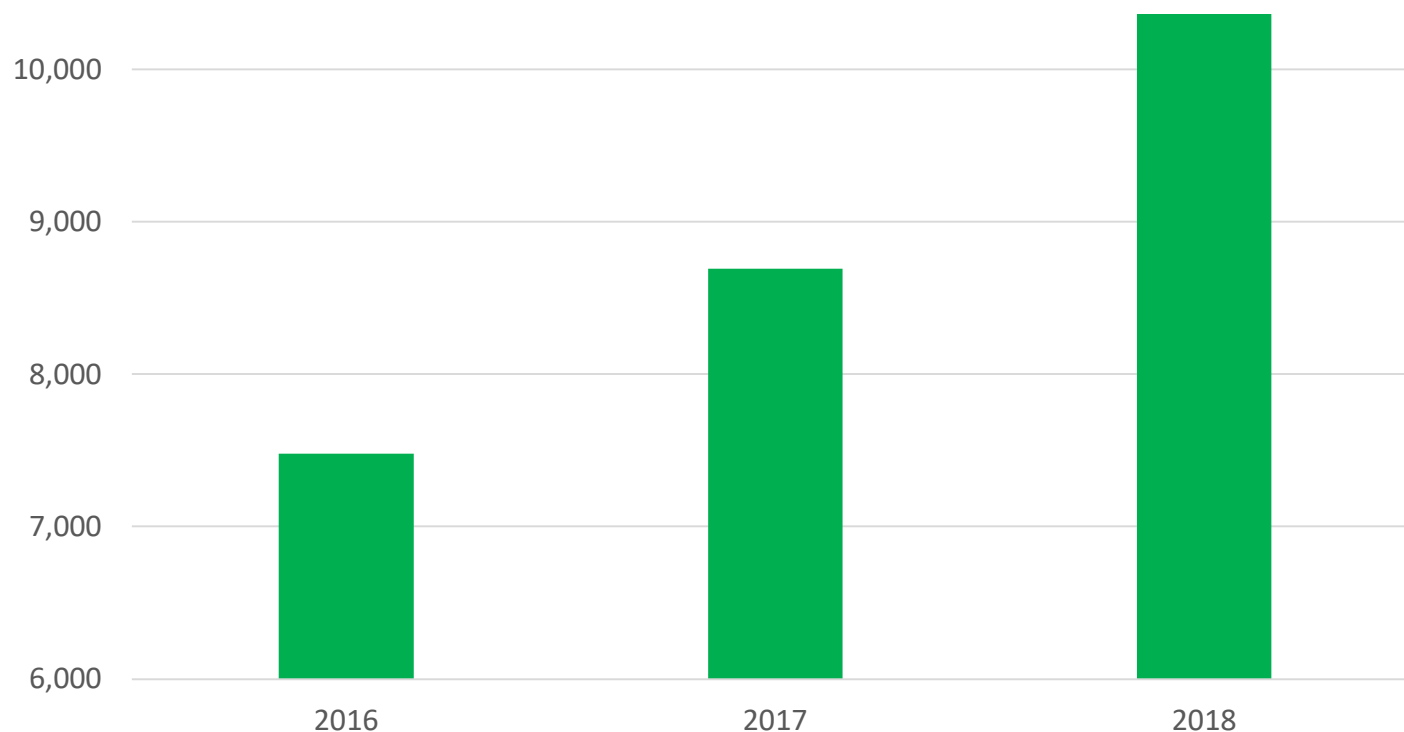
The Price Discovery Continuum

Lots of issues which seldom trade make it a dealer market



Unique Market Auctions

Electronic auctions increased over 30% since end of 2016



**Unique auctions received by HTGM; eliminates duplicate auctions of the same bonds on different platforms*

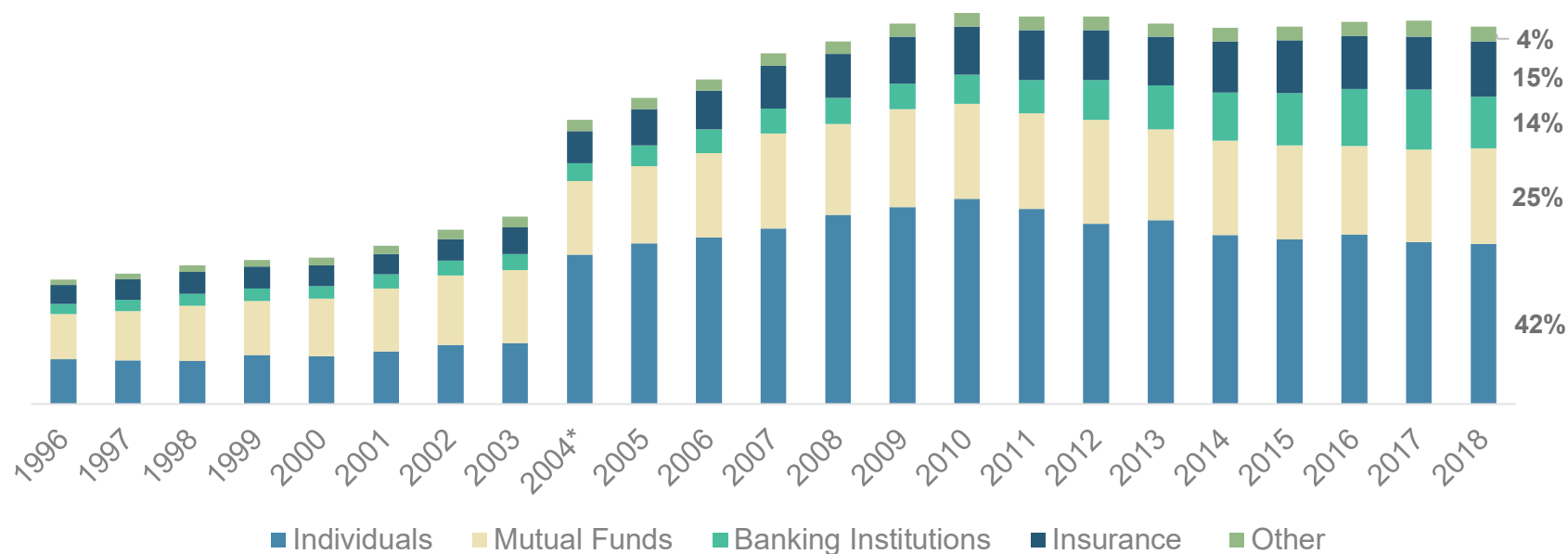
May 2019

Evolution of Muni Market Technology

An analysis of trends we're tracking in the industry

Retail Investors Hold Nearly Half of all Munis

Unlike most other fixed income asset classes, munis has a large retail investor base, which creates an interesting dynamic, though their overall position in the market has shrunk from its peak in 2010.



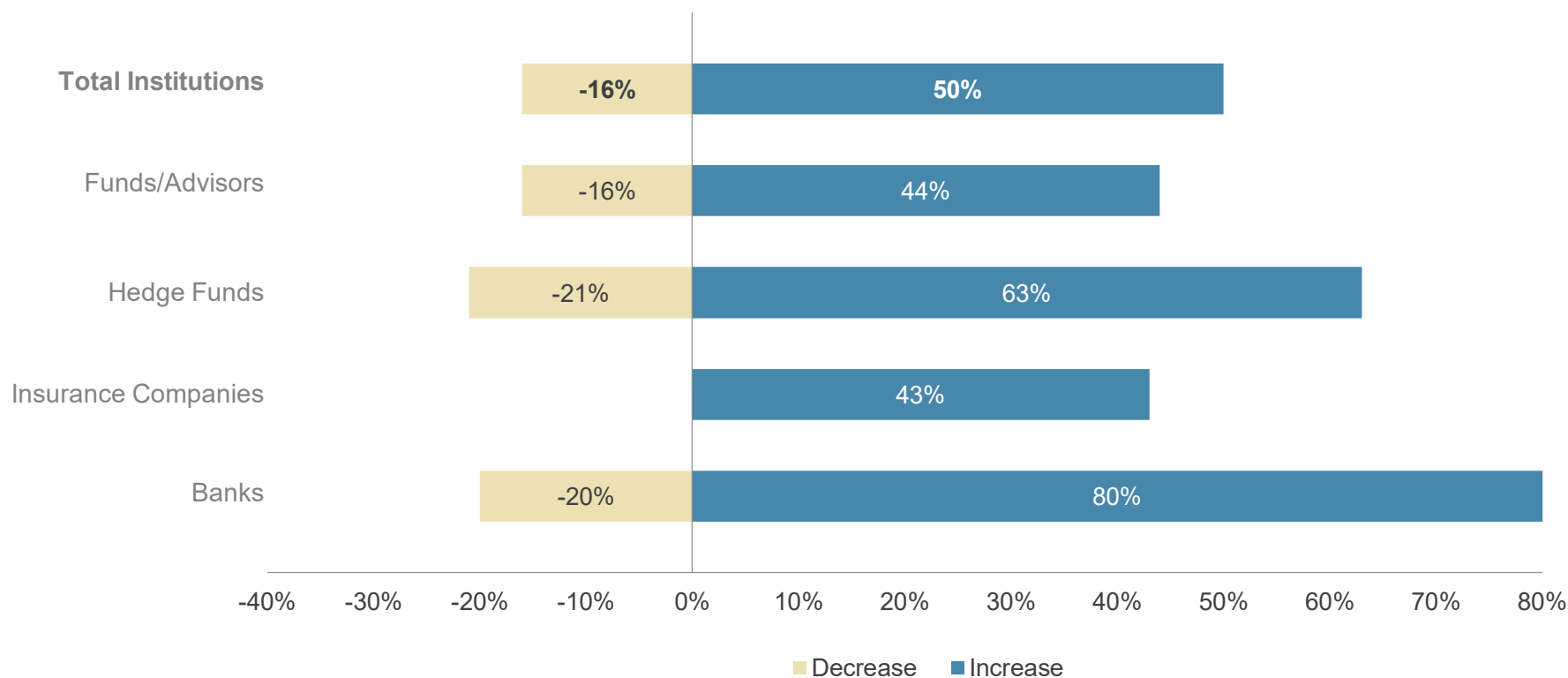
Source: SIFMA

Greenwich Associates

Institutional Interest in the Asset Class Remains Robust

Half of all institutional investors that Greenwich Associates speaks with anticipate being more active in munis... hedge funds are a key driver

Percentage of Clients Expecting to Increase or Decrease their Trading Volume*



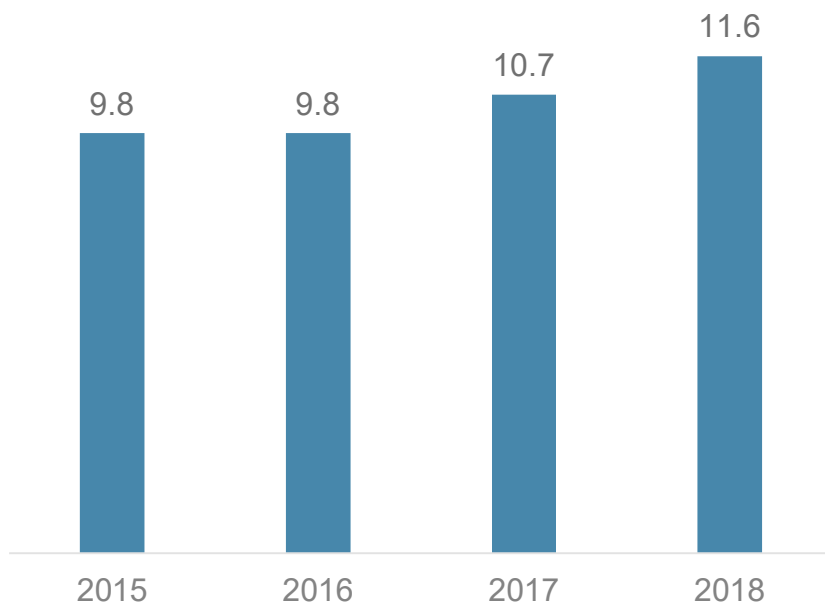
Source: Greenwich Associates

The Market is Highly Concentrated

Despite a broad base of investors, and with the typical account trading with over 11 dealers, the three largest dealers see over half the flow

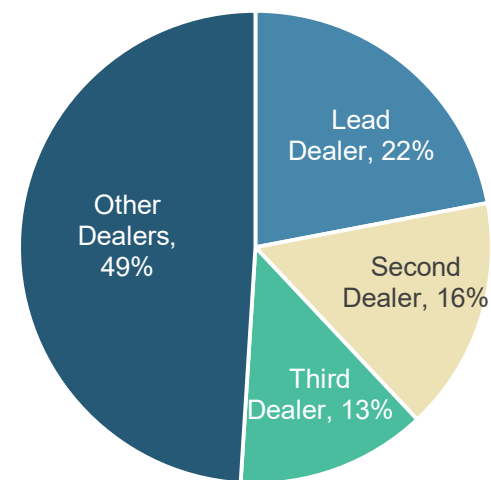
A Typical Investors' Volume Allocation to Dealers

Average Number of Dealers' Used



Source: Greenwich Associates

Greenwich Associates



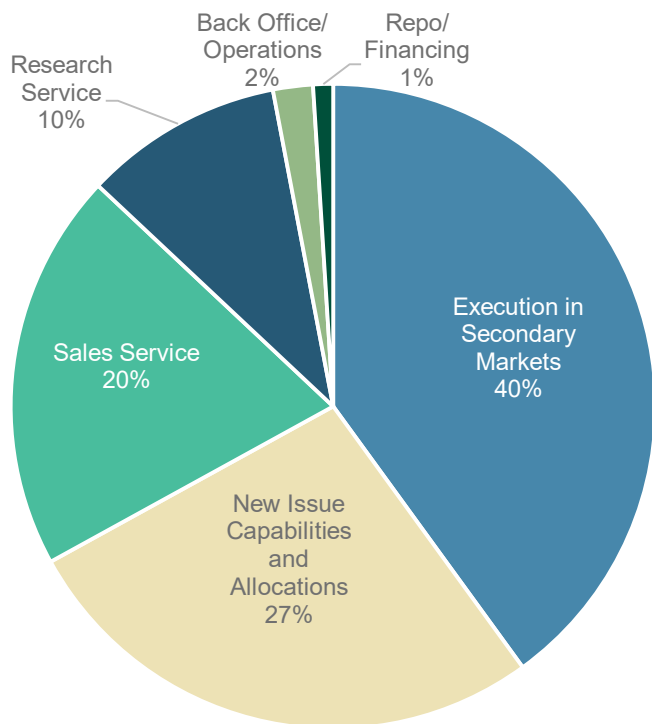
Greenwich Share Leaders

1(t)	Citi
1(t)	MS
3	BofA

Investors Still Care About Their Dealer Relationships

Even as the market electronifies, investors still value the partnership they have with their dealers

Key Business Drivers



What “Matters” Within Service

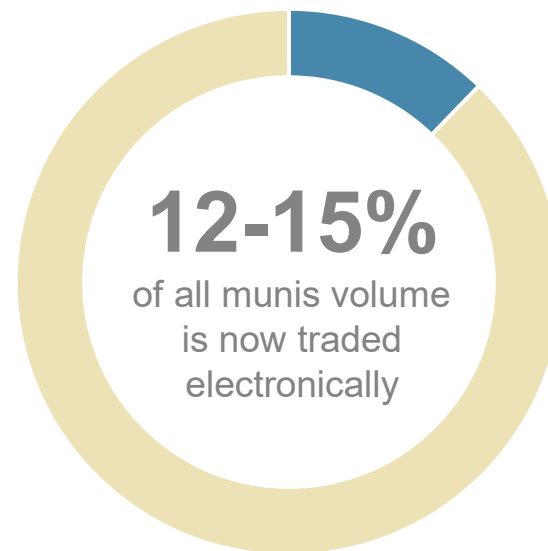
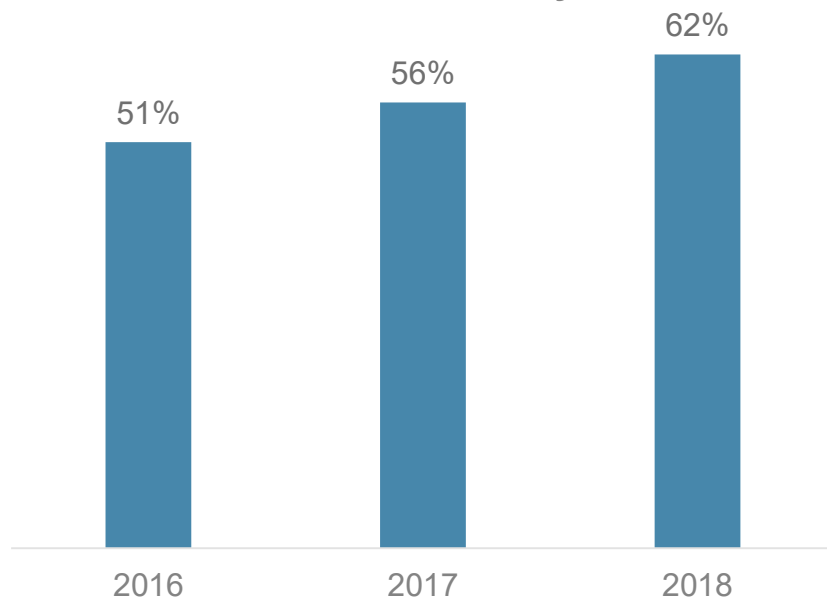
Greenwich Quality Index - Qualitative Factor	Category	Correlation Coefficient
Understanding and Anticipating Needs	Sales	0.75
Top 3 Sales Reps	Sales	0.66
Best at Executing Large Trades	Trading	0.62
Useful Market Color	Sales	0.60
Providing Consistent Liquidity	Trading	0.60
Best at Providing Trade Ideas	Sales	0.58
Top 3 Access to Traders	Trading	0.57
Top 3 Research Providers	Research	0.52
Most Intense Sales Coverage	Sales	0.51
Access to Research Personnel	Research	0.49
After Market Support for New Issue Deals	Trading	0.49
Best Trade Ideas	Research	0.47
Best Credit Analytics	Research	0.46
Most Competitive Quotes - NY Sector	Trading	0.45
Most Competitive Quotes - Healthcare	Trading	0.44
Most Competitive Quotes - CA Sector	Trading	0.44
Most Competitive Quotes - Education	Trading	0.37
Most Competitive Quotes - Tobacco	Trading	0.36
Best liquidity for SMA clients	Trading	0.34
Most Competitive Quotes - Taxable Bonds	Trading	0.31

Source: Greenwich Associates

... But an E-Trading Evolution is Underway

More investors are trading munis electronically and volumes have been growing

Proportion of Buy-Side Firms Trading Electronically

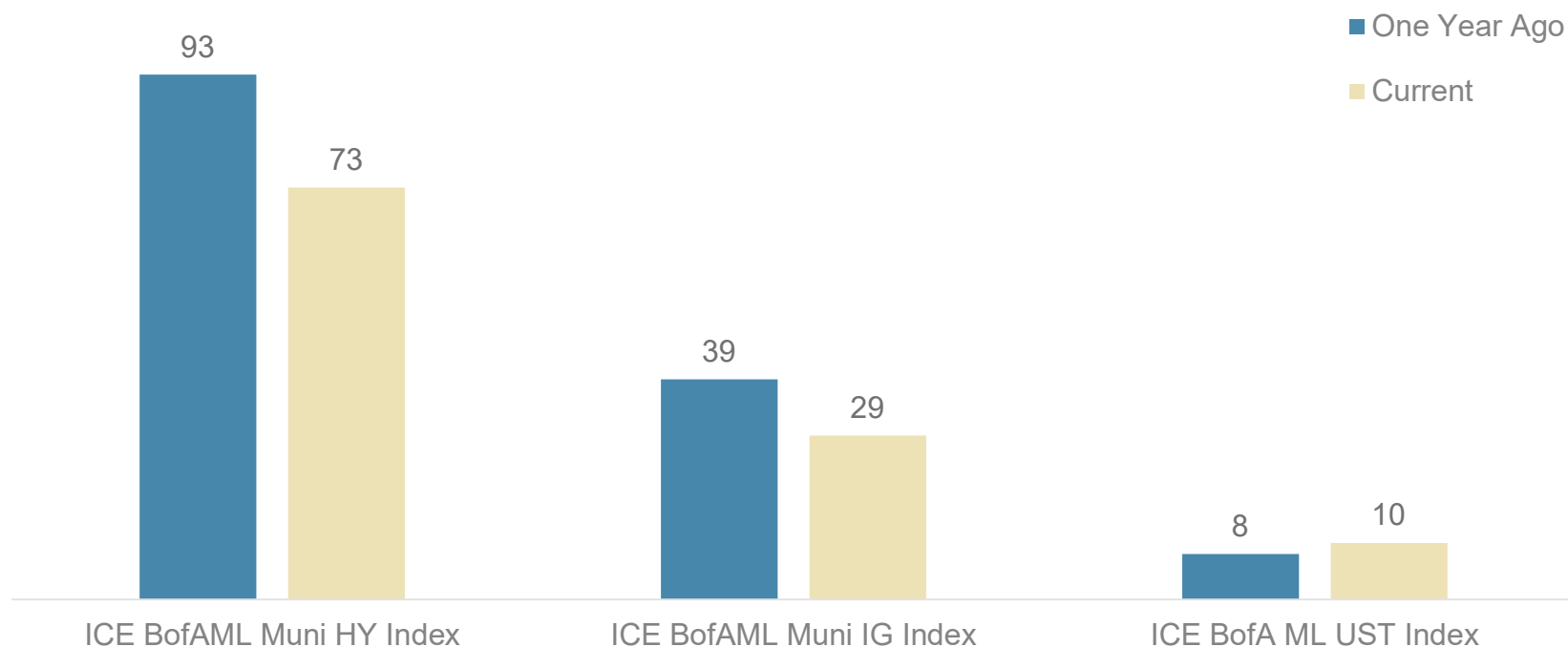


Source: Greenwich Associates

... And We Are Already Seeing the Impact

Indications are that the muni market liquidity has improved meaningfully over the past year relative to the Treasuries market.

ICE Liquidity Indicators™ Market Price Impact @ 1 day to Liquidate



Note: Data as of 3/6/2019. The ICE Liquidity Indicators™ service provides an independent, near-term view of relative liquidity—the ability to exit a position at or near the current value.

Source: ICE Data Services

What Do Investors Want Moving Forward?

We asked muni PMs and Traders what types of e-innovations they wanted to see in Munis...

“I'd love to see dealers' inventory electronically offered, maybe with an API or something like that.”

“From the bid wanted process, if there was a way to electronically send tickets, that would be the best. Especially when doing the bid-wanted process through Bloomberg, having basically everybody on board so that we can electronically execute trades -- instead of having to call up and having to confirm everything over the phone.”

“I'd like dealer to find a way to better distribute inventory so we can see what offers are live and in play.”

“There might be disrupters who are going to bring technology that would involve the dealer community as a whole. We set up things to try to exist with the existing framework of communications between the buy and the sell side which is like a sea of inventory runs and messages coming into the buy side firms like us, and typically via Bloomberg, and we try to use Bloomberg's technology to put some structure and form to all that, to sort through it, to classify it, to help us wade through the myriad offerings that are out there in the secondary market. So we're doing some technology on our end, but I would think our market is ripe for more growth in electronic means by which transactions are considered and executed.”

“The most obvious one to us is better electronic delivery of information and/or dealer inventories.”

“Streamlined and efficient dissemination of market information in order to enhance best execution.”

Source: Greenwich Associates

Contact Information

GREENWICH
DATA | ANALYTICS | INSIGHTS

David Stryker
Principal
Greenwich Associates

+1 203 625.5167
david.stryker@Greenwich.com

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MARKET IMPLIED BENCHMARK YIELD CURVES AND VOLATILITY



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Selected Benchmark Yield Curves

- MMD publishes dominant reference curve in muni market
 - “... updated periodically throughout the day, depending on market conditions...”
 - Also publishes numerous other yield curves (state, sector, credit, muni taxable, etc.)
- MMA builds consensus curve based on survey of 20 dealers
 - Reports median yields after excluding extremes
 - Updated once a day
- Bloomberg BVAL uses “... real-time trades and contributed sources ...”
 - Updated hourly
- MBIS – powered by Kalotay Analytics
 - Updated hourly
 - Based on large number of dealer bids/offers
 - Benchmark based on pool of AA/A bonds
 - Also publishes a AAA 5% NC-10 curve
- *Still Missing*
 - Real-time, market-implied yield curves
 - Market-implied interest rate volatility



Why Interest Rate Volatility Needed

- Most long munis are callable
 - *Need OAS* model for proper rich/cheap analysis and risk management*
- OAS model needs interest rate volatility as input

**Option-adjusted spread*



Kalotay's CurviLinear™ Software

- Solves for best-fit yield curve and interest rate volatility
 - *Explains prices of a set of investment grade bonds with minimum error*
- Relies on unmatched speed and precision of MuniOAS™*, which incorporates tax effect on market prices of discounts
 - *Ideally suited for muni yield curves*

**Patent pending, one million valuations per minute*



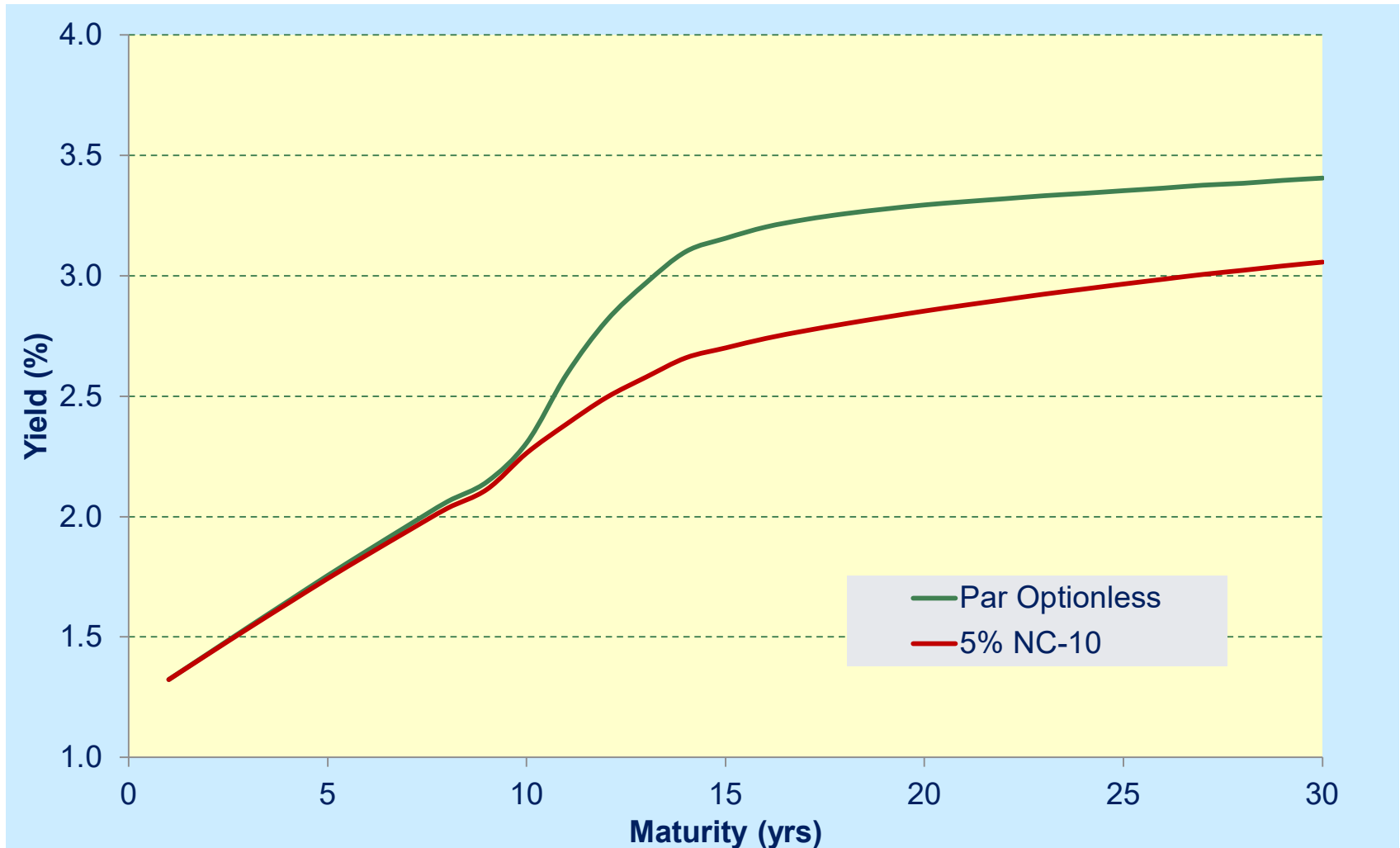
Extracting Market-Implied Yield Curve and Volatility

- Given set of bonds and prices, first solve for best-fit par optionless yield curve and volatility
 - *Minimize least squared error between OAS model prices and input prices*
 - *Recent vol range has been 15% - 17%*

- Then convert par optionless curve into standard 5% NC-10 benchmark form using OAS model with same vol as above
 - *Other reference curves to accommodate shorter calls and different coupons, e.g. 4% NC-8, possible*



From Par Optionless to 5% NC-10 at 15% Vol



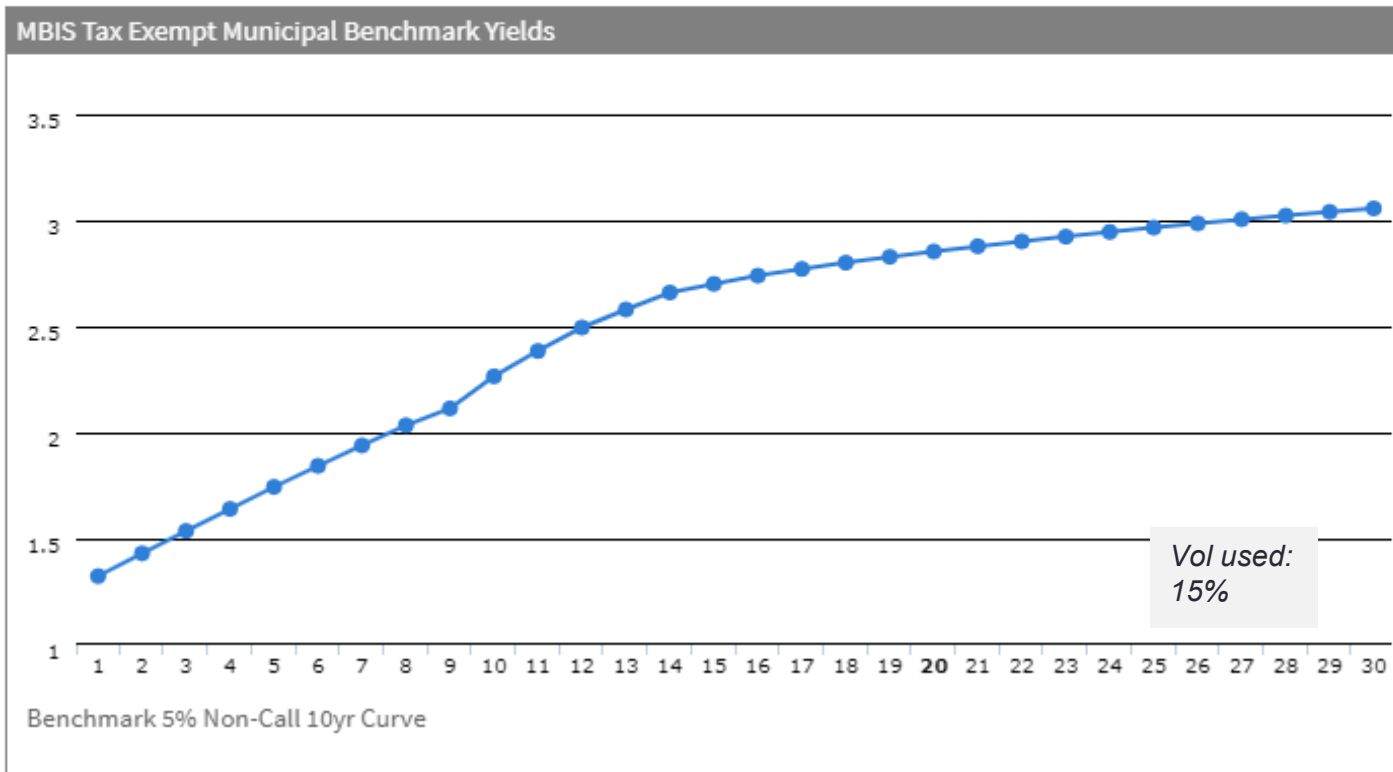
CurviLinear™ In Action

Municipal Benchmark Curve

Powered by MBIS and Kalotay Analytics

Date: Curve:

*Benchmark is a hybrid AA/A curve
Other curves, including a AAA 5% NC-10 and AAA NCL, are available*



Related Articles

- “Life Without Advance Refunding”, *Municipal Finance Journal*, 2018
- “Creating a Live Yield Curve in the Illiquid Muni Market”, *Journal of Fixed Income*, 2017

In the *Bond Buyer*:

- *Beware of Bad Benchmark Curves* – January 6, 2016
- *Spread(ing) Confusion* – November 23, 2015



Accendo Strategies

*Helping Clients Make Informed Strategic Decisions
and Deploy Successful Product Initiatives*



Major Trends in Buy-side Fixed Income

- Accendo interviewed hundreds of portfolio managers – here are some of the dominant findings of the muni world:
 - Municipal bonds are still one of the top three sectors producing valuation issues
 - Significant valuation and risk (effective duration) differences between major providers of muni analytics
 - Demand for accuracy

Major Trends in Buy-side Fixed Income

- On-demand higher speed analytics
- Hourly curve updates and intraday pricing
- The move towards real-time valuations
- The creation and use of fixed income ETF's for short and long term sector allocations and hedging
- The move towards electronic fixed income marketplace and exchange traded fixed income securities including less traded OTC's

The MuniOAS demo

- An integration of MuniOAS with the ICE Data Services municipal bond database
- Sample muni bond portfolio

The MuniOAS demo

Non-Deminimis Discount Bond (+100 bp Shift)

Term	Yield Curve	Description	Par Amt	Price	Accrued	Value
1	1.51	NEW JERSEY ST E - 3.00% - 20370701 - 20260701	1,000,000	98.500	1.225	997,250

Tax Neutral OAS	Conventional OAS	Tax Neutral Duration	Conventional Duration	Shocked Tax Neutral Price	Shocked Conventional Price	Shocked Tax Neutral Value	Shocked Conventional Value	Difference
6.77	8.51	16.74	13.09	83.040	86.127	842,645	873,524	-30,878

- Downside can be precipitous because rate shift up pushes price below de minimis threshold (95.50)

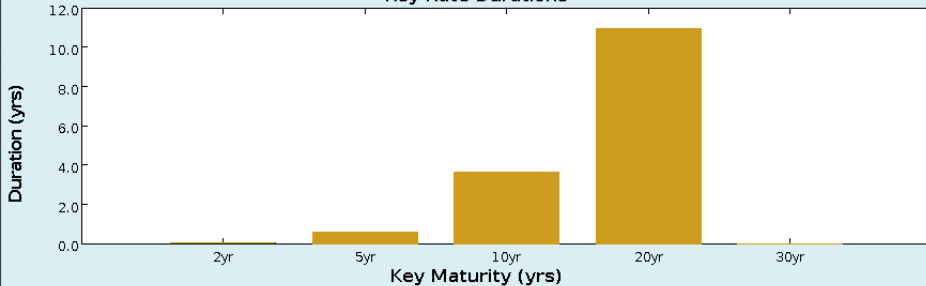
Getting Muni Portfolio Risk Right

Portfolio

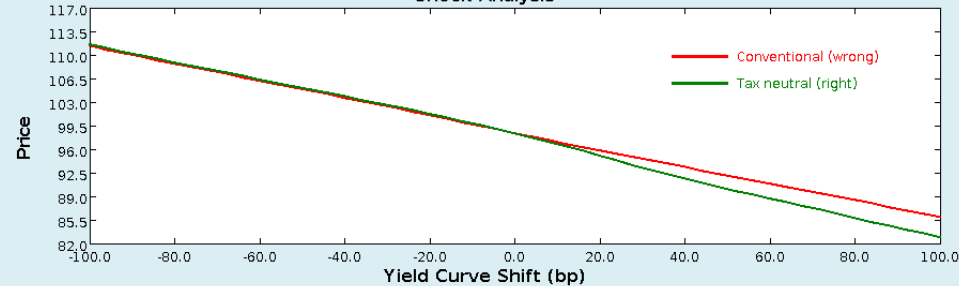
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2	1.54	EAST BAY CA REG - 4.00% - 20300901 - 20230901	1,000,000	106.380	0.967	1,073,467	67.29	67.29	5.60	5.07	100.045	100.045	1,010,120	1,010,120	-0	
3	1.57	DES MOINES IA - 2.00% - 20270601 - 20240601	1,000,000	98.280	0.983	992,633	32.92	38.89	10.60	6.79	88.193	91.488	891,760	924,717	-32,958	
5	1.68	JAMES CITY CNTY - 2.00% - 20270615 - 20260615	1,000,000	98.700	0.906	996,056	31.02	34.86	10.71	7.22	88.341	91.716	892,467	926,218	-33,752	
7	1.75	MET TRANSPRTN A - 2.25% - 20331115 - 20201115	1,000,000	92.300	0.081	923,812	15.90	38.46	16.11	11.80	78.926	81.741	790,074	818,225	-28,151	
10	1.95	UNIV OF CALIFOR - 3.00% - 20420515 - 20260515	1,000,000	97.140	0.108	972,483	-21.67	-18.76	18.35	15.07	80.414	83.289	805,218	833,977	-28,759	
15	2.55	JOHNSON CNTY KS - 2.00% - 20280901 - 20260901	1,000,000	98.050	0.483	985,333	26.41	31.74	11.98	8.18	86.629	90.234	871,124	907,172	-36,047	
20	3.14	PORTLAND OR SWR - 2.00% - 20290615 - 20260615	1,000,000	97.700	0.906	986,056	21.16	27.76	12.67	8.68	85.730	89.379	866,359	902,842	-36,483	
30	3.21	SOUTH BROWARD F - 3.00% - 20360501 - 20260501	1,000,000	97.691	0.225	979,160	29.24	32.30	16.63	12.54	82.806	85.946	830,305	861,707	-31,402	
Vol	15.00					Start value: 8,906,250						Shocked value: 7,800,074	8,058,503	-258,429		

Key Rate Durations



Shock Analysis



The MuniOAS demo

De Minimis Discount Bond (+100 bp Shift)


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

Tax Neutral OAS	Conventional OAS	Tax Neutral Duration	Conventional Duration	Shocked Tax Neutral Price	Shocked Conventional Price	Shocked Tax Neutral Value	Shocked Conventional Value	Difference
15.90	38.46	16.11	11.80	78.926	81.741	790,074	818,225	-28,151

- De minimis effect pronounced when rates rise
- Overestimated (conventional) OAS underprices bond when rates decline

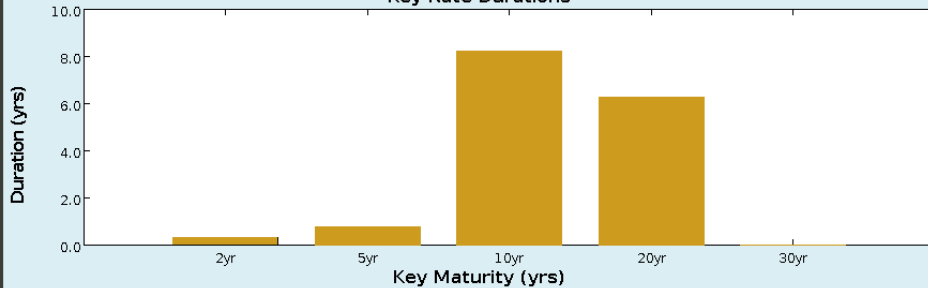
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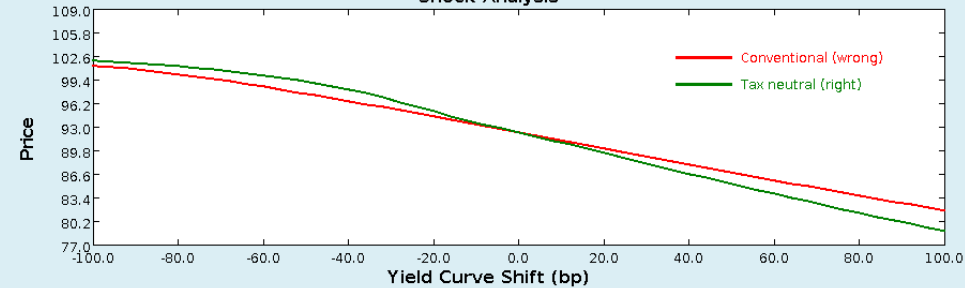
Powered by:  Select Yield Curve Shift=>

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Key Rate Durations



Shock Analysis



Questions & Answers

Thank you for attending.

Please contact us for one on one presentations and demos.

Contacts:

Jeff Walker

jwalker@accendostrategies.com

(203) 834-2725

Michael Palmieri

mpalmieri@kalotay.com

(212) 482-0900 ext. 4

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