

Benchmarks in the Municipal Bond Space

Moderator: Jon Azoff

Speaker: Tom Doe , Todd Frazier, John Rolander

NAST

Benchmark Yield Curve Discussion

2019

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Municipal Industry is an Evaluated Market

- The comparison to residential real estate is apt

- Mutual fund evolution in late 1970's positively aggregated capital for larger projects
- Misconception that all 1+ million CUSIPs could be accurately evaluated every day and
- Belief that municipal bonds were tradeable uniform securities with broad underlying liquidity – a promise of daily liquidity
- 1980's high interest rates miscast the municipal market's purpose
- 1990's created a perception that market could be quantified
- **December 2003 SEC filed charges against mutual fund for municipal price manipulation**
- Derivatives have been an influential but not a recognized force on benchmarks and evaluations
- Insurance proliferation reinforced false confidence in data and market uniformity
- **Municipals are an evaluated market both for price and credit – while more data exists it is limited and quality inconsistent**
- The exemption creates a dynamic where profits are derived only by prices rising and there is an inability to arbitrage overvalued securities
- 55,000+ issuers create an eclectic constituency that can be vulnerable to inconsistent communication of financial health and management

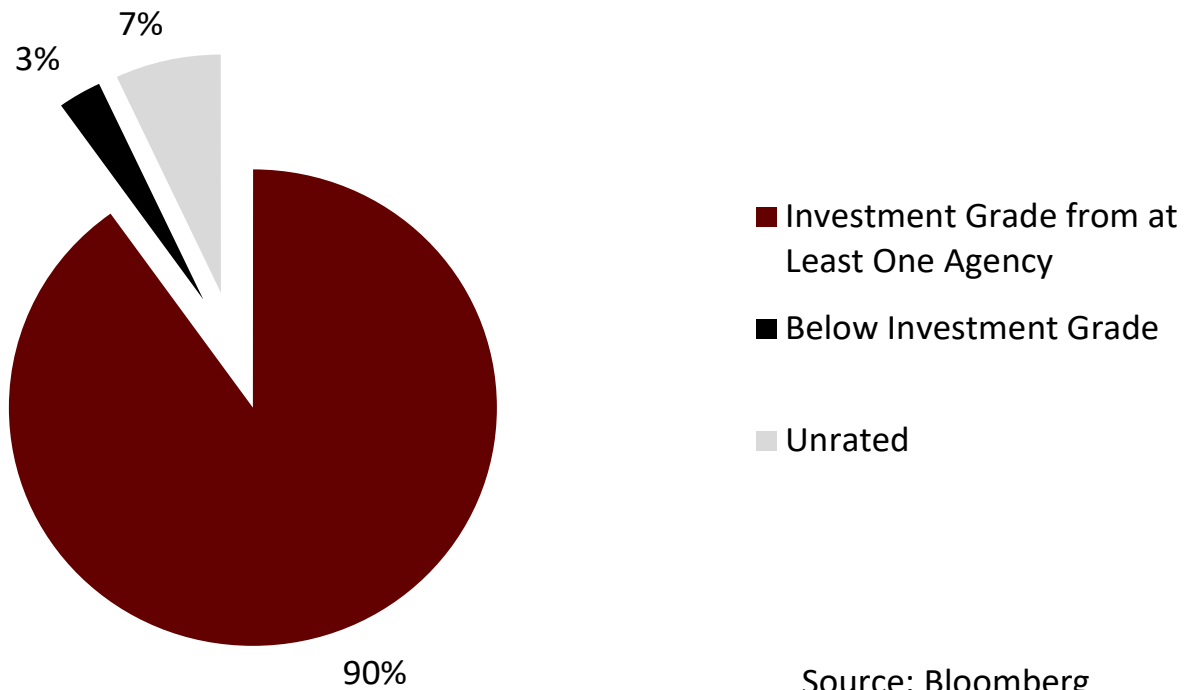
Benchmark Timeline – Defining Data Events

- Delphis Hanover 1963 – for primary pricing.
- MMD 1981 - to apply technical analysis to municipals
- 1986 – municipal futures contract – “early reads” begin in 1991
- 1994 MMD sold to Thomson
- 1995-1996 Bond Buyer Index manipulation involving options on municipal futures - \$100M in “free” premium
- 1995 municipal bond funds began to index returns per SEC
- IDC pays Lehman’s MMD bill to evaluate Index 1990’s -2000’s
- 1999 municipal daily yield change moves from 5 bps to 1 bps
- 1999 MMA created a AAA benchmark
- 1Q05 MMD benchmark change coupon to 5% - \$1B 30-yr MMD rate lock trade
- 2Q08 benchmarks improved into quarter-end as Salt River “over traded” – hedge fund makes \$20M
- 4Q08 benchmarks rallied into year-end so funds could salvage a losing year – MMD coupon changed 6 times
- November 2010 tobacco bond evaluations from 7 trades served as catalyst for mutual fund outflows
- August 2012 MSRB hosts benchmark providers after NYT article July 2012 on “Rigging”
- October 2015 ICE buys IDC
- August 2016, Bloomberg buys Barclays (Lehman) Index for \$787M
- October 2016 ICE buys S&P
- 2018 Thomson-Reuters (MMD) sold to Blackstone – renamed Refinitiv
- 4Q18 municipal benchmarks amplified into year-end to generate positive returns for the year
- 2019 Refinitiv sold to London Stock Exchange

Investment Grade Dominates Municipals

- 90% of outstanding municipal bonds are rated as investment grade

Breakdown of Outstanding Municipals (%)



Source: Bloomberg

Investment Grade and Benchmarks Linked

10yr 2010	MMA: 5%	MMD	LMIS: (Barclays): 10yr	Wake Co., NC
MMA: PAR	0.97	0.96	0.93	0.98
MMA: 5%		1.00	0.97	0.99
MMD			0.98	0.99
LMIS				0.97
10yr 2011	MMA: 5%	MMD	LMIS: (Barclays): 10yr	Wake Co., NC
MMA: PAR	0.99	0.98	0.99	0.97
MMA: 5%		1.00	1.00	0.99
MMD			1.00	1.00
LMIS				0.99

Longer Maturities Similar to Intermediate

30yr 2010	MMA: 5%	MMD	LMIS: (Barclays):	
			Long-Term	Salt River, AZ
MMA: PAR	0.97	0.95	0.95	0.94
MMA: 5%		0.99	0.97	0.96
MMD			0.99	0.98
LMIS: Long				0.99
30yr 2011	MMA: 5%	MMD	LMIS: (Barclays):	
			Long-Term	Salt River, AZ
MMA: PAR	0.99	0.99	0.98	0.92
MMA: 5%		1.00	1.00	0.94
MMD			1.00	0.93
LMIS: Long				0.95

Municipal Data Has Limits

- Divergence in responsibilities and use

David J. Madigan, who once worked at M.M.D., said that the company had tried to caution financial institutions not to use the index as an exact measure of municipal bond prices.

“It wasn’t supposed to be the base for prices,” said Mr. Madigan, now the chief investment officer at Breckinridge Capital Advisors.

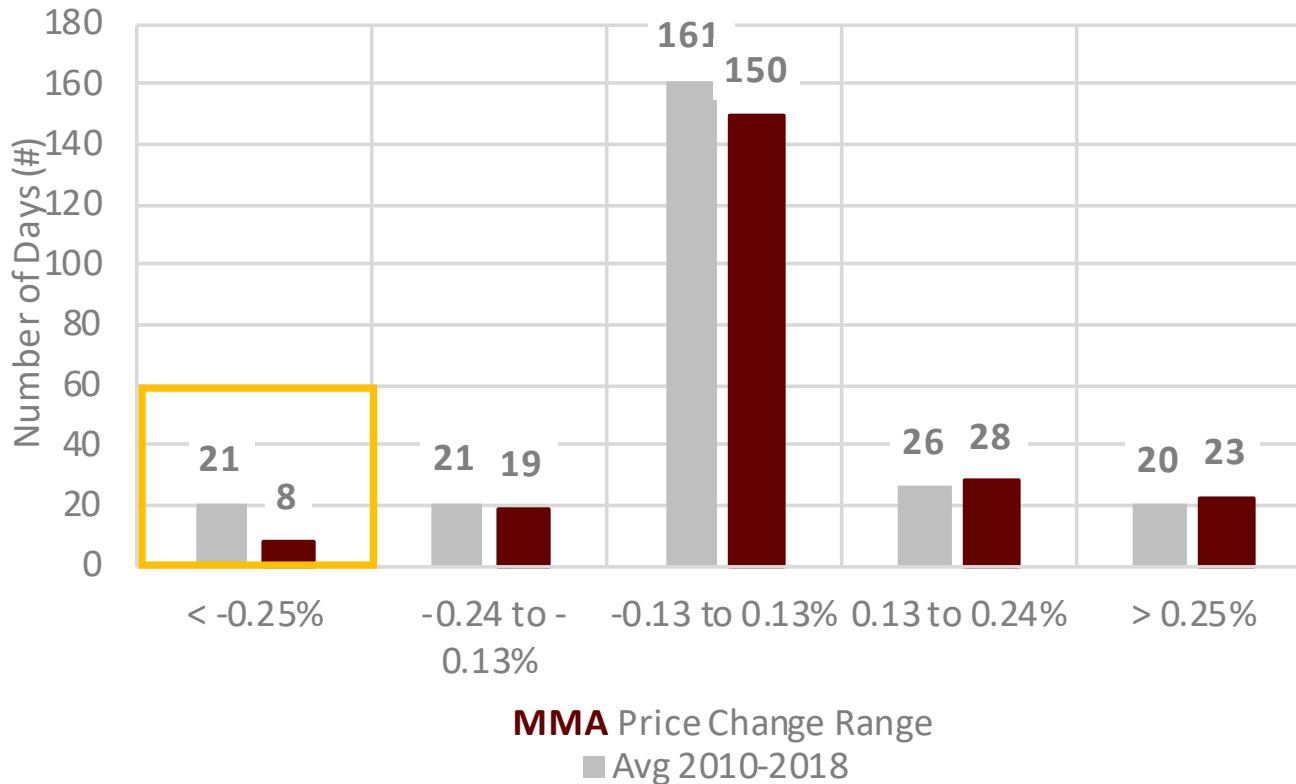
Mr. Madigan said that M.M.D. published the rates to clients each day after talking with big banks about the prices they paid for particular munis. Using these sorts of conversations made the rates vulnerable to manipulation by the banks that M.M.D. consults, according to Mr. Madigan and other market watchers.

- *New York Times*, July 30, 2012

Few Days of Large Price Movement

-Analysis of benchmark data becomes more nuanced

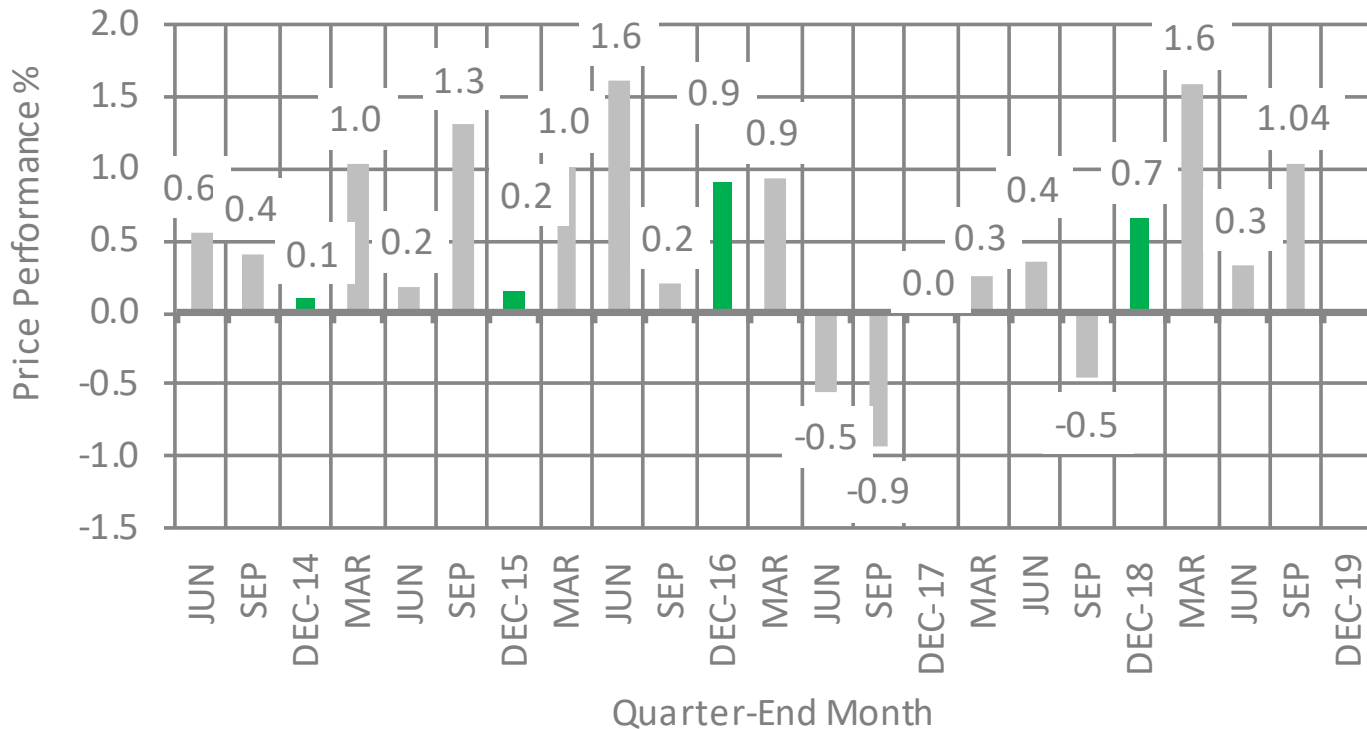
Municipal Price Change Distribution:
Average 2010-2018 vs. 2019



Price Discovery Creates Opportunity

- Especially at the conclusion of performance periods

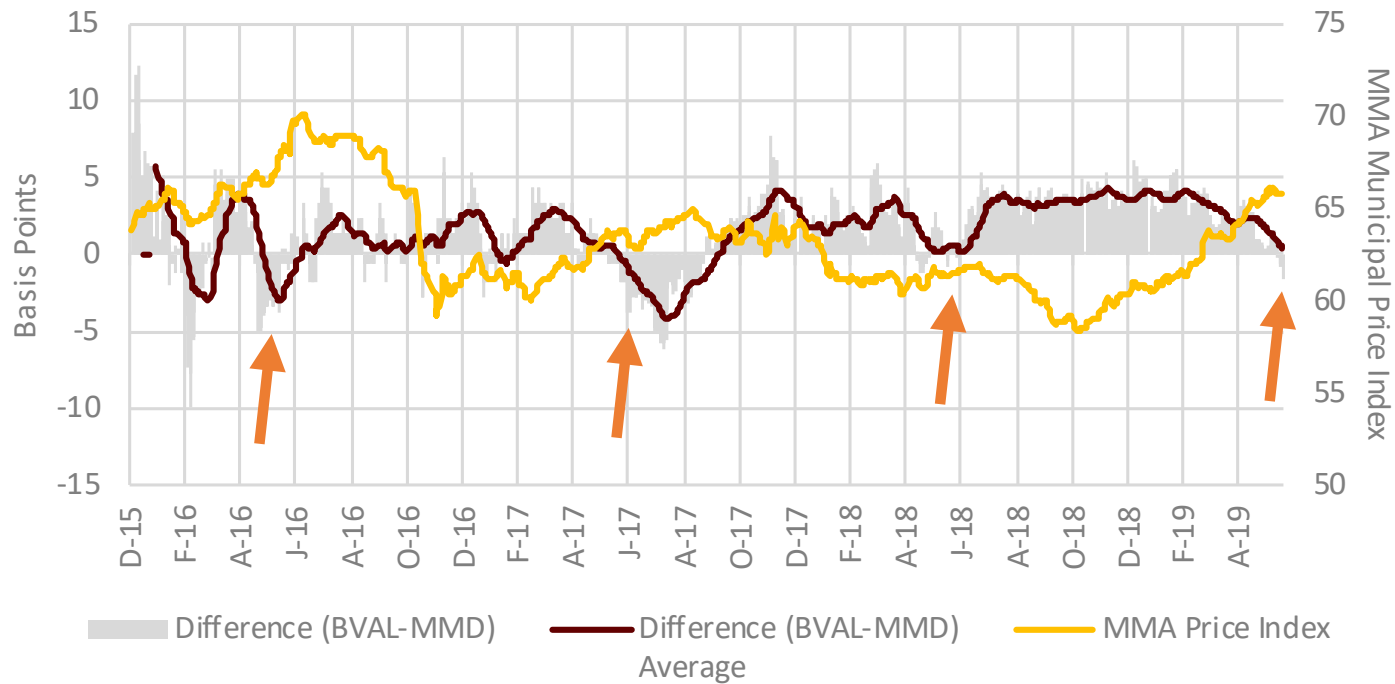
MMA Municipal Price Performance: Quarter-End Post Mid-Month



Different Methods Create Opportunity

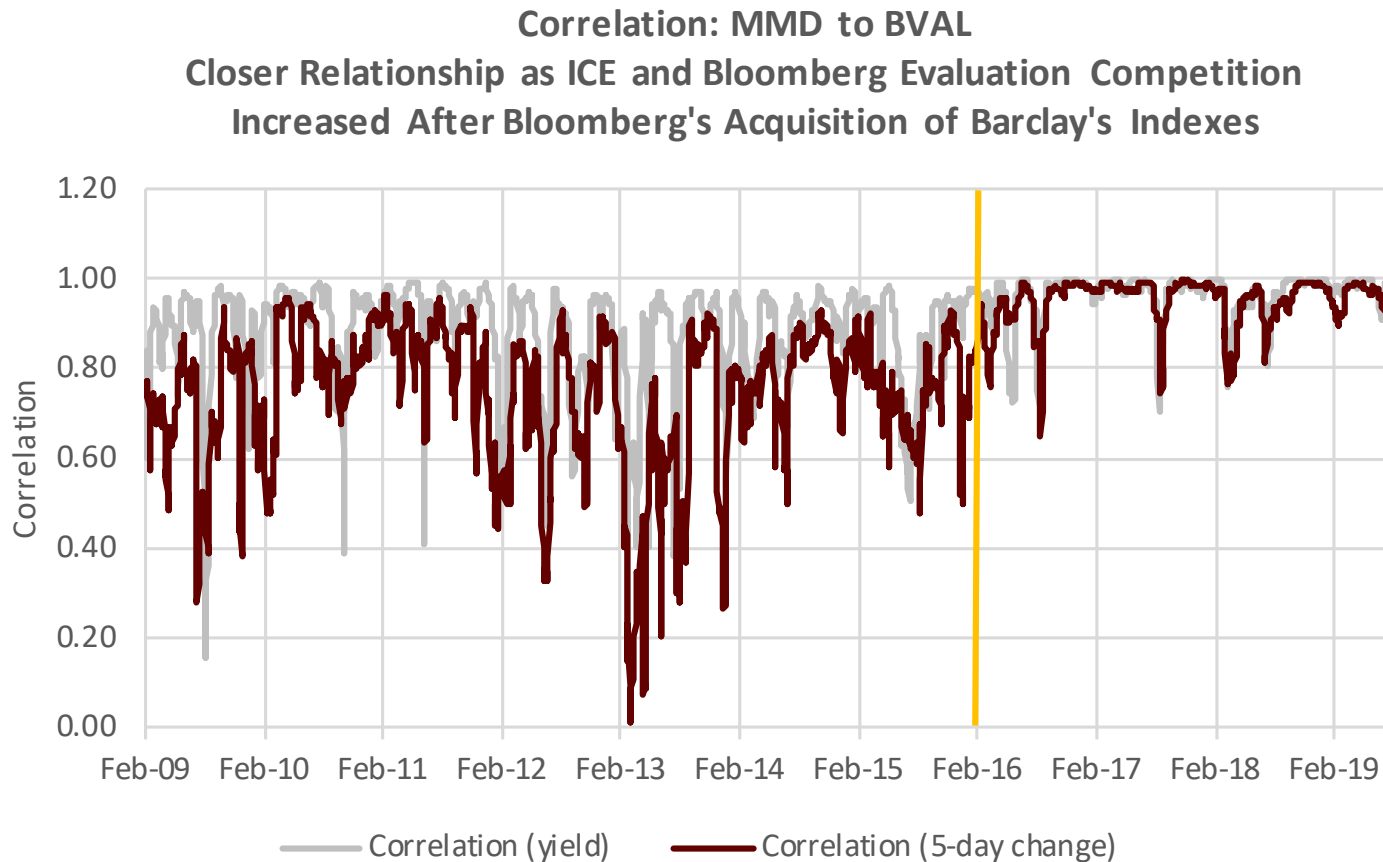
- June outperformance of BVAL benefitted issuer's use of Bloomberg benchmark

Lansing MI Use of BVAL Rather Than MMD Took Advantage of the Seasonal June Behavior When BVAL Has Been Lower Than MMD



Evaluation Business is What Matters

- Bloomberg and ICE want to be similar to compete for clients' data acceptance



Benchmarks from Major Players Similar

- Mimic MMD is the goal to generate evaluation acceptance and revenue

Total Yield Change	10y MMA	10y BVAL	10y ICE	10y MMD	10y Trs
01/18 - 01/19	0.40	0.22	0.26	0.24	0.22

Correlation-5 day Change (01/18 - 01/19)	BVAL	ICE	MMD	Treasury
MMA	0.95	0.94	0.95	0.75
Slope				
MMA	0.75	0.75	0.73	0.46

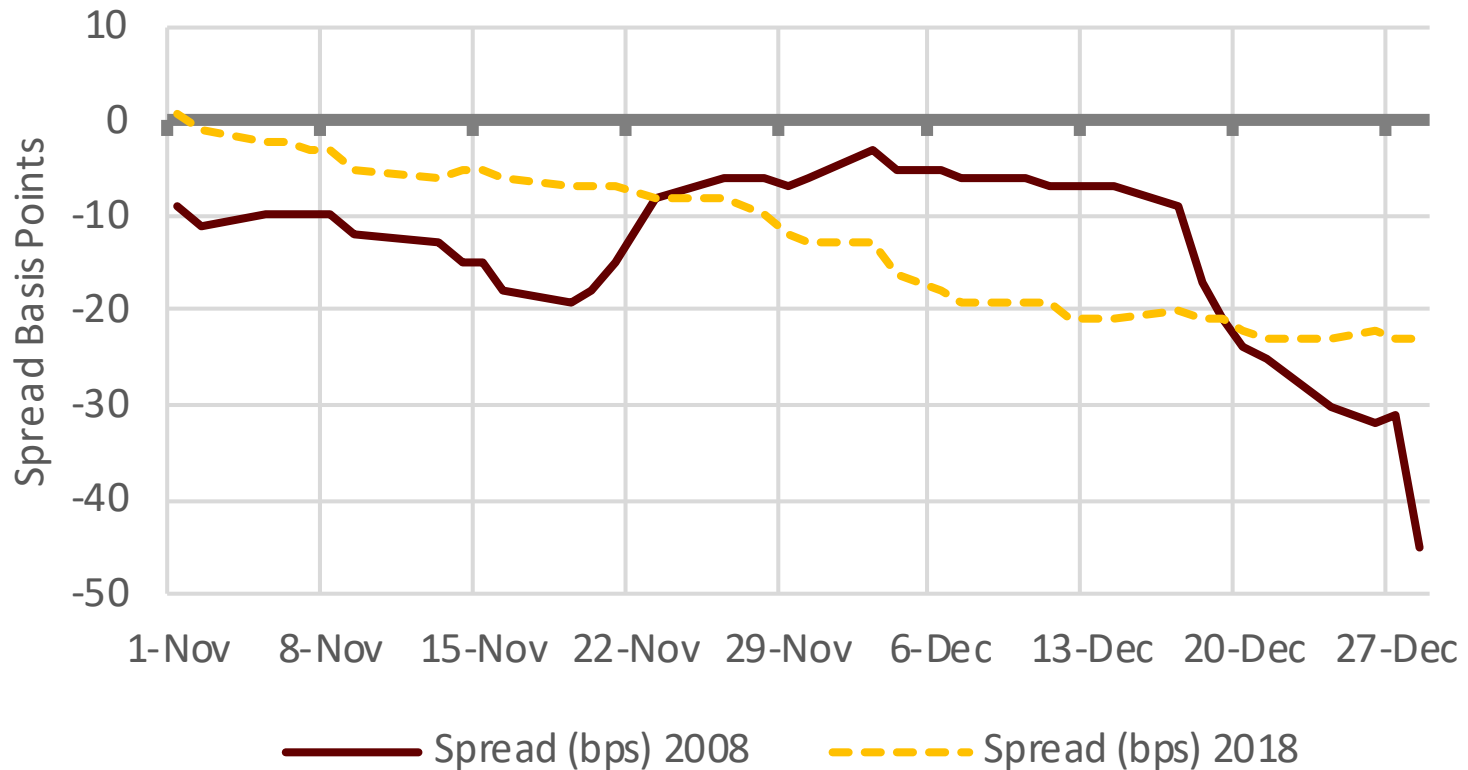
Correlation 10yr (01/18-01/19)	MMA: 5%	MMD	FL (BVAL)	FL (FTID)	Treasury
BVAL	0.85	1.00	0.93	0.97	0.94
MMA: 5%		0.83	0.90	0.95	0.84
MMD			0.94	0.97	0.94
FL (BVAL)				0.94	0.80

Slope 10yr (01/18-01/19)	MMA: 5%	MMD	FL (BVAL)	FL (FTID)	Treasury
BVAL	0.76	0.98	0.85	0.87	0.94
MMA: 5%		0.92	0.98	1.01	0.95
MMD			0.87	0.87	0.96
FL (BVAL)				0.92	0.93

Creating Performance – 2008 & 2018

- How is this able to be transparent in a commercial context?

Two Notable Periods When MMD Amplified
Performance Coincided with Fund Investor Activity

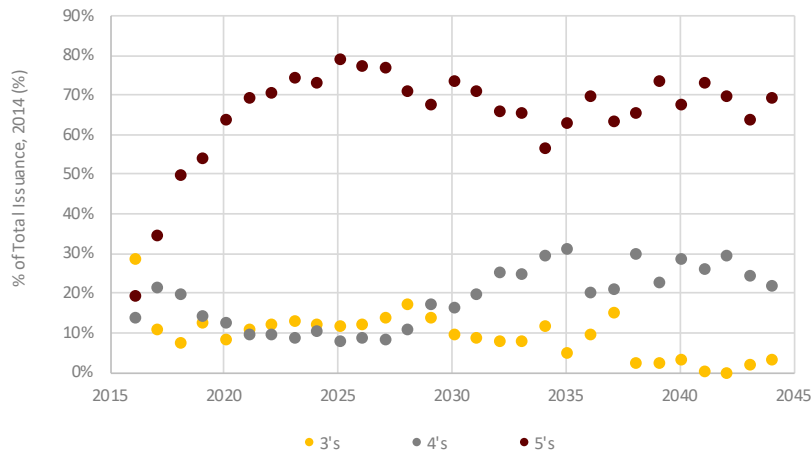


Going Forward Benchmark Ambiguity

- As market couponing changes there is an impact on accuracy and price discovery

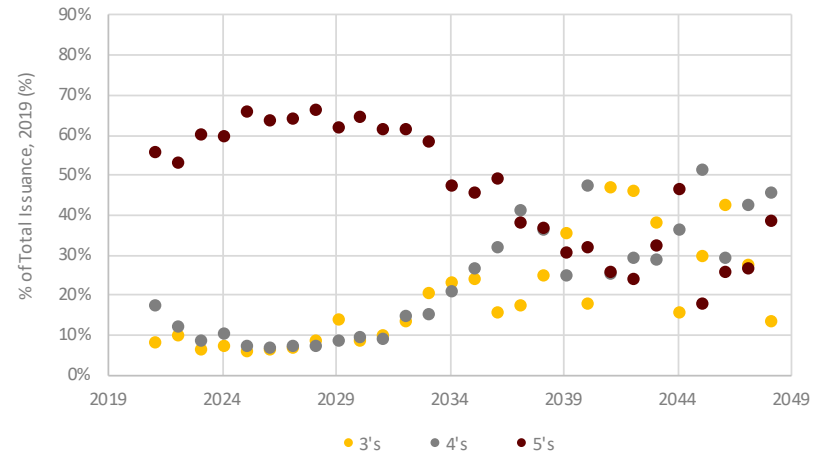
2014

New Issue Cpn Distribution Across Curve, 2014 Negotiated Sales:
Lower Cpn Structures Far Less Prevalent vs. 2019 Across Curve



2019

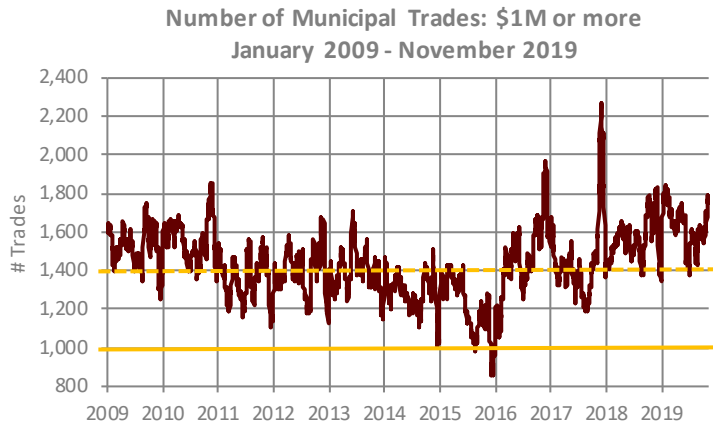
New Issue Cpn Distribution Across Curve, 2019 Negotiated Sales:
Lower Cpn Make Up Larger % of Longer Maturity New Issue



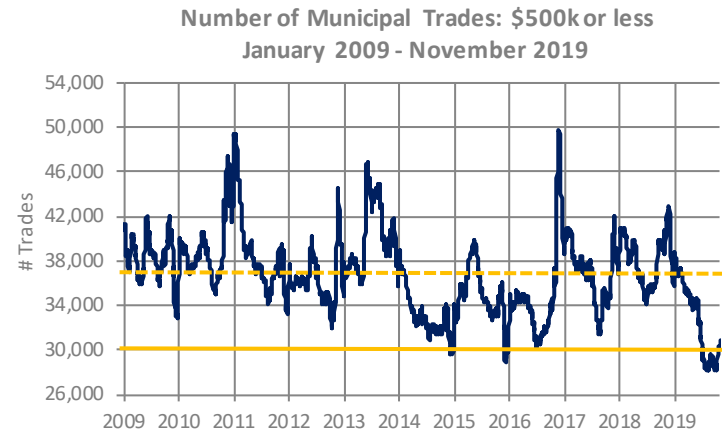
Secondary Trading Affects Price Discovery

- Fewer small block trades, above average institutional
- The regulatory question is which institutions price the market daily

Institutional



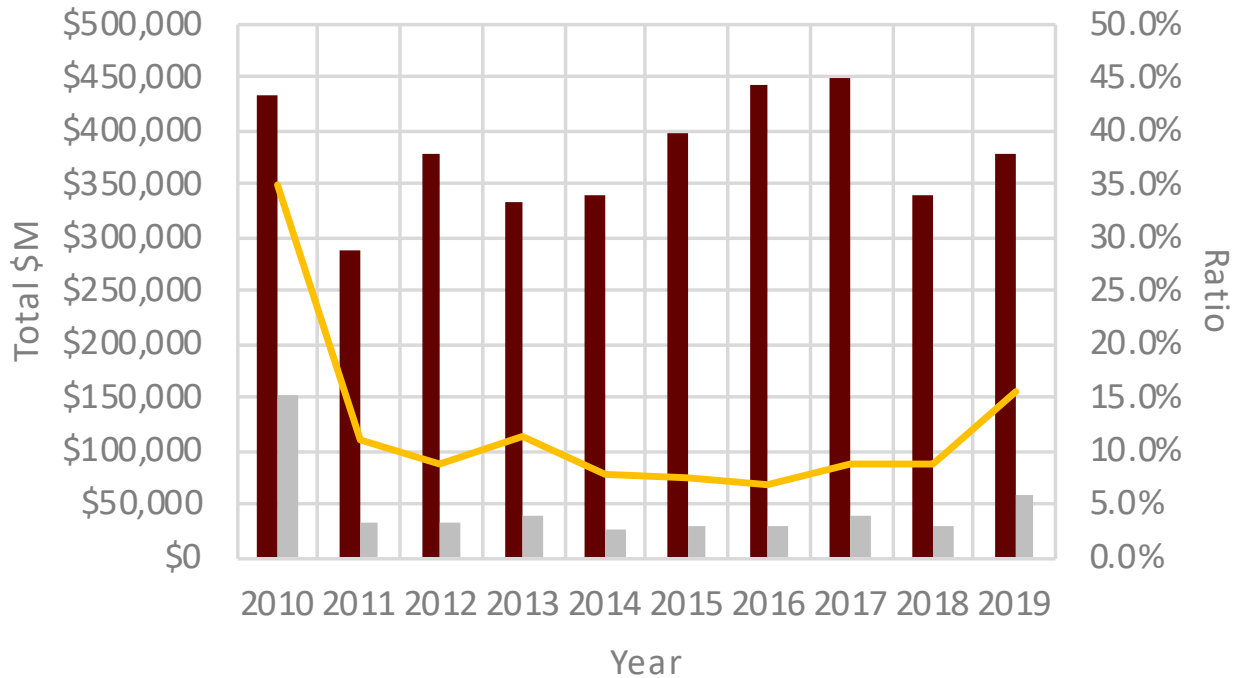
Retail



More Taxable Municipals Change Benchmark

- It could be time to use the Treasury curve as market increases its pricing comfort

Taxable Issuance as a % of Total: 2010-2019*



■ Total ■ Taxable — Ratio

* as of 11/29

Industry Benchmark Discussion

- What is the goal?

- One benchmark?
- Degree of transparency?
- Who is responsible for oversight of daily process?
- How are issuers best served?
- How are investors best served?
- How are underwriters best served?
- All benefit from lowest yields? (Except for new buyer)
- Adversity as in 2008 (MMD) and 2013 (Bloomberg) stressed benchmark practices - what do we learn from history?
- When secondary trading low or primary pricing light, how is data vulnerable?
- How is the industry informed when benchmark process, assumptions, personnel or ownership change?
- Academic or regulatory study to examine transactions, benchmark and evaluation relationships?
- Who is providing the key price discovery for benchmarks and evaluations on any given day?



Benchmarks in the Municipal Bond Space

SDMN Webinar

Todd Fraizer
Managing Director, Head of PFM Pricing Group

December 12th, 2019

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(704) 319-7901
pfm.com



◆ Importance of Benchmark Yield Curves

- Benchmark yield curves provide **reference prices for municipal bonds**, especially if the underlying transactions are scarce/illiquid
 - A method of measuring the value of a section of the bond market
 - A tool used by issuers, investors and other financial professionals to describe the market, and to compare the rate of return on specific securities
 - A tool that allows performance to be compared relative to a point in the market, accounting for differences in couponing, call feature, and credit.
- Benchmarks can also help **post-trade analysis of execution quality**
 - A metric that should track the same spot in the market, so that performance can be measured across time and different market environments

◆ Characteristics of a Useful Benchmark

- **Transparency** of data and methodology of benchmark yield curves
- **Cost** of access to benchmark yield curves



MMD AAA G.O. Curve (MMD)

- Key characteristics:
 - 5% coupon
 - 10-year par call
 - AAA rated State GO bonds
 - 30 tenor points
- Most widely used benchmark in the municipal market
- MMD is produced by Thomson Municipal Market Monitor (TM3) owned by Renitiv, an independent third-party provider of financial markets data and infrastructure
- Subscription cost relatively high

MMD Yields

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[MMD Tax Exempt Yields 1-30 YR](#) |
 [Tax Exempt Yield Curve Changes](#) |
 [MMD Taxable Yields 1-30 YR](#) |
 [Yield Curve Assumptions](#)

Municipal Yield Curves as of 12/10/2019

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		General Obligations						"AAA" Coupon Range	
		"AAA"	PRE-RE	INSURED	"AA"	"A"	"BAA"	"LOW"	"HIGH"
1	2020	1.04	1.04	1.12	1.07	1.13	1.42	5.00	5.00
2	2021	1.05	1.05	1.15	1.10	1.20	1.49	5.00	5.00
3	2022	1.06	1.06	1.21	1.12	1.25	1.55	5.00	5.00
4	2023	1.07	1.07	1.27	1.15	1.31	1.60	5.00	5.00
5	2024	1.11	1.12	1.33	1.20	1.38	1.68	5.00	5.00
6	2025	1.18	1.20	1.41	1.29	1.46	1.78	5.00	5.00
7	2026	1.25	1.27	1.48	1.36	1.53	1.86	5.00	5.00
8	2027	1.31	1.33	1.55	1.43	1.60	1.92	5.00	5.00
9	2028	1.38		1.63	1.51	1.68	2.00	5.00	5.00
10	2029	1.45		1.71	1.59	1.75	2.07	5.00	5.00
11	2030	1.52		1.82	1.68	1.85	2.17	5.00	5.00
12	2031	1.56		1.86	1.74	1.90	2.21	5.00	5.00
13	2032	1.60		1.90	1.79	1.94	2.25	5.00	5.00
14	2033	1.64		1.94	1.84	1.99	2.29	5.00	5.00
15	2034	1.68		1.98	1.88	2.05	2.33	5.00	5.00
16	2035	1.72		2.02	1.92	2.09	2.37	5.00	5.00
17	2036	1.76		2.06	1.96	2.13	2.41	5.00	5.00
18	2037	1.80		2.10	2.00	2.17	2.45	5.00	5.00
19	2038	1.83		2.13	2.03	2.20	2.48	5.00	5.00
20	2039	1.86		2.16	2.06	2.23	2.51	5.00	5.00
21	2040	1.89		2.19	2.09	2.26	2.54	5.00	5.00
22	2041	1.92		2.22	2.12	2.29	2.57	5.00	5.00
23	2042	1.95		2.25	2.15	2.32	2.60	5.00	5.00



Interpolated AAA

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Interpolated AAA Yields as of 12/09/2019*

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YR	MATURITY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	2020	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
2	2021	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06
3	2022	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07
4	2023	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08
5	2024	1.10	1.10	1.10	1.11	1.11	1.11	1.11	1.11	1.12	1.12	1.12	1.12
6	2025	1.15	1.15	1.16	1.16	1.17	1.17	1.17	1.18	1.18	1.18	1.19	1.19
7	2026	1.22	1.23	1.23	1.24	1.24	1.25	1.25	1.25	1.26	1.26	1.26	1.26
8	2027	1.27	1.27	1.28	1.28	1.29	1.29	1.30	1.30	1.31	1.31	1.32	1.32
9	2028	1.34	1.34	1.35	1.35	1.36	1.36	1.37	1.37	1.38	1.38	1.39	1.39
10	2029	1.42	1.42	1.43	1.43	1.44	1.44	1.44	1.45	1.45	1.45	1.46	1.46
11	2030	1.48	1.48	1.49	1.49	1.50	1.50	1.51	1.51	1.52	1.52	1.53	1.53
12	2031	1.54	1.54	1.55	1.55	1.56	1.56	1.56	1.56	1.57	1.57	1.57	1.57
13	2032	1.58	1.58	1.59	1.59	1.60	1.60	1.60	1.60	1.61	1.61	1.61	1.61

*Monthly interpolated MMD AAA yields are estimated using a straight line calculation between the current, early, mid and late dated MMD AAA yields and are meant to approximate intra-year MMD AAA yields.



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Bloomberg

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MBIS Municipal Benchmark Curve

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S&P Municipal Bond Index

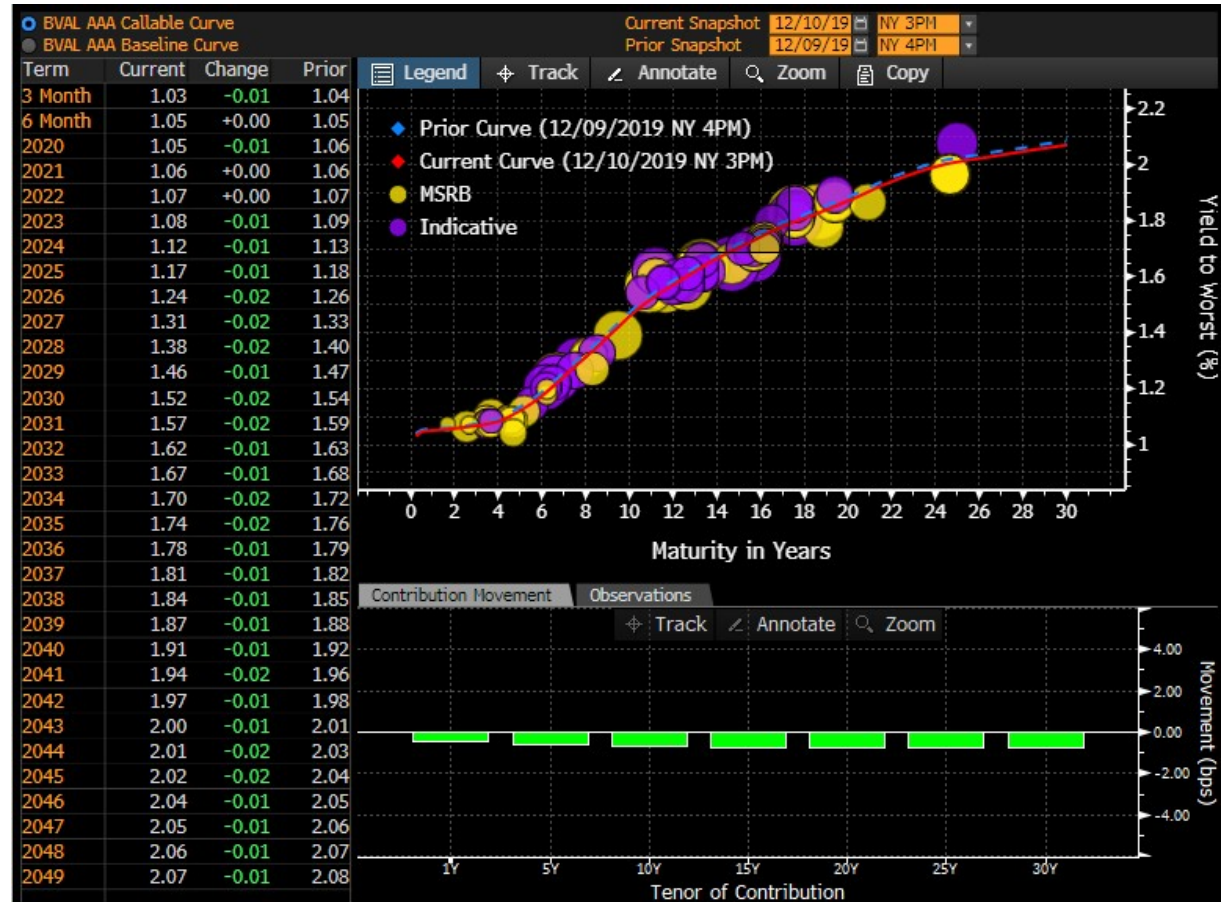
[Historical Index Data](#)

<https://emma.msrb.org/ToolsAndResources/MarketIndicators>



BVALAAA Callable Curve (BVAL)

- Key characteristics:
 - 5% coupon
 - 10-year par call
 - Offer-side
 - Constant maturity
 - 32 tenor points
- BVAL is produced by Bloomberg L.P., an independent third-party financial software, data and media company
- Base Curve is free via MSRB's EMMA website
- BVAL interpolated curve requires a Bloomberg subscription





Tue Dec 10 2019 NY 3PM Interpolate to Custom Date 03/10/20 Yield 1.03

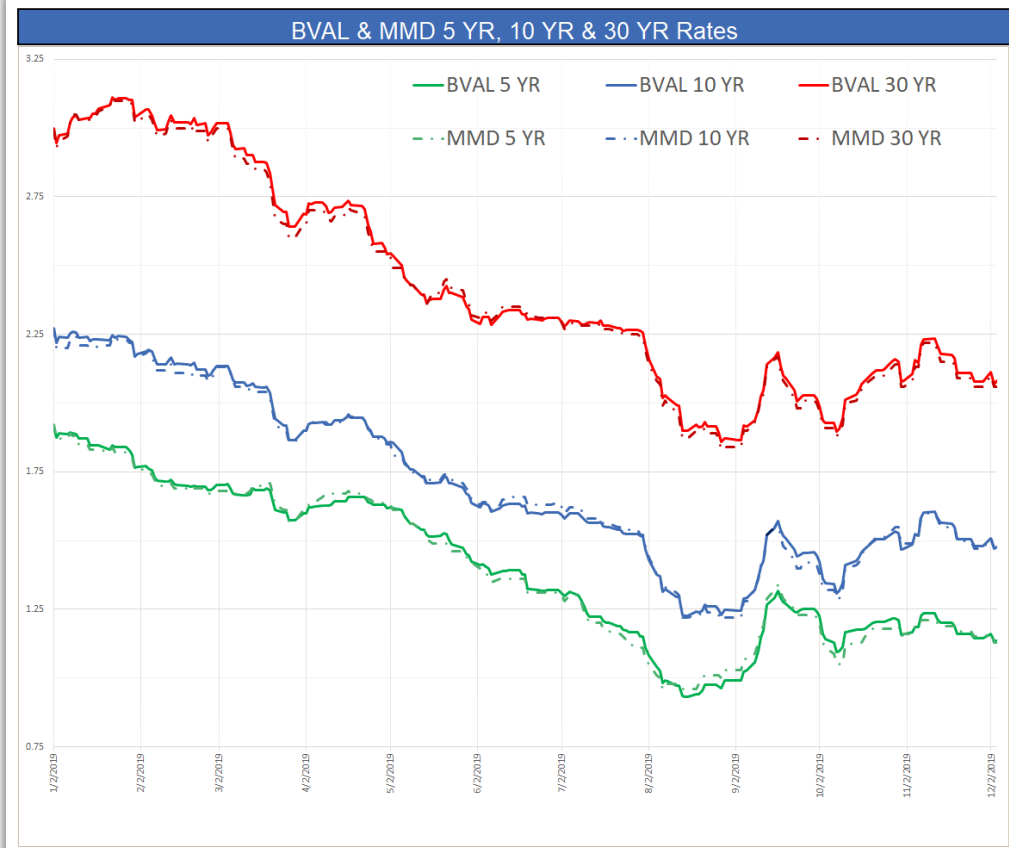
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2020	--	--	1.03	1.04	1.04	1.05	1.05	1.05	1.05	1.05	1.05	1.05
2021	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.06	1.06
2022	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.07	1.07	1.07
2023	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.08	1.08	1.08	1.08	1.08
2024	1.08	1.09	1.09	1.09	1.10	1.10	1.10	1.11	1.11	1.11	1.12	1.12
2025	1.12	1.13	1.13	1.14	1.14	1.15	1.15	1.15	1.16	1.16	1.17	1.17
2026	1.18	1.18	1.19	1.20	1.20	1.21	1.21	1.22	1.23	1.23	1.24	1.24
2027	1.25	1.26	1.26	1.27	1.27	1.28	1.28	1.29	1.29	1.30	1.31	1.31
2028	1.32	1.32	1.33	1.34	1.34	1.35	1.35	1.36	1.36	1.37	1.38	1.38
2029	1.39	1.39	1.40	1.41	1.41	1.42	1.43	1.43	1.44	1.45	1.45	1.46
2030	1.46	1.47	1.48	1.48	1.49	1.49	1.50	1.50	1.51	1.51	1.52	1.52
2031	1.53	1.53	1.53	1.54	1.54	1.55	1.55	1.55	1.56	1.56	1.57	1.57
2032	1.58	1.58	1.58	1.59	1.59	1.59	1.60	1.60	1.61	1.61	1.61	1.62
2033	1.62	1.63	1.63	1.63	1.64	1.64	1.65	1.65	1.65	1.66	1.66	1.67
2034	1.67	1.67	1.68	1.68	1.68	1.68	1.69	1.69	1.69	1.70	1.70	1.70
2035	1.71	1.71	1.71	1.72	1.72	1.72	1.73	1.73	1.73	1.74	1.74	1.74
2036	1.75	1.75	1.75	1.76	1.76	1.76	1.76	1.77	1.77	1.77	1.78	1.78
2037	1.78	1.78	1.79	1.79	1.79	1.79	1.80	1.80	1.80	1.80	1.80	1.81
2038	1.81	1.81	1.82	1.82	1.82	1.82	1.83	1.83	1.83	1.83	1.84	1.84



● BVAL and MMD closely track one another

- Average difference in any maturity since January 1st, 2019 is less than 1 basis point (-0.5 to 1.5bps)
- Maximum variance in any maturity since January 1st, 2019 is roughly 5bps

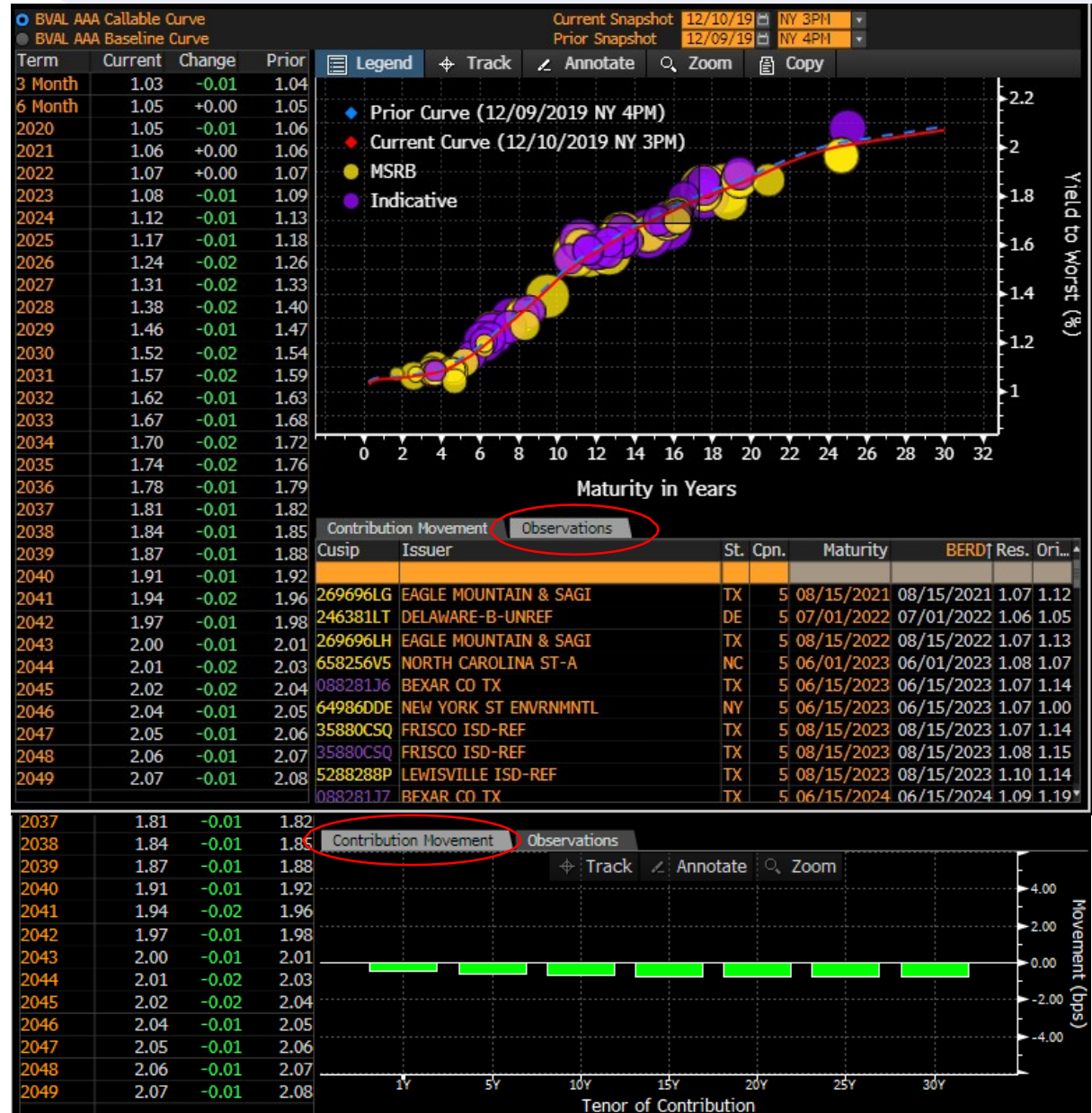
BVAL AAA vs. MMD Rate Comparison (1/2/19-12 to 12/4/19)						
Basis Point Variation				Percentage Variation		
Maturity	Avg.	Min.	Max.	>1bps	<1bps	Within 1bps
1 Year	-0.5bps	-4.7bps	3.2bps	17.67%	39.22%	43.10%
5 Year	0.6bps	-4.6bps	6.4bps	50.00%	23.28%	26.72%
10 Year	0.5bps	-3.7bps	5.0bps	36.64%	23.28%	40.09%
15 Year	1.0bps	-3.2bps	6.4bps	49.14%	9.48%	41.38%
20 Year	0.5bps	-2.7bps	4.4bps	34.91%	18.53%	46.55%
30 Year	1.5bps	-2.8bps	4.9bps	73.71%	11.64%	14.66%





Characteristics of the BVAL that compare favorably to other benchmarks:

- BVAL is a trade data algorithmic based model with viewable observations that have been incorporated into the curve.
- BVAL also provides viewable impact of contributor submissions
- BVAL frequency of publication is dependable and predictable, produced hourly from 9am-4pm, providing more timely information to the municipal market.
- BVAL is publicly available to all market participants through the MSRB's EMMA website.





Principles for Financial Benchmarks

- ◆ **“The Principles should be understood as a set of recommended practices that should be implemented by Benchmark Administrators and Submitters.**
- ◆ Submissions to Benchmarks: As described in the January Consultation Report, there are a variety of methods by which different forms of data are developed, collected and transmitted to Administrators. The Submission process may create additional vulnerabilities to the determination process if not addressed by appropriate controls and policies. For example, **there may be conflicts of interests in and incentives to manipulate the determination process where the Submitters are also Market Participants with stakes in the level of the Benchmarks.** Furthermore, there may be other conflicts of interests and opportunities for manipulative conduct created by the possibility of voluntary and/or selective Submissions, the varied composition of Submitters, and discretion in the selection of data to be submitted.
- ◆ These **Principles also address vulnerabilities in the Submission process** (e.g., conflict of interest, improper communication between Submitters and Administrators, selective Submission of data) by outlining the responsibilities that should be undertaken by Submitters (i.e., a Submitter Code of Conduct).
- ◆ If the procedures and policies concerning the Methodology do not contain adequate detail, the ability of Stakeholders to evaluate the credibility of a Benchmark may be restricted. Furthermore, a lack of transparency may allow abusive conduct to influence Benchmark determinations. **Low transparency in the absence of strong internal controls may also create opportunities for gaming Submissions to influence a Benchmark.**
- ◆ **Benchmark Administrators should publically disclose the extent of their compliance with the Principles annually.**
- ◆ An appropriate control framework at the Administrator for the process of determining and distributing the Benchmark, which should be appropriately tailored to the materiality of the potential or existing conflicts of interest identified, and to the nature of Benchmark inputs and outputs. The **control framework should be documented, available to any relevant Regulatory Authority and Published or Made Available to Stakeholders.** Among other things, a control framework should include an effective whistleblowing mechanism in order to facilitate early awareness of potential misconduct.”



MMD Yields

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[MMD Tax Exempt Yields 1-30 YR](#)

[Tax Exempt Yield Curve Changes](#)

[MMD Taxable Yields 1-30 YR](#)

[Yield Curve Assumptions](#)

Yield Curve Assumptions

Inputs into the creation of the curve are both objective and subjective.

Examples of objective analysis are observable and measurable and include primary market levels, secondary market trades, two sided markets, bids and offerings and many other factual data points. Examples of subjective analysis include information from an MMD analysts point of view, including validating perceptions and concerns of market activity using insight and opinion.

BVAL Muni AAA Curves

Bloomberg BVAL's AAA Callable Curve (BVAL)

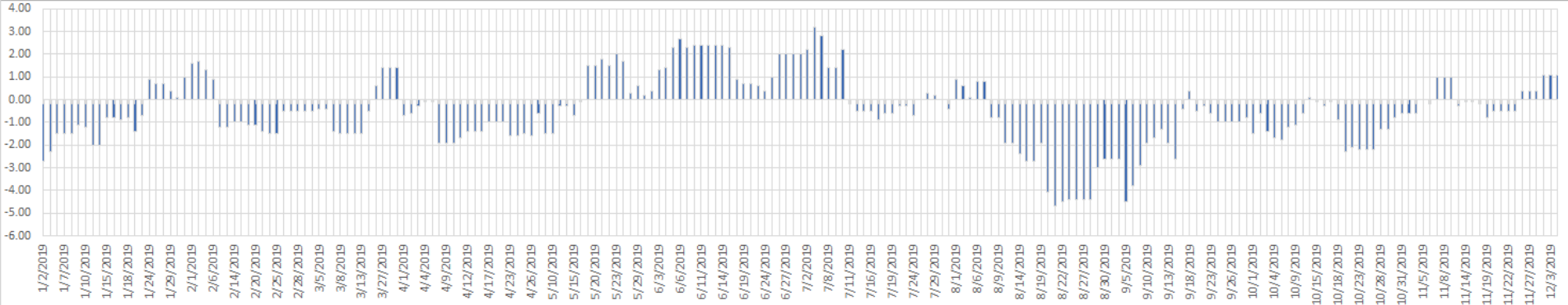
- Contributor Data (as described by Bloomberg)
 - “Contracted” Broker Dealers
 - Submit multiple times per day
 - Written scale submissions
 - Periodic review of contributors



BVAL AAA vs. MMD Rate Comparison

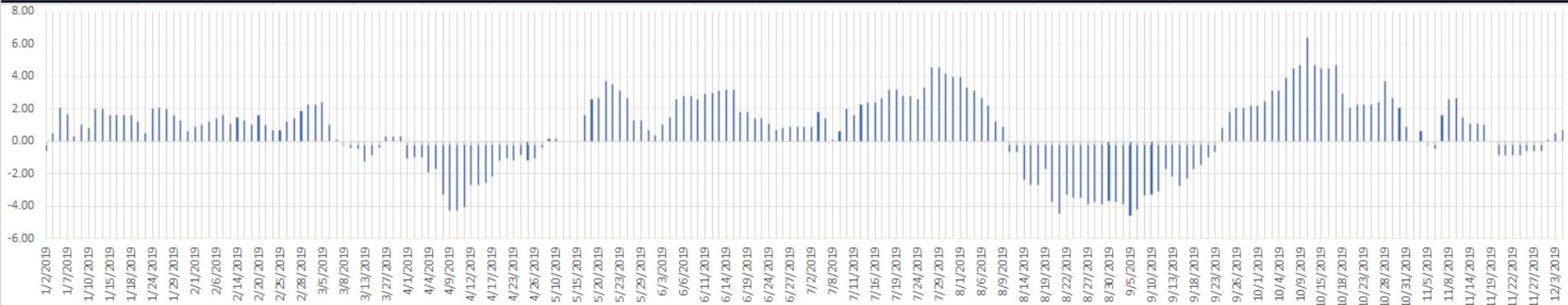


BVAL AAA vs. MMD 1Yr



BVAL AAA vs. MMD 1Yr	Average: -0.520	Min -4.700	Max 3.200	1bps or Greater 17.67%	Percentage of Time Difference	1bps or less 39.22%	Within 1bps 43.10%
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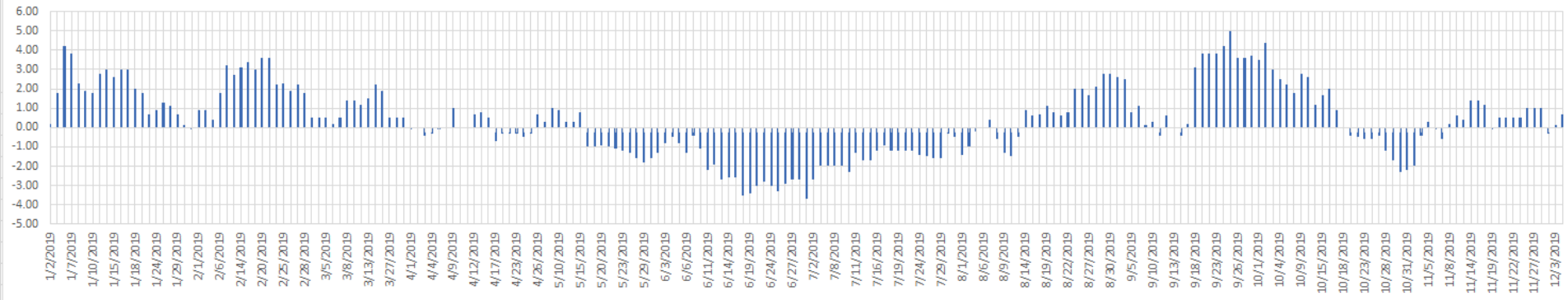
BVAL AAA vs. MMD 5Yr



BVAL AAA vs. MMD 5Yr	Average: 0.609	Min -4.600	Max 6.400	1bps or Greater 50.00%	Percentage of Time Difference	1bps or less 23.28%	Within 1bps 26.72%
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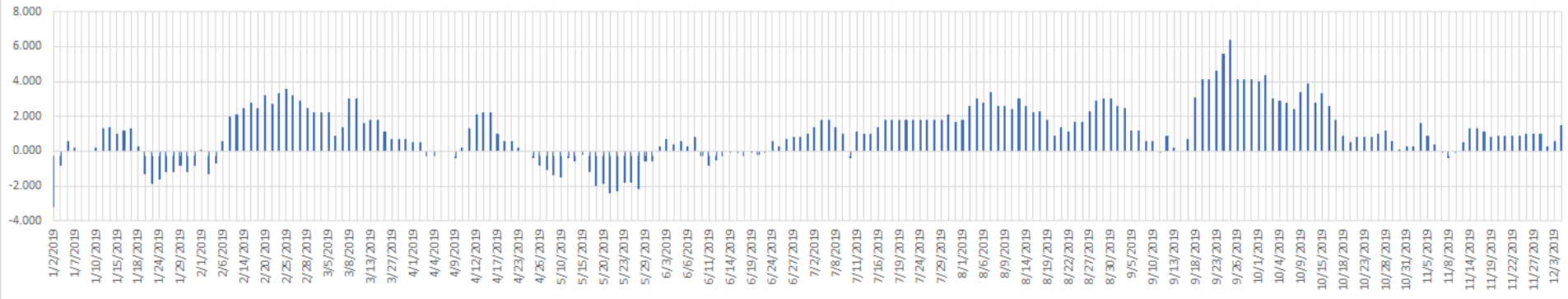


BVAL AAA vs. MMD 10 YR



BVAL AAA vs. MMD 10 YR	Average: 0.478	Min	-3.700	Max	5.000	Percentage of Time Difference					
						1bps or Greater	36.64%	1bps or less	23.28%	Within 1bps	40.09%

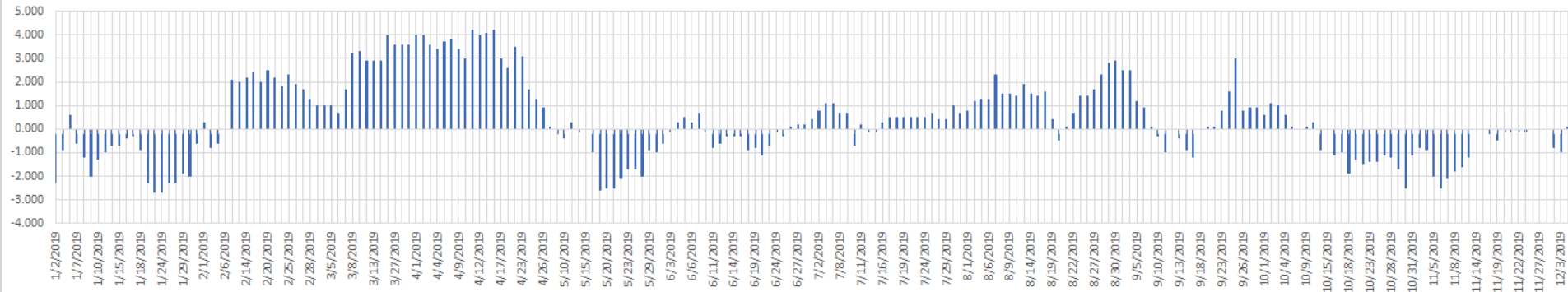
BVAL AAA vs. MMD 15 YR



BVAL AAA vs. MMD 15 YR	Average: 1.037	Min	-3.200	Max	6.400	Percentage of Time Difference					
						1bps or Greater	49.14%	1bps or less	9.48%	Within 1bps	41.38%

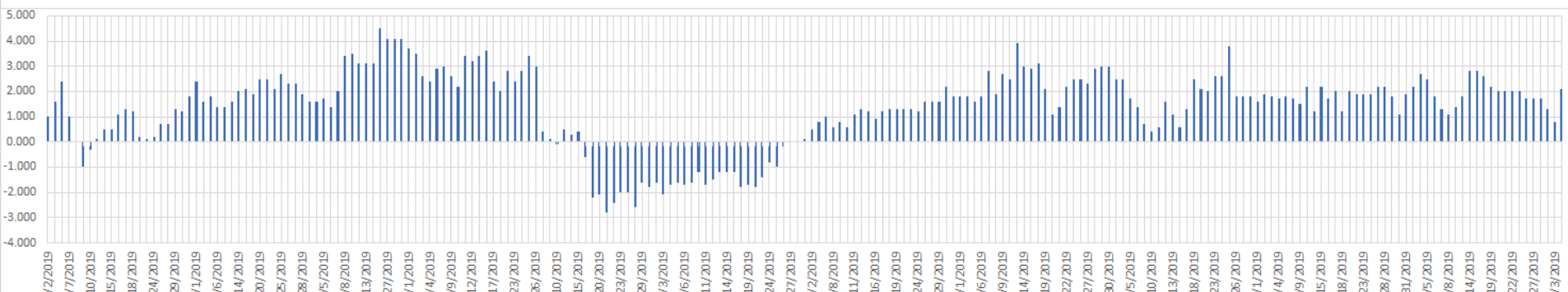


BVAL AAA vs. MMD 20 YR



BVAL AAA vs. MMD 20 YR	Average: 0.522	Min -2.700	Max 4.400	Percentage of Time Difference		
				1bps or Greater 34.91%	1bps or less 18.53%	Within 1bps 46.55%

BVAL AAA vs. MMD 30 YR



BVAL AAA vs. MMD 30 YR	Average: 1.461	Min -2.800	Max 4.900	Percentage of Time Difference		
				1bps or Greater 73.71%	1bps or less 11.64%	Within 1bps 14.66%



pfm



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December 12, 2019

Market Update

Market Commentary

Market Observations

Primary Market:

- Municipal calendar estimated at \$13.21 billion - \$11.63 billion of negotiated deals and \$1.58 billion of competitive sales
- The largest negotiated issue of the week is \$1.2 billion of Texas Private Activity Bond Surface Transportation Corporation senior lien revenue refunding bonds for the NTE Mobility Partners North Tarrant Express Managed Lanes Project

Secondary Market:

- Municipal Bond Funds reported \$614.8 million in net inflows last week, compared with \$2.4 billion of inflows the previous week, a decrease of \$1.7 billion, marking 48 weeks in a row of inflows, the lowest since September 2018 and ends an eight week run of inflows greater than \$1 billion

General Market Overview:

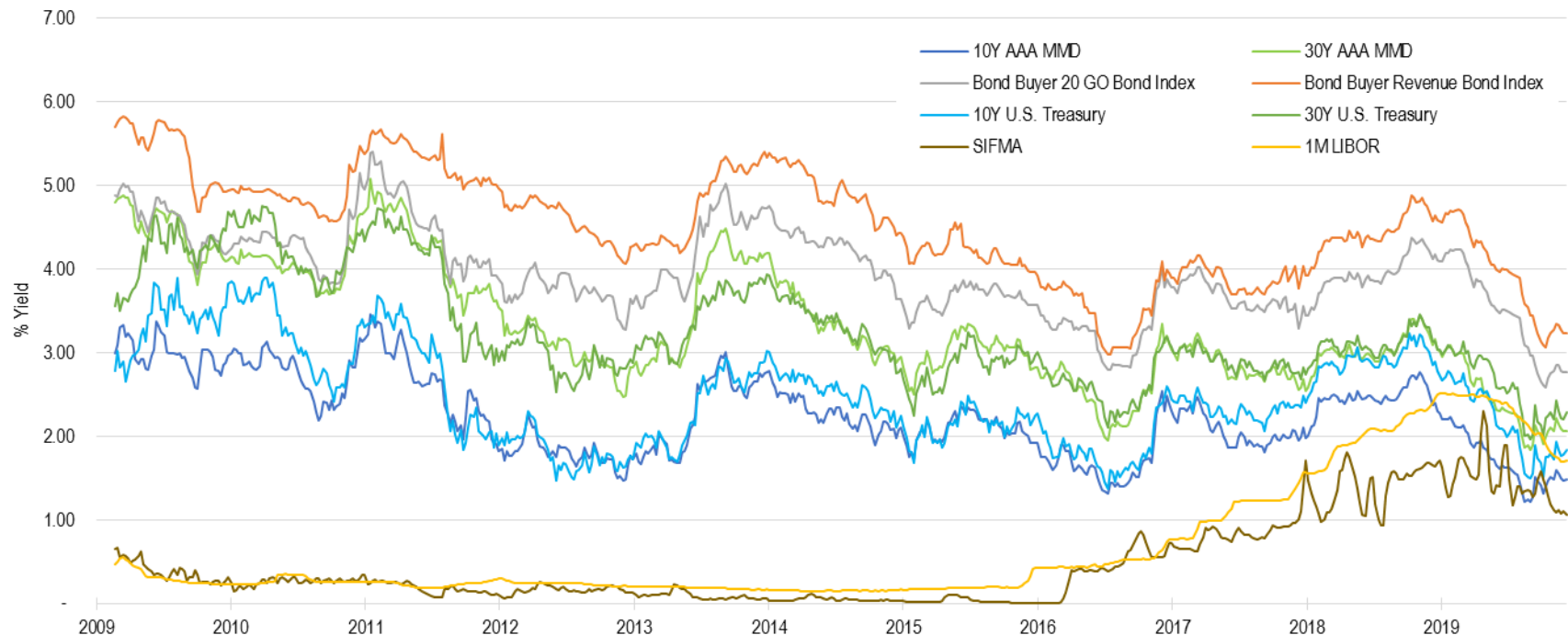
- Strong jobs report came in at 266k, well above the 180k median forecast and Unemployment fell to 3.5% from 3.6%, marking a 50-year low
- Final FOMC meeting of the year is scheduled for Tuesday and Wednesday – virtually no market expectation of rate cut
- Trade talks continue; however, U.S. is scheduled to begin 15% tariff on additional \$160 billion of Chinese imports; as of Friday, White House economic adviser confirmed this plan is still in place
- Economic data: Productivity and Costs, Redbook, CPI, EIA Petroleum Status Report, Jobless Claims, PPI-FD, EIA Natural Gas Report, Fed Balance Sheet, Retail Sales, Import and Export Prices, Business Inventories

Source: Ipreo, TM3 Refinitiv, Bloomberg, BBC, Wall Street Journal, New York Times, AXIOS

Statistics

	12/6/2019	11/29/2019	Change	
5Y MMD	1.14	1.15	(0.01)	▼
10Y MMD	1.48	1.47	0.01	▲
15Y MMD	1.71	1.70	0.01	▲
20Y MMD	1.89	1.88	0.01	▲
30Y MMD	2.07	2.06	0.01	▲
MMD 2/30 Yield Curve Steepness	100	99	1	▲
Bond Buyer 11 GO Bond Index	2.30	2.30	-	-
Bond Buyer 20 GO Bond Index	2.77	2.77	-	-
Bond Buyer Revenue Bond Index	3.24	3.24	-	-
1Y UST	1.57	1.60	(0.03)	▼
5Y UST	1.67	1.62	0.05	▲
7Y UST	1.78	1.73	0.05	▲
10Y UST	1.84	1.78	0.06	▲
30Y UST	2.29	2.21	0.08	▲
UST 2/30 Yield Curve Steepness	68	60	8	▲
10Y MMD/UST Ratio	80	83	(2.1)	▼
30Y MMD/UST Ratio	90	93	(2.8)	▼
SIFMA	1.06	1.10	(0.04)	▼
1M LIBOR	1.72	1.70	0.02	▲
30-Day Negotiated Visible Supply	15,255.7	17,563.1	(2,307.4)	▼
30-Day Competitive Visible Supply	2,070.0	3,358.1	(1,288.1)	▼
Lipper Muni Bond Fund Flows	615	2,355	(1,740)	▼

Weekly Benchmark Interest Rates



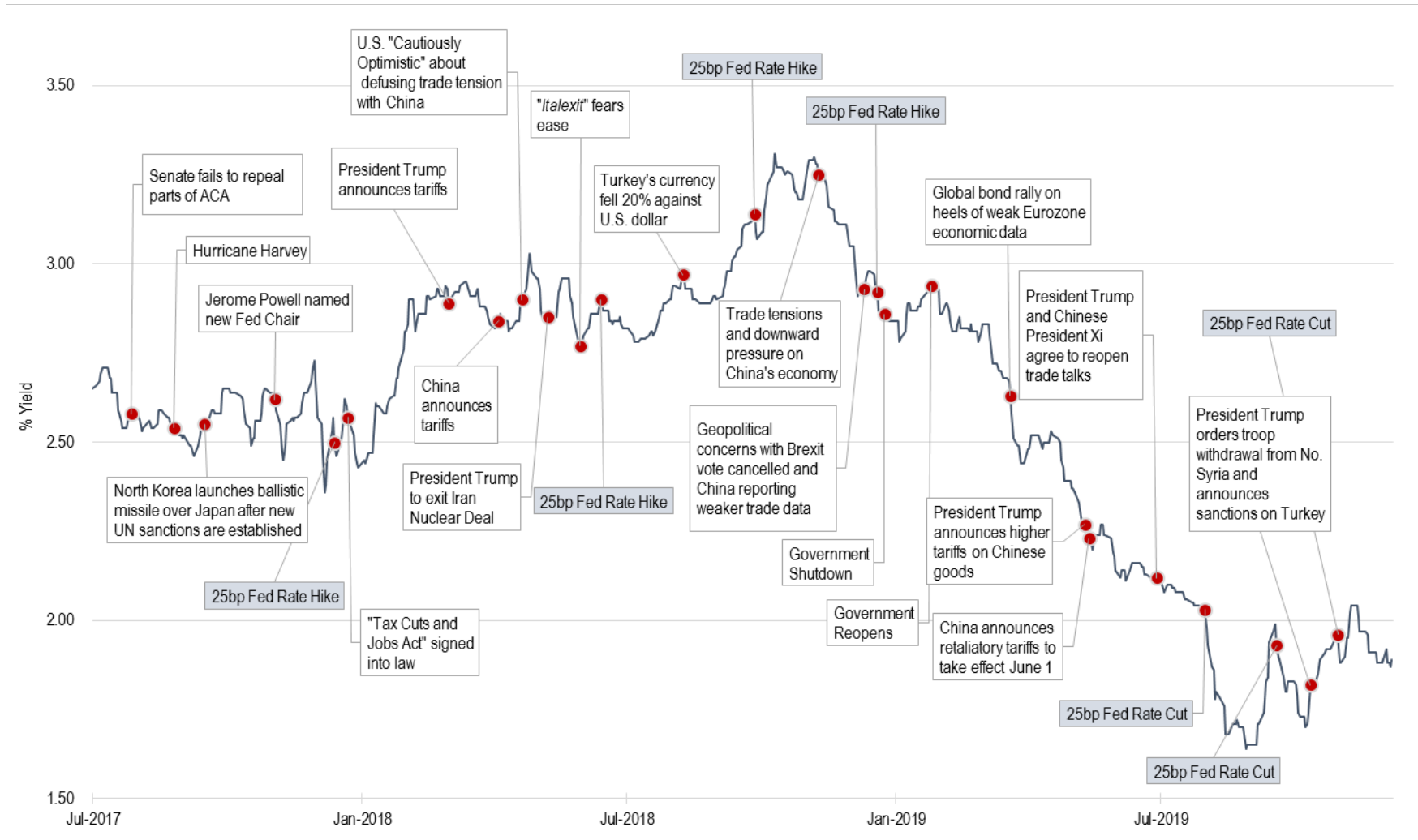
Rates Analysis Since January 2009

	10Y AAA MMD	30Y AAA MMD	Bond Buyer 20 GO Bond Index	Bond Buyer Revenue Bond Index	10Y U.S. Treasury	30Y U.S. Treasury	SIFMA	1M LIBOR
Current	1.48	2.07	2.77	3.24	1.84	2.29	1.06	1.72
Maximum	3.53	5.08	5.41	6.00	3.90	4.75	2.30	2.52
Minimum	1.22	1.84	2.59	2.98	1.37	1.96	0.01	0.15
Average	2.26	3.34	3.97	4.54	2.49	3.27	0.48	0.67
% Time Lower	4%	2%	1%	4%	15%	3%	83%	84%

Source: Refinitiv Municipal Market Data, U.S. Treasury and Bloomberg

Change in 20-Year MMD

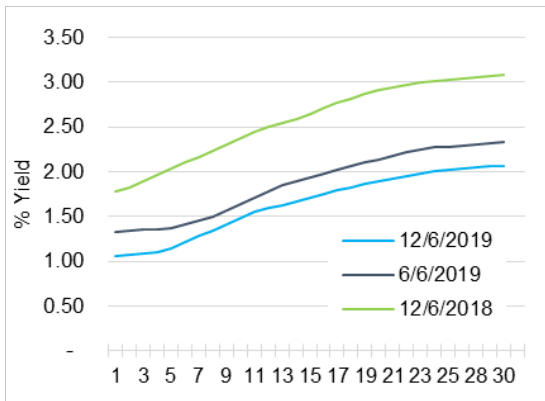
Change in 20-Year MMD with Market Commentary



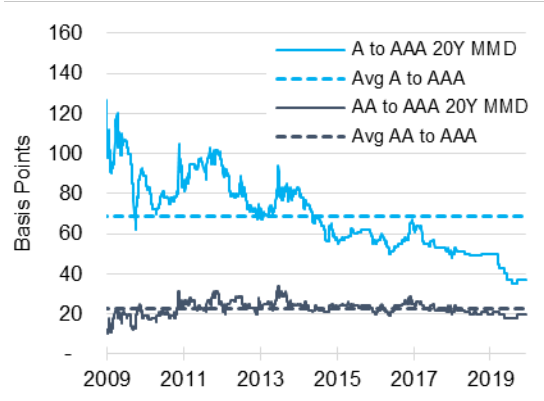
Source: Refinitiv Municipal Market Data and HilltopSecurities

Tax-Exempt Market Overview | MMD

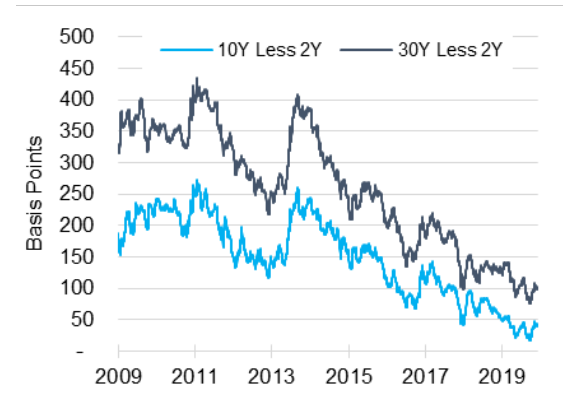
AAA MMD Historical Yield Curve Comparison



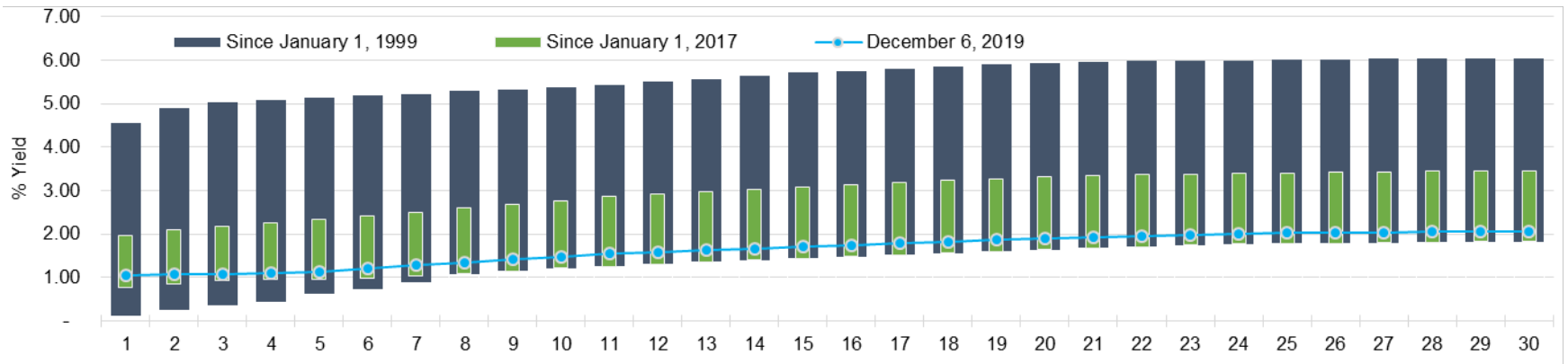
Historical MMD Credit Spreads to AAA



AAA MMD Historical Yield Curve Steepness



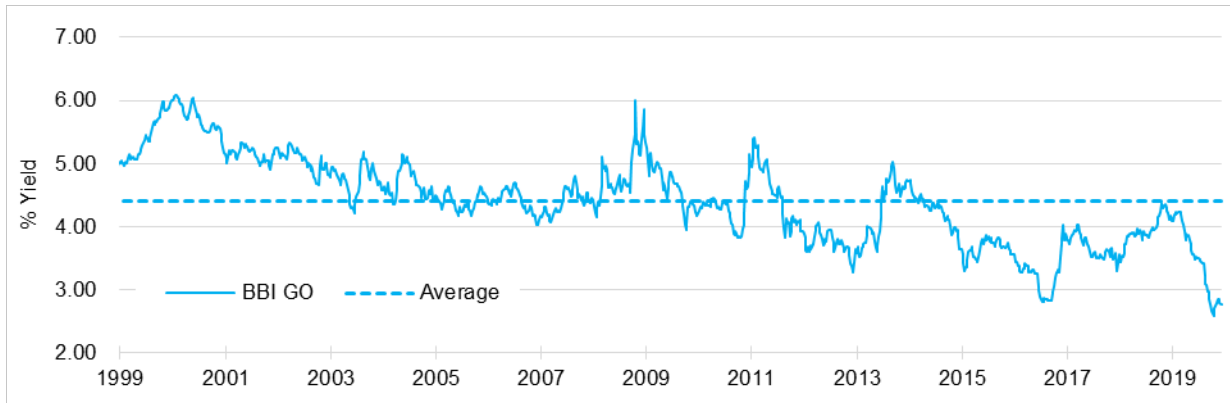
Maximum and Minimum AAA MMD Yields



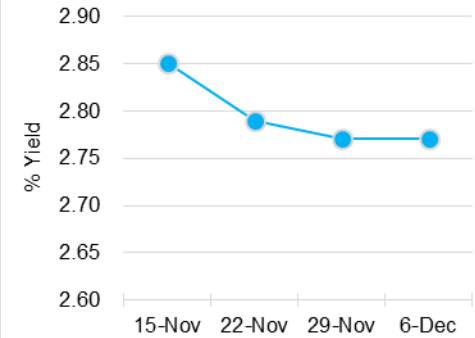
Source: Refinitiv Municipal Market Data

Tax-Exempt Market Overview | The Bond Buyer

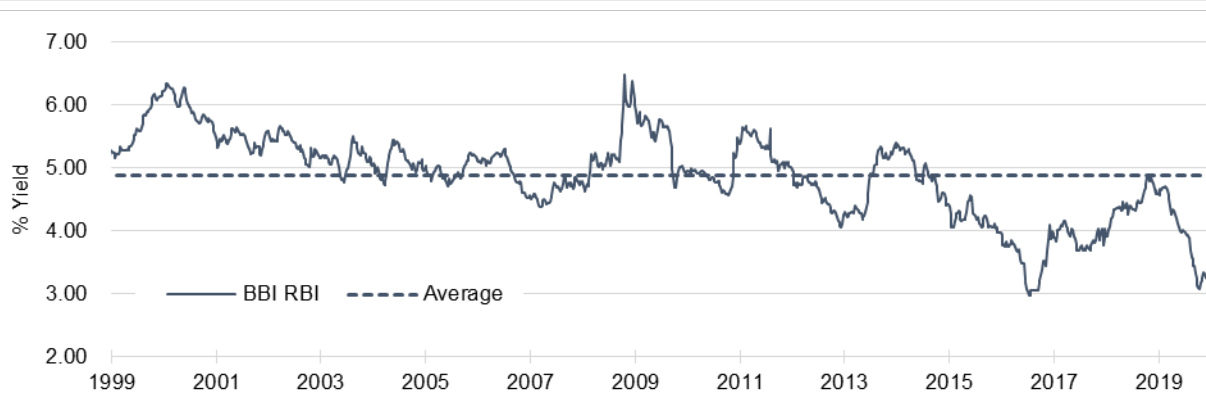
The Bond Buyer 20-Bond General Obligation Index



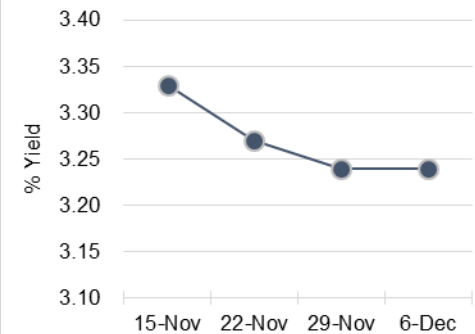
4-Week Snapshot



The Bond Buyer Revenue Bond Index



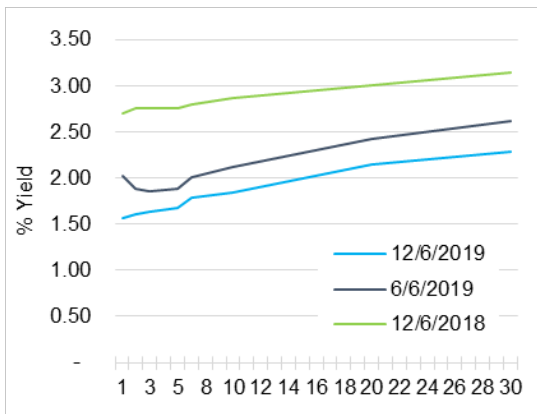
4-Week Snapshot



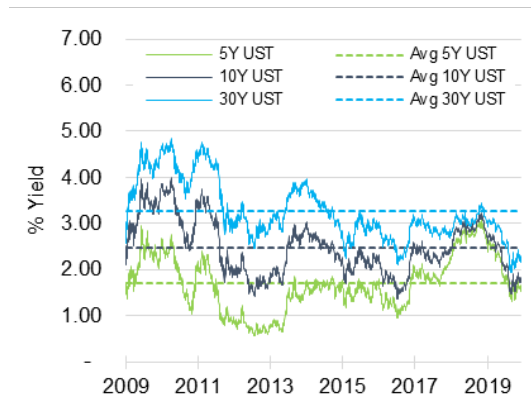
Source: The Bond Buyer

Taxable Market Overview | U.S. Treasuries

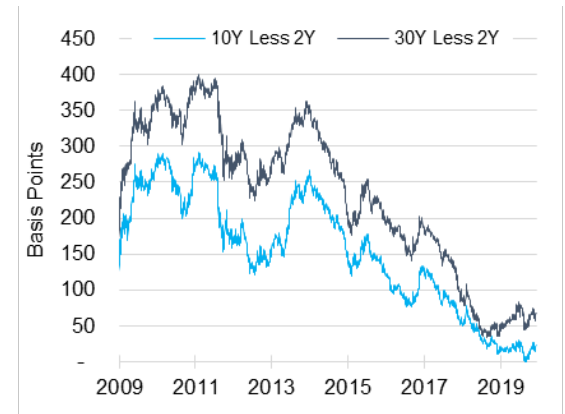
UST Historical Yield Curve Comparison



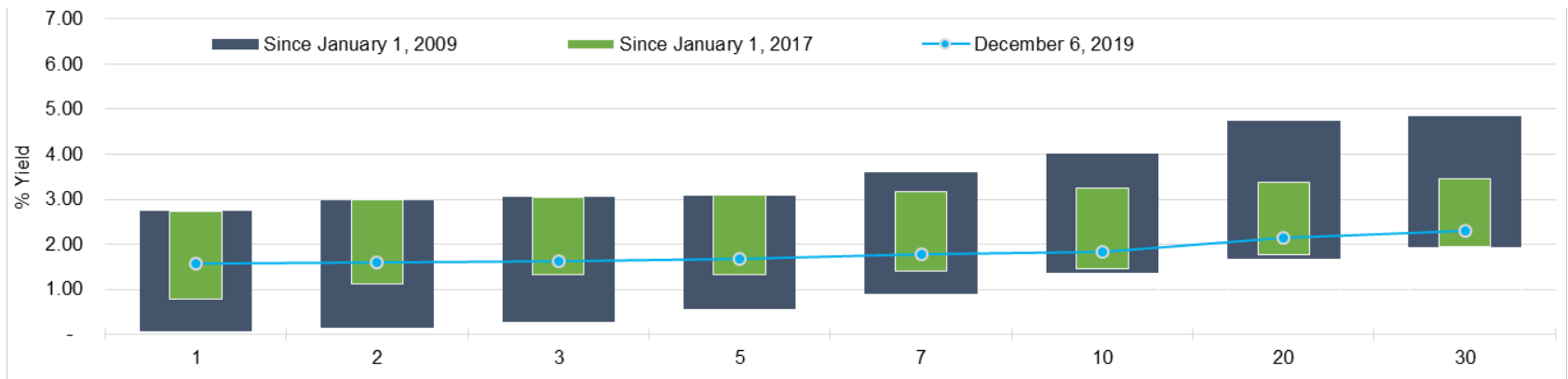
Historical UST Rates



UST Historical Yield Curve Steepness



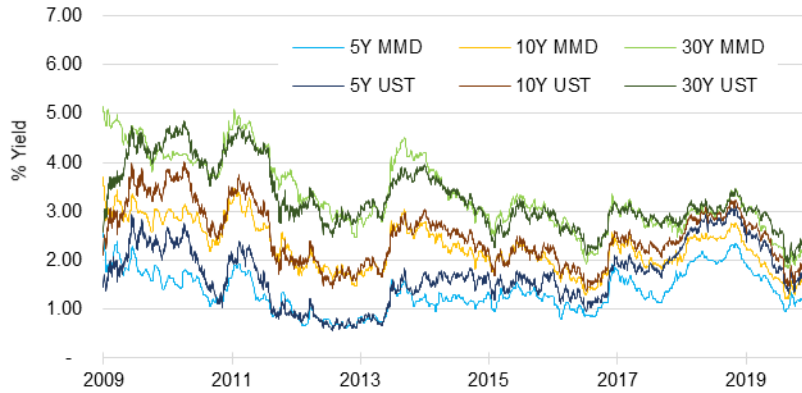
Maximum and Minimum UST Yields



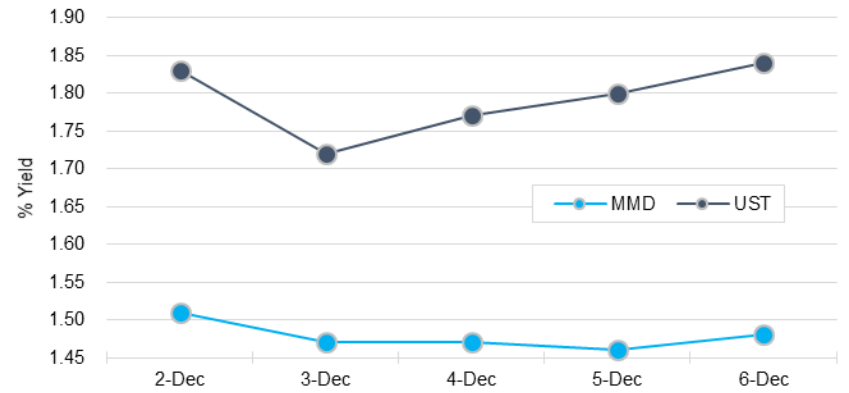
Source: U.S. Treasury Department

MMD vs UST

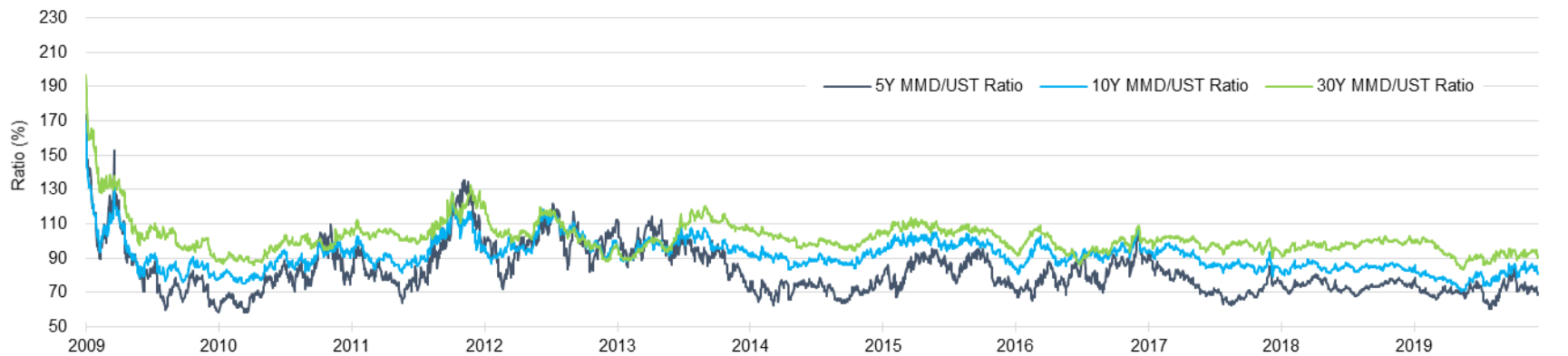
MMD | UST 5-10-30 Year Historical Rates Comparison



MMD | UST 10-Year 1-Week Comparison



MMD | UST 5-10-30 Year Ratios

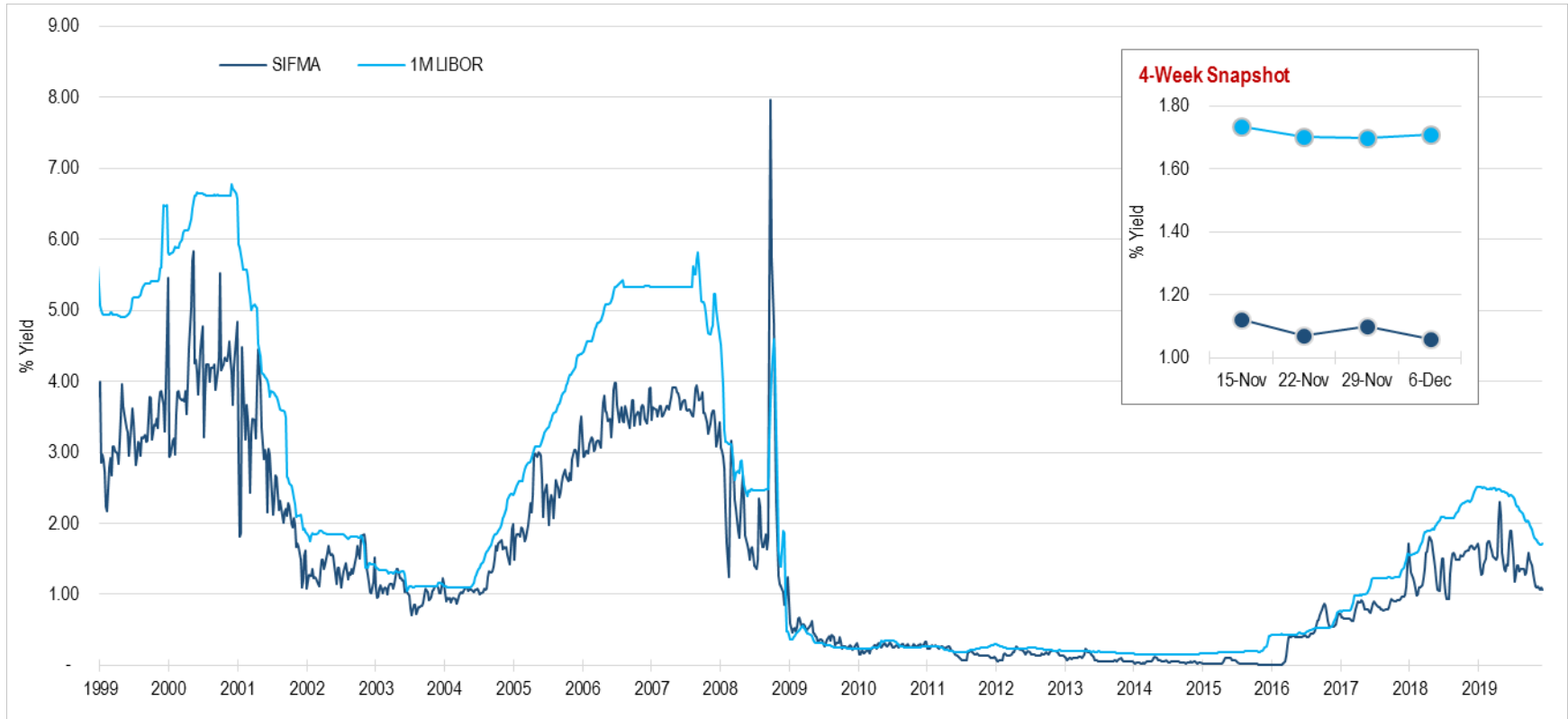


Source: Refinitiv Municipal Market Data and U.S. Treasury Department

Short-Term Market

- SIFMA reset at 1.06%, a 4 bp decrease from the prior week's 1.10%
- 1M LIBOR reset at 1.71%, a 1 bp increase from the prior week's 1.70%

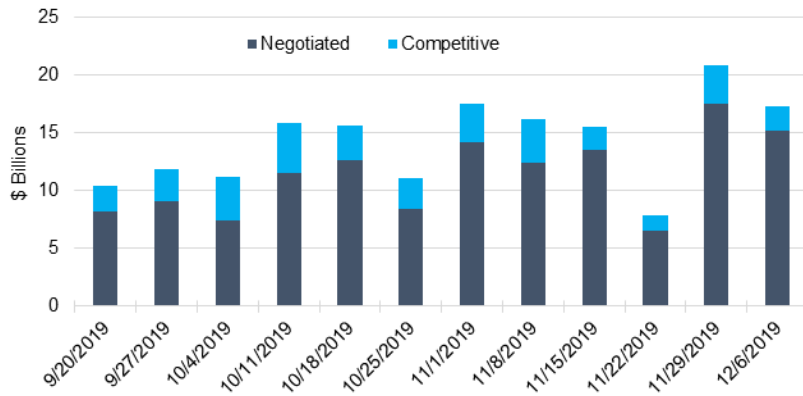
SIFMA vs 1M LIBOR



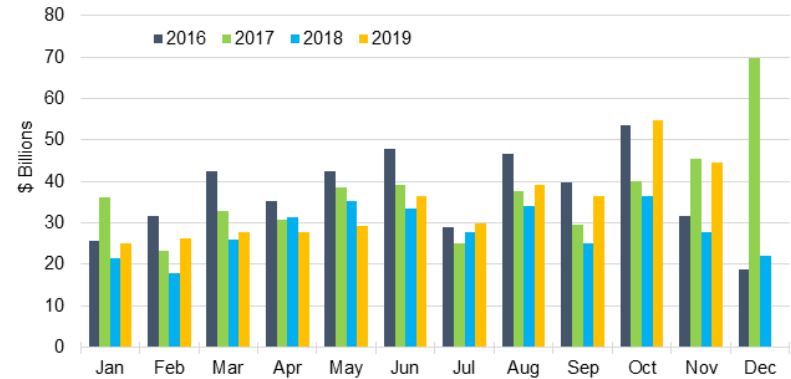
Source: Bloomberg

Municipal Issuance Statistics | Supply and Demand

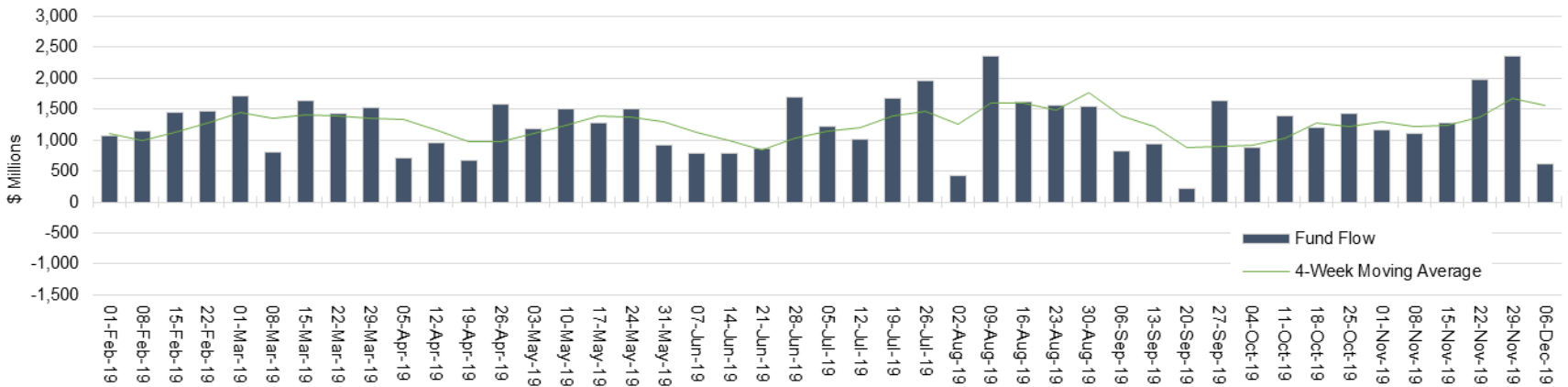
Visible Supply



Monthly Bond Issuance



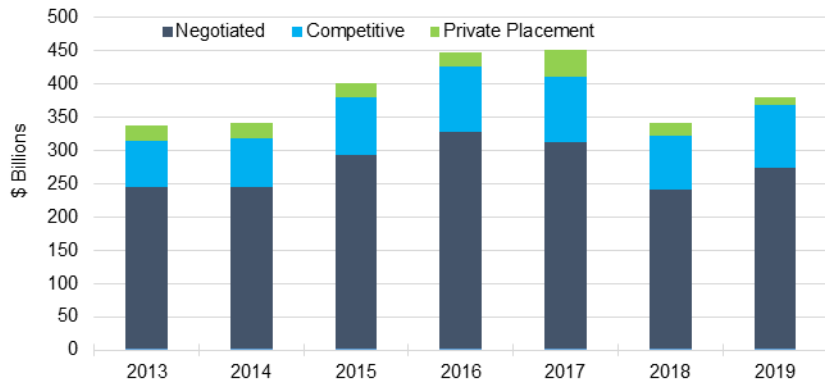
Municipal Bond Fund Flows



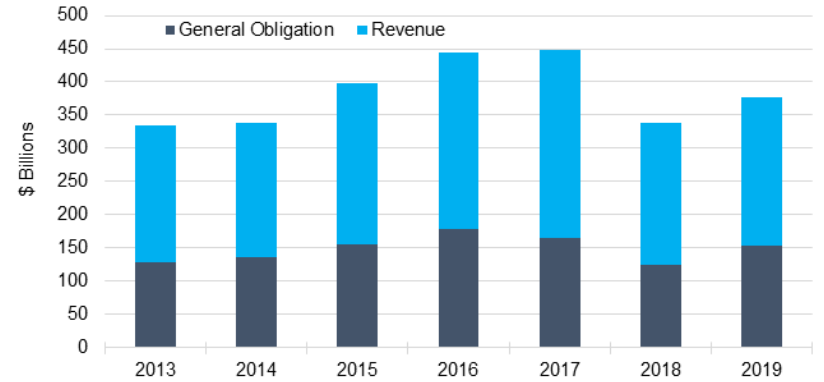
Source: The Bond Buyer, Bloomberg and Lipper

Municipal Bond Issuance Statistics | Analysis by Issuance Type

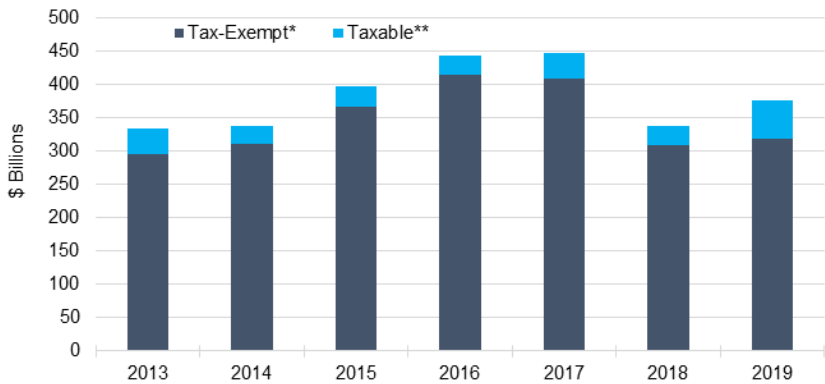
Negotiated vs Competitive vs Private Placement



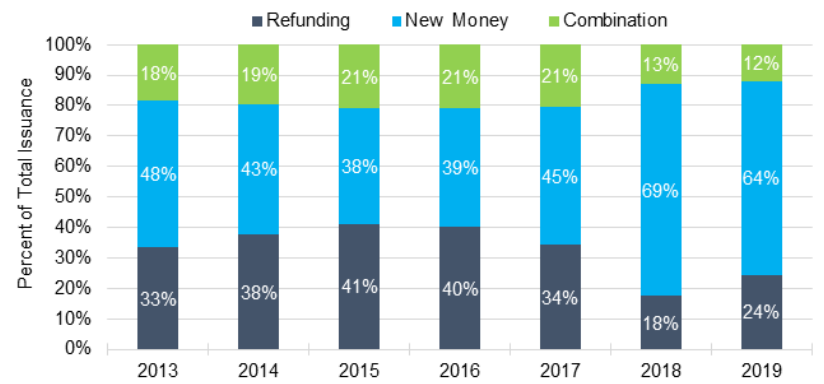
Revenue vs General Obligation



Taxable vs Tax-Exempt



Refunding vs New Money



* Tax-Exempt Includes AMT Bonds **Taxable Includes Stimulus Bonds

Source: The Bond Buyer "A Decade of Bond Finance" and Thomson Reuters (based on data available through November 27, 2019) Excludes Notes

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Questions?