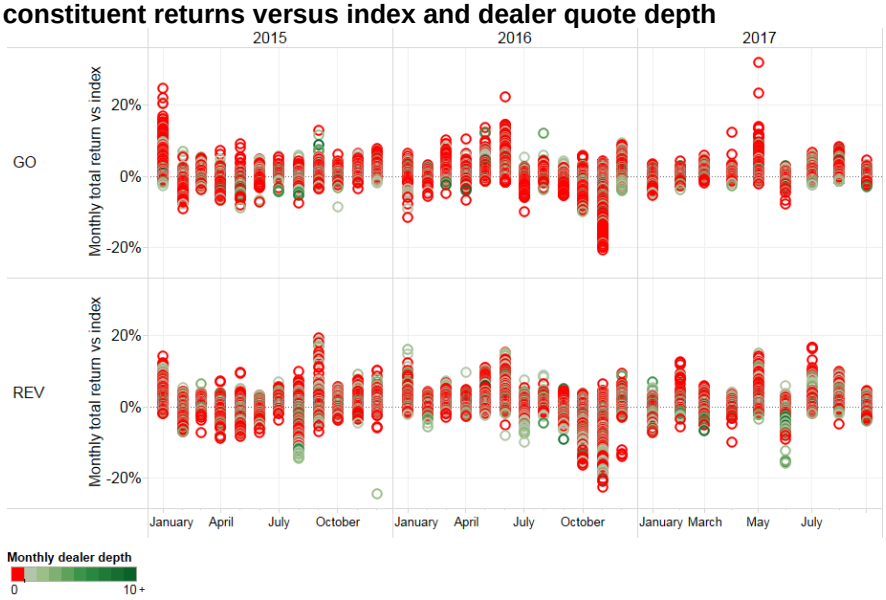
Dealer quote depth trends and potential performance impact on indexed municipal bonds

Liquidity is one of several key factors that drive investment returns across every tradable asset, but quantifying it is particularly challenging for securities that trade very infrequently like municipal bonds. Money managers may not realize that they are already receiving a valuable barometer of liquidity through their daily bombardment of dealer quotes. Market participants are only beginning to extract some of the value from their large and often "noisy" dealer quote depth dataset. Ironically, investors have been consciously (or at least subconsciously) using quote trends to guide their decisions since the days when quotes were given over the phone, but today's advances in AI driven parsing technology enables the vast quantities of quote data to be digitized, normalized, combined with reference data, and stored for analysis in real-time.

- Dealer depth is the number of dealers quoting a bond at a specific point in time and it can provide some insight into the liquidity of a bond. We analysed monthly dealer depth trends from January 2015 to September 2017 on over 120 dealers for the entire municipal bond market and the constituents in the S&P National AMT-Free Municipal Bond Index.
- The likelihood of a bond trading in a given month increases with the number of dealers quoting the bond that month. Data indicates that a bond being quoted by two dealers was more than twice as likely to have a round lot trade occur (17%) than a bond quoted by a single dealer (7%).
- Analysis of parsed quote data shows that index bonds made up 7% of the instances when a single dealer was quoting a bond and a peak of 24% for the bonds quoted by five dealers.
- Data indicates that bond issue sizes less than $70 million had an average quote depth lower than one and average depths greater than three dealers did not appear until issue sizes exceeded $360 million.
- When comparing round lot trade count, quote depth, and time since issuance (seasoning), the data indicates five distinct depth bands, with 50% of all the round lot trades accounted for by issues with less than 1.4 years of seasoning.
- We reviewed monthly S&P credit rating transitions to assess the impact of event risk on quote depth and our analysis indicates that bonds that had experienced rating actions often had a higher than average quote depth, with every downgrade cluster having an average quote depth higher than 1 dealer.
- When clustering monthly performance by each quote depth cohort, quoted bonds modestly outperform in declining yield environments and significantly underperform when rates increase rapidly. However, the unquoted cohort typically performs better on both the top and bottom 10% each month versus the quoted bonds.

Figure 1: Monthly S&P National AMT-Free Municipal Bond Index constituent returns versus index and dealer quote depth



Source: IHS Markit, S&P Dow Jones Indices, LLC

Dealers carefully choose the select group of bonds that they quote

Market makers are an integral part of a functioning municipal bond market and the quotes they send out every day to their clients provide a gauge for several aspects of liquidity and also reflect their view on the market. Similar to paid advertising, sending a quote does come at a cost, with a desk's reputation often being more at risk than actual capital. A dealer needs to be careful about the quantity and quality of their broadly distributed quotes, as trading partners don't like to see bids too far below the market or offers well above the market. Of course, there is no way to assess the genesis of each quote, as they are a culmination of a dealer's own inventory and trade axes from a principal perspective, as well as sell orders and client axes from an agent basis. One thing that is sure is that these quotes do not come from a vacuum and each one is sent to spur a conversation on the quoted bond or a similar bond, and these are the conversations that lead to trades.

Another important aspect of a quote is that it focuses a set of investors' eyes on a particular bond, which can sometime trigger an army of analysts to begin reviewing the issuer's recent CAFRs, local economic trends, and political trends linked to the future performance of the bond. This vast amount of cumulative time reviewing the quoted bond triggers fresh opinions on the optimal bid/offer yield versus comparable bonds and the perceived imbedded risk. The process has the power to change the valuation of a bond in either direction without a trade ever occurring, which is another reason why buyers and sellers send their quotes with caution.

Dealer depth is the number of dealers quoting a bond at a specific point in time and it can provide some insight into the liquidity of a bond. We analyzed monthly dealer depth trends from January 2015 to September 2017 on over 120 dealers for the entire municipal bond market and the constituents in the S&P National AMT-Free Municipal Bond Index. **Figure 1** shows monthly distinct constituents' performance versus the index and quote depth, with red markers indicating no dealers quoting the bond. The vast majority of the bonds have a zero quote depth, but the data indicates that quoted bonds' returns versus the index are often at one or both of the extremes in a month's performance spectrum.

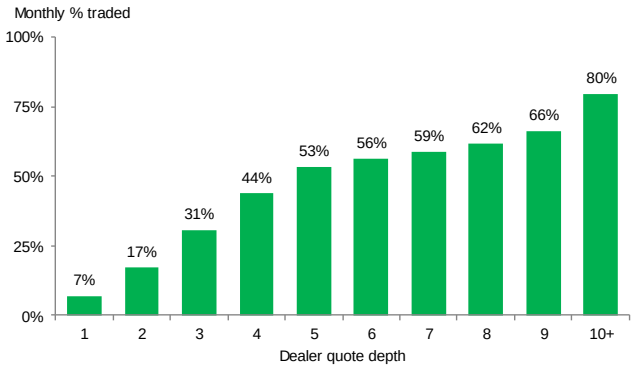
Probability of trading increases with quote depth

We note that just as a bond that never trades can still be liquid, the same is true for a bond that is never quoted. However, the likelihood of a bond trading in a given month increases with the number of dealers quoting the bond that month. **Figure 2** shows that a bond being quoted by two dealers was more than twice as likely to have a round lot trade occur (17%) than a bond quoted by a single dealer (7%). The probability increases to 80% for bonds quoted by 10 or more dealers. We note that this same direct relationship between trade probability and depth occurs with corporate bonds, but the magnitude of each depth's probability of trading varies.

However, the frequency of multiple dealers quoting a bond drops precipitously for each increase in dealer depth. The bar chart in **Figure 3** shows that over 1.2 million bonds had one dealer quoting on a given month between January 2015 and September 2017, but approximately only 3,000 were quoted by 10 or more dealers.

Figure 2: Monthly likelihood of ≥$1MM trading by dealer quote depth

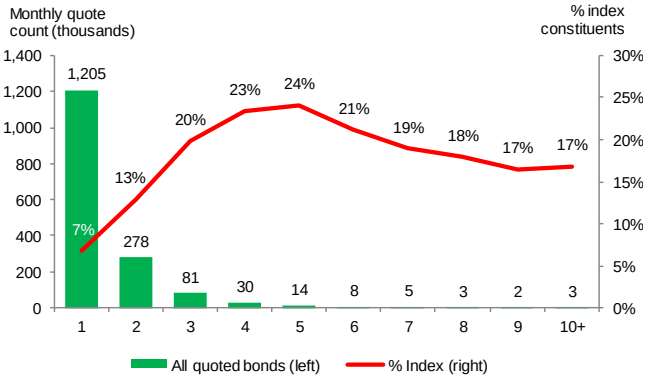
January 2015 – September 2017



Source: IHS Markit

Figure 3: Monthly quote depth count of municipal bond universe and percentage of index bonds quoted by depth

January 2015 – September 2017



Source: IHS Markit, S&P Dow Jones Indices, LLC , MSRB

Index bonds have a higher quote depth on average

The constituents of the S&P National AMT-Free Municipal Bond Index make up a large portion of the issues that are quoted by one of more dealers. The line graph in **Figure 3** shows that index bonds made up 7% of the instances when a single dealer was quoting a bond and a peak of 24% for the bonds quoted by five dealers. The overlap is particularly surprising given that there were almost 500,000 unique municipal bonds quoted and slightly under 15,000 unique constituents during the analysis period, and given the almost one million bonds outstanding the probability of a constituent being quoted would be extremely low if dealers just quoted randomly. Just like any major benchmark, the most likely driver of this phenomenon is a combination of funds benchmarked to the index required to hold a higher proportion of index bonds, which drives quote traffic higher for those bonds, as well as the index criteria being designed to optimize liquidity.

Quote depth linked to common liquidity factors

Issue size and the time since issuance are two characteristics commonly linked to bond liquidity regardless of the sector. The search cost component of liquidity will generally decrease based on increases in the size of a bond issue, while the traditional buy and hold nature of the fixed income market often results in peak trading activity occurring near the time of issuance (outside of any major issuer specific credit events).

Figure 4 on the next page shows the average issue size versus round lot trade (circles) and bond counts (blue +'s) on a Log scale and average dealer quote depth, with red indicating an average quote depth of less than one. The data only includes issues that had at least one round lot size trade and indicates an apparent relationship between round lot trade frequency, issue size, and quote depth when accounting for the thin bond populations at the higher end of issue size. The chart shows that bond issue sizes less than $70 million had an average quote depth lower than one and average depths greater than three dealers did not appear until issue sizes exceeded $360 million.

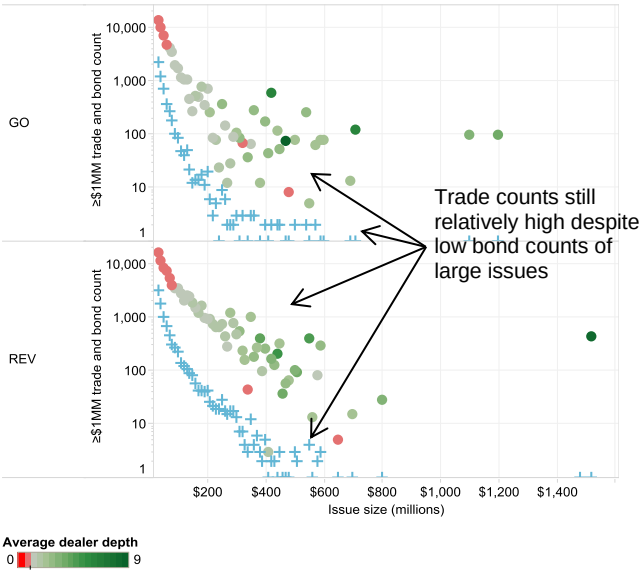
Limiting the population to only issues with large size trades admittedly does create some bias towards larger bond issues, so **Figure 6** compares the average issue size for every quoted bond during the analysis period regardless of the existence of a trade. The chart highlights the very linear relationship between dealer depth and issue size up until a quote depth of five, dealers, as the population of the higher depth cohorts gets very thin with increases in depth. The data indicates that the average issue size of quoted revenue bonds is consistently higher than general obligation bonds, which is consistent with the disparity between each category's average issues sizes of $52 million and $62 million, respectively.

The comparison between round lot trade count, quote depth, and time since issuance (seasoning) indicates five distinct depth bands, with 50% of all the round lot trades accounted for by issues with less than 1.4 years of seasoning. The initial band (1) is indicated by the very dark green markers (≥1 average dealer depth) during the first six months since issuance, which is followed by (2) a period of modest liquidity (0.5-1.0 average dealer depth) until shortly after 8 years of seasoning (3). Average depths remain below 0.5 dealers (indicated in red) through the call period and increases above 0.5 dealers shortly after 10 years of seasoning (4). The fifth band (5) is the final state of lower liquidity that returns around 14 years after issuance for GOs and 15 years for revenue bonds.

Figure 7 compares the average time since issuance versus dealer quote depth and indicates that the average seasoning per cohort decreases with increases in depth. The analysis does show a consistent disparity between debt obligation types, with quoted revenue bonds averaging six months more of seasoning than general obligation bonds. The disparity can partially be explained by the revenue bond population's average seasoning being 5.0 years versus 4.5 years for GOs.

Figure 4: Average issue size versus round lot trade and bond count (Log scale) and dealer quote depth

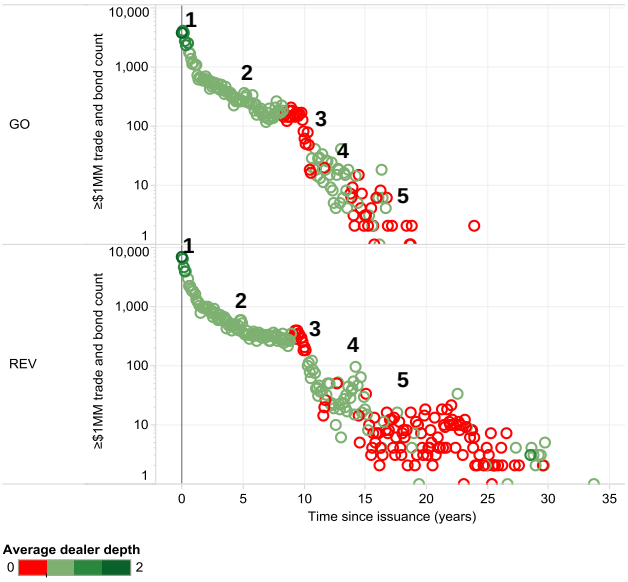
January 2015 – September 2017



Source: IHS Markit, S&P Dow Jones Indices, LLC, MSRB

Figure 5: Time since issuance versus round lot trade count (Log scale) and dealer quote depth

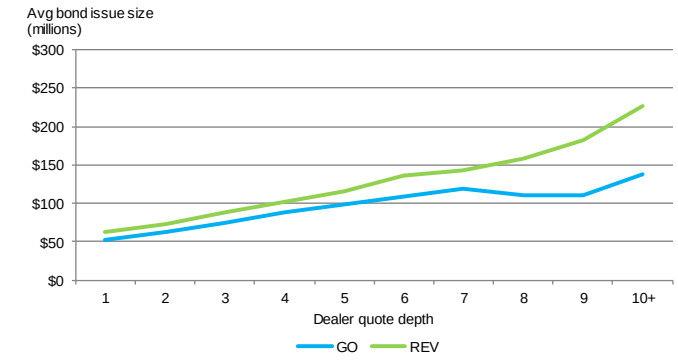
January 2015 – September 2017



Source: IHS Markit, S&P Dow Jones Indices, LLC, MSRB

Figure 6: Average deal issue size versus dealer quote depth

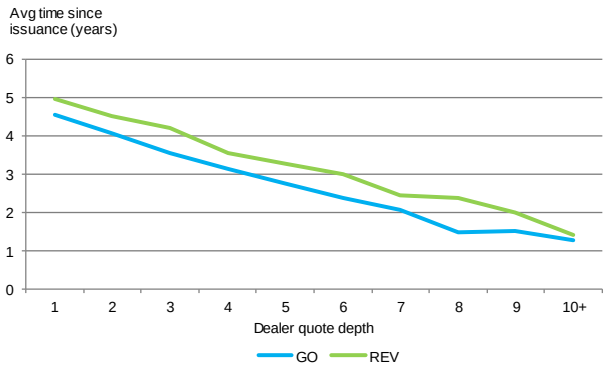
January 2015 – September 2017



Source: IHS Markit, S&P Dow Jones Indices, LLC

Figure 7: Average time since issuance versus dealer quote depth

January 2015 – September 2017



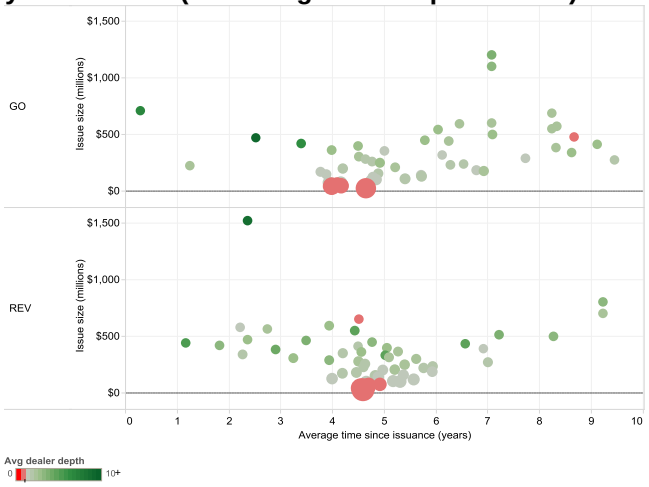
Source: IHS Markit, S&P Dow Jones Indices, LLC

The combined relationship between issue size and average bond seasoning with quote depth is shown in **Figure 8**, as almost every cluster above an $80 million issue size has an average dealer quote depth above 1.0. The chart also shows four clusters reporting an average quote depth greater than 6.0 dealers and all were under 3.5 years seasoning. The data indicates that only two issues larger than $450 million had an average quote depth lower than 1.0, which were the $483,510,000 Texas State Unrefunded Balance-Transportation 5.0% 4/2037 issued 6/2007 and the $650,000,000 Hudson Yards Infrastructure Corp Sen Revenue Bonds Fiscal 2012 Series A (NY) 5.75% 2/2047 issued 10/2011.

On average, bond seasoning is very positively correlated with changes in US Treasury rates given that more seasoned callable bonds are closer to their 10-year call date (shorter duration) and the lower average bond price premium (excluding zero coupon bonds) compared to the less seasoned bonds mitigates some of the duration risk. However, data indicates that there is somewhat of a ceiling in liquidity, even during the times of increased demand for seasoned bonds during sharp increases in rates.

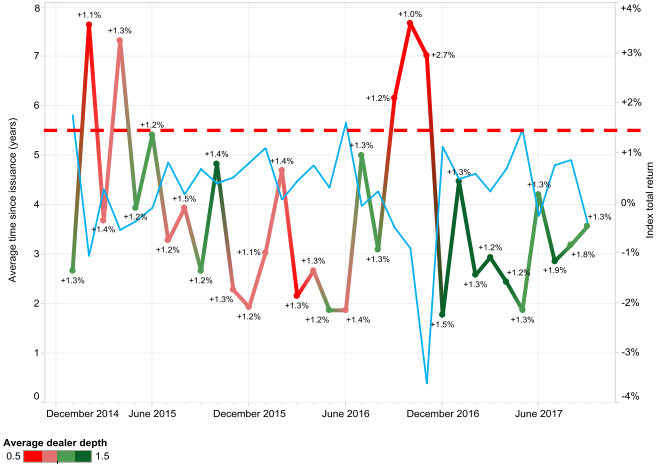
Figure 9 shows the monthly index performance versus average time since issuance in years for the top 10% performing bonds and average performance versus the index (indicated by labels) each month and the negative correlation between index returns and the average seasoning becomes very apparent in the data. Most importantly, the monthly average liquidity is red (average below 1.0 dealers) for all months when the seasoning is higher than 5.5 years.

Figure 8: S&P National AMT-Free Municipal Bond Index constituent average dealer depth versus average years since issuance and issue size scaled by bond count (excluding zero coupon issues)



Source: IHS Markit, S&P Dow Jones Indices, LLC

Figure 9: Average time since issuance for monthly top 10% performers and average quote depth (excluding zero coupon issues) compared to the index



Source: IHS Markit, S&P Dow Jones Indices, LLC

Rating actions can have an impact on quote depth

We reviewed monthly S&P credit rating transitions to assess the impact of event risk on quote depth given that all significant positive and negative credit events for an issuer should eventually result in a rating action. Admittedly, the population of municipal bonds that have been upgraded or downgraded during the analysis period was somewhat limited, but data indicates that bonds that had experienced rating actions often had a higher than average quote depth. **Figure 10** shows that every bond downgraded had an average quote depth higher than 1 as indicated by the shade of green, while only a small portion of upgrades showed a similar uptick in average dealer depth. The chart also indicates that the 23 instances of bonds downgraded to below investment grade had an average dealer depth of 5 or more dealers. In addition, bonds rated A- down to BBB had an average quote depth of at least one.

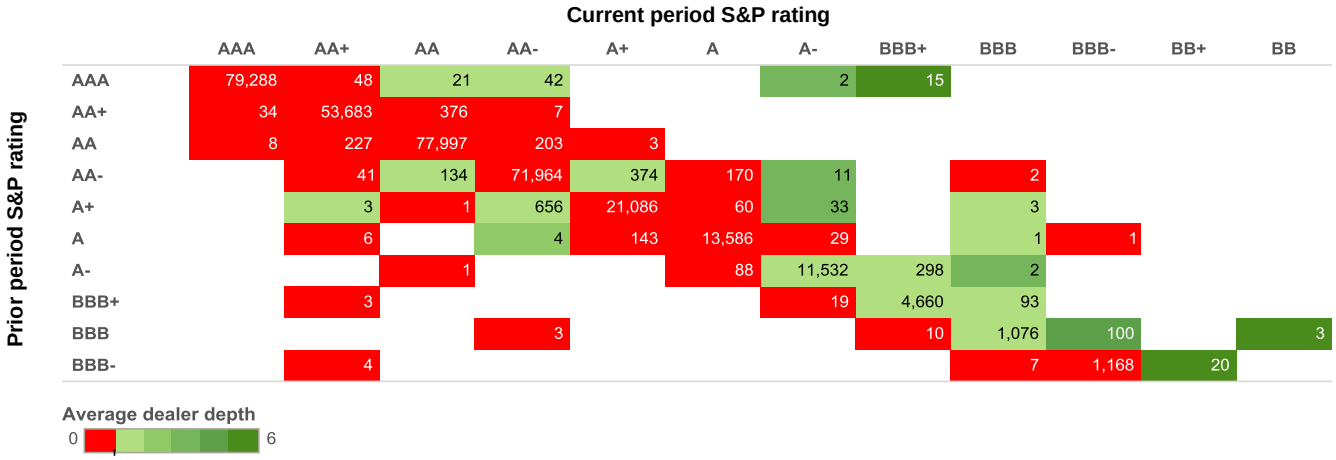
Extreme market conditions amplified performance of quoted bonds vis-à-vis liquidity and transparency

Dealer depth is a factor in performance, as it is a bond liquidity metric. Given the nature of the fixed income markets, where only a small portion of the universe trades on a given day, it is difficult to determine if the quoted bond's performance versus the index is more driven by the price transparency provided by a quoted level or it being chosen to be bid or offered based on it being perceived as more liquid. It is more likely driven by the latter, although there is likely some degree of price arbitrage present among the unquoted bonds that dominate all indices given the possibility that not all of the actual market price movement is captured due to the lack of hard "evidence" from a trade or quote.

Figure 11 on the next page compares the monthly average performance of a dealer quote depth cohort compared to the S&P National AMT-Free Municipal Bond Index versus the monthly change in 10-year US treasury yields. The chart clearly demonstrates that quoted bonds modestly outperform in declining yield environments and significantly underperform when rates increase rapidly. It is important to caveat that the chart oversimplifies the variation in performance given that the quoted cohorts are dwarfed by the number of unquoted bond and the latter will always appear to perform in line with the index with the slight difference being driven by the comparison not being index weighted.

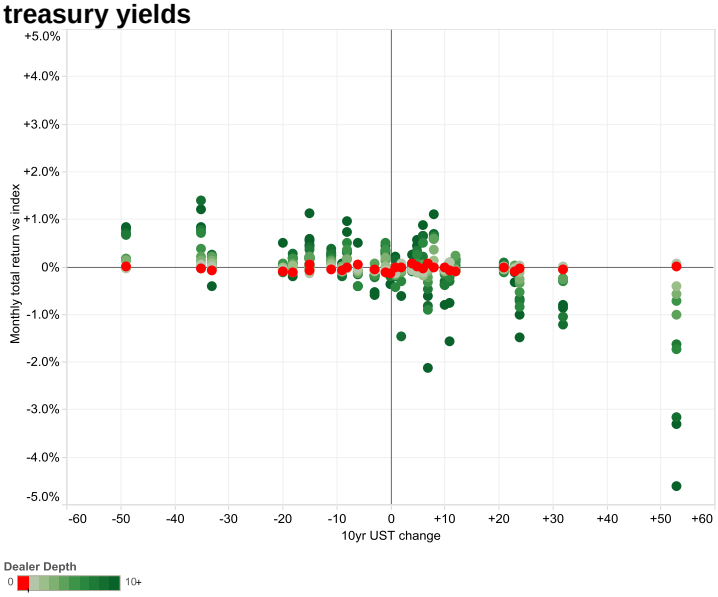
In an attempt to provide a more accurate performance comparison between quoted and unquoted bonds, **Figure 12** shows the monthly quoted versus not quoted top and bottom 10% performance versus the index. On average, the unquoted (circles) cohort performs better on both the top and bottom deciles versus the quoted bonds (bars), which can largely be explained by the large pool of bonds in the unquoted cohort. In fact, the quoted cohort performed best on both extremes only four out of the 33 months, with July and August 2017 being the only periods where it occurred during consecutive months.

Figure 10: S&P National AMT-Free Municipal Bond Index constituent average dealer depth versus monthly rating transitions from January 2015 – September 2017 (includes count of bond instances)



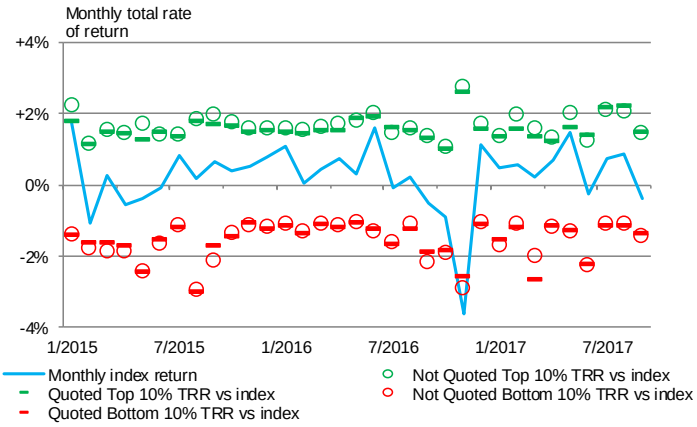
Source: IHS Markit, S&P Dow Jones Indices, LLC

Figure 11: Monthly average performance versus S&P National AMT-Free Municipal Bond of each dealer quote depth cohort versus the monthly change in 10-year US treasury yields



Source: IHS Markit, S&P Dow Jones Indices, LLC, US Treasury

Figure 12: Monthly quoted versus not quoted top and bottom 10% performance versus index

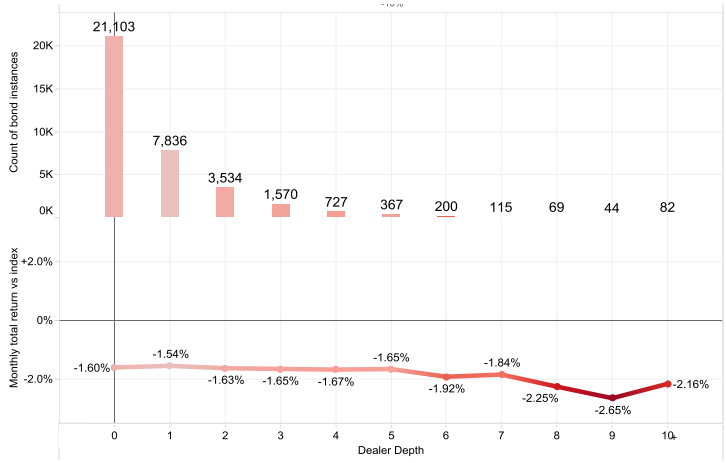


Source: IHS Markit, S&P Dow Jones Indices, LLC

Figure 13: Monthly S&P National AMT-Free Municipal Bond Index performance versus constituent performance grouped by dealer depth

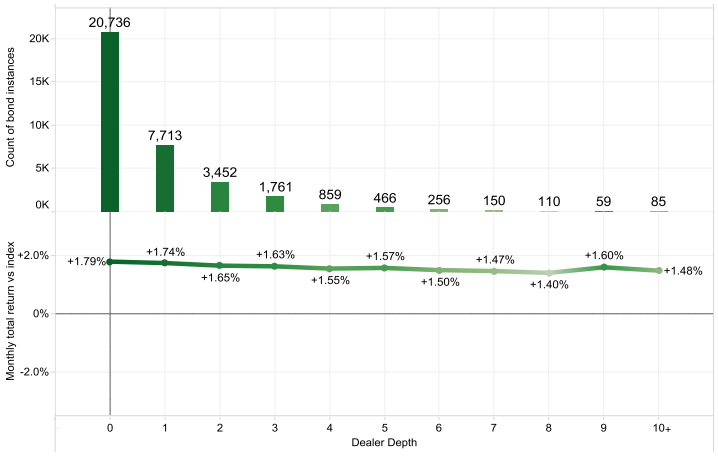
January 2015 – September 2017

Bottom 10% performance versus index by dealer depth in aggregate



Source: IHS Markit, S&P Dow Jones Indices, LLC

Top 10% performance versus index by dealer depth in aggregate



Source: IHS Markit, S&P Dow Jones Indices, LLC

Data indicates that a bond's performance versus the index in both the top and bottom deciles generally declines with increases in dealer depth, with the effect most pronounced in the bottom decile (**Figure 13**). Of course, the number of instances declines significantly with each progressive increase in depth, which creates more variability at the higher end of the quote depth spectrum.

The decile distribution of performance versus the index (**Figure 14**) does indicate that a higher proportion of bonds quoted by three or more dealers are in the top 20% of performance, while the proportion in the bottom decile increases above 10% starting at the same point. As the universe of higher quote depth bonds declines, the performance begins to barbell with a higher percentage in both the top and bottom decile.

Highly liquid bonds provide insight into seasonal liquidity trends

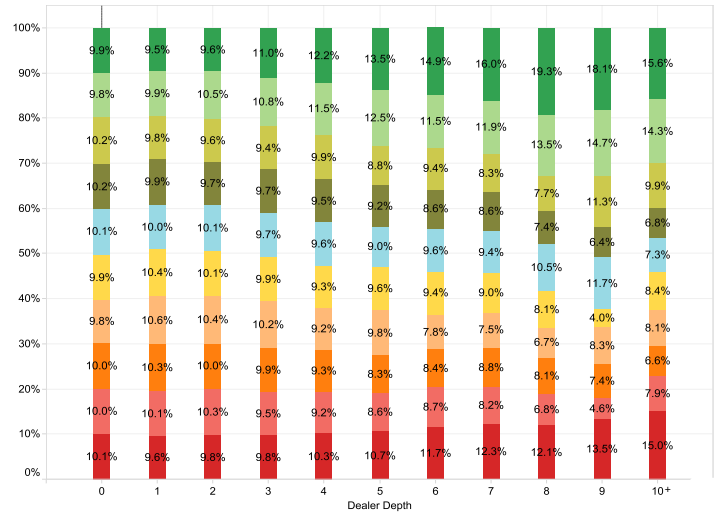
In an attempt to capture seasonal trends in liquidity, we took the top 10% of constituents ranked by average dealer depth, for the subset of bonds that were in the index every month between January 2015 and September 2017, and tracked average performance versus the index and average quote depth (**Figure 15**). The static pool consisted of 673 bonds, with a $131 million average issue size, average of 2.8 years of seasoning, average quote depth of 2.7 dealers, and an average dollar price of 118.80 as of January 2015. We understand that a bias based on increasing seasoning will continue to build up with each progressive month, but the impact may not have been too significant over the 33 month period given that liquid pool's performance versus the index was still generally directionally consistent the same months each year. The data indicates that January and September were the only months where the liquid pool beat the index all three years (albeit October – December 2017 are not included) and it generally underperformed every spring and August. It is also worth noting that average dealer depth declined below 2 (red) July 2017 and September 2016 and 2017.

Quote depth is an important piece of the liquidity mosaic

The "equitification" of the fixed income markets through the rapid growth of the sector's exchange traded funds will continue to require new metrics to actively measure market liquidity in near real-time. The

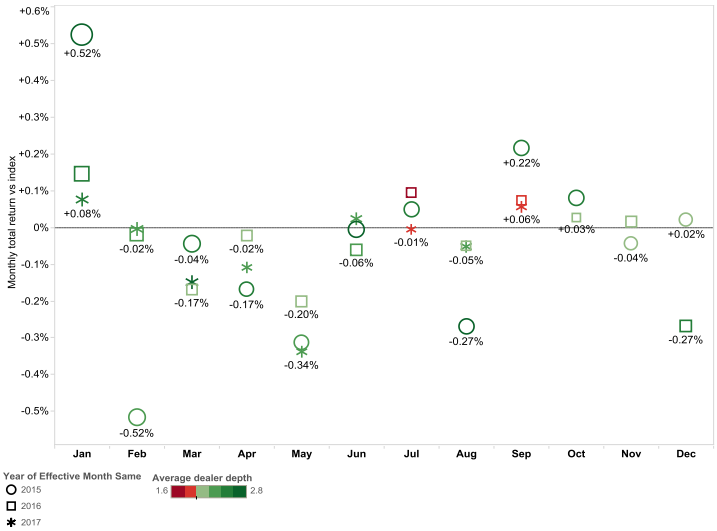
Figure 14: Percentage of bond instances in each decile of monthly performance versus S&P National AMT-Free Municipal Bond Index by quote depth cohort

January 2015 – September 2017



Source: IHS Markit, S&P Dow Jones Indices, LLC

Figure 15: Top 10% average quote depth for static pool of constituents' average monthly performance versus index (markers scaled by round lot trade count of pool)



Source: IHS Markit, S&P Dow Jones Indices, LLC, MSRB

infrequency of trades on the broader municipal bond universe leaves a void in the picture of the current state of liquidity that can partially be filled by dealer depth data. Using quote depth as an input into a liquidity risk management program can enable money managers to proactively manage their portfolio by monitoring shifts in the types of bonds being quoted by the broader market. The depth data adds credence to the premise that liquid bonds are the first to be sold in a down market in funds that require instantaneous redemptions, often resulting in disproportionate price declines compared to the less transparent segment of the market that was not traded or quoted.

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