

Times like these

Structural changes in off-the-run Treasury pricing and liquidity

- Our previous work has focused on the changing liquidity dynamics for on-the-run Treasuries and has found that market depth has declined and become more sensitive to delivered volatility...
- ...However, given questions from investors and renewed attention from the Treasury Department, we attempt to explore the pricing and liquidity of off-the-run Treasuries
- Trading data for off-the-runs are sparse, but we can assess relative value via Root Mean Square Error (RMSE), a measure of dispersion relative to our par fitted Treasury curve. Dispersion remains well below the peak observed during the financial crisis but has doubled over the last three years
- We find that Treasury curve dispersion tends to increase as the Fed's balance sheet shrinks, dealer inventories fall, market depth declines, and the GCF/triparty spread widens, and vice versa
- Given the backdrop of a stable Fed balance sheet, reduced dealer risk appetite, declining and less resilient market depth, and increased balance sheet costs, we think the recent rise in RMSE is structural in nature, rather than temporary
- The most pronounced increase in dispersion first occurred in intermediates and the long end, where the Fed had focused the bulk of its purchases during QE3. More recently, there has been a distinct rise in RMSE at the front end, likely reflective of foreign official selling amid broad declines in FX reserves
- We find that off-the-runs have cheapened relative to on-the-runs, particularly for monthly new-issues. This cheapening has become more pronounced over the last two years and has been most severely felt in more deeply off-the-run issues
- There are a couple of potential solutions which could stem cheapening in off-the-runs, namely a centrally-cleared repo market and Treasury buybacks. Both solutions may have wide-ranging benefits for off-the-run valuations and liquidity, but there are hurdles to these being enacted over the near term
- For investors who are concerned about off-the-run liquidity, we recommend staying in more liquid, on-the-run issues. In particular, we recommend rolling longs in the 2- to 5-year sector

Fixed Income Strategy

Jay Barry ^{AC}

(1-212) 834-4951

john.f.barry@jpmorgan.com

Bruce Sun

(1-212) 834-7218

bruce.sun@jpmorgan.com

Phoebe A White

(1-212) 834-3092

phoebe.a.white@jpmorgan.com

J.P. Morgan Securities LLC

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The changing landscape for off-the-run liquidity and valuations

In prior publications, we have shown that an evolving market structure has contributed to changes in liquidity. Market depth has always been procyclical—increasing in times of low delivered volatility, and vice versa—but we have found that the combination of reduced primary dealer risk appetite and the increased prevalence of high-frequency trading has further reduced the resiliency of market depth, making transacting in Treasuries even more difficult in volatile environments (see [US Treasury Market Structure and Liquidity](#), Jay Barry et al, 4/2/15). Thus far, our work has focused exclusively on the market for on-the-run Treasuries. More recently, we have turned our attention to off-the-runs for a number of reasons. First, in the Requests for Information that Treasury released last month, there were numerous questions on changes in the nature of liquidity provision in the off-the-run sector (see [US Treasury Market Daily](#), 1/20/16).¹ Moreover, Treasury also raised this topic in its questionnaire for primary dealer meetings prior to the February refunding: “Please discuss the liquidity conditions for off-the-run Treasury securities. What is your expectation for off-the-run Treasury security liquidity in the future? What steps should the Treasury consider if you believe that liquidity in off-the-run securities has diminished?”²

Overall, the trading data for off-the-run Treasuries are sparse compared to that for on-the-runs. The bulk of trading in on-the-runs occurs on electronic trading platforms, and data are readily available, while most off-the-run trading occurs via voice, and data sources are harder to come by.³ Nevertheless, this paper uses indirect measures to study the nature of liquidity in off-the-run Treasuries. Over the following pages, we discuss the aggregate level of dispersion along the Treasury curve and how this has evolved over time. We also discuss the drivers of Treasury curve dispersion and how structural declines in dealer risk appetite coupled with increased leverage constraints is making it more challenging to finance off-the-run Treasuries. Moreover, we explore the evolving relationship between on-the-run and off-the-run Treasuries

¹ <https://www.treasury.gov/press-center/press-releases/Documents/Market%20Structure%20RFI%20Final.pdf>

² <https://www.treasury.gov/resource-center/data-chart-center/quarterly-refunding/Documents/Dealer%20Agenda%20February%202016.pdf>

³ https://www.treasury.gov/press-center/press-releases/Documents/Joint_Staff_Report_Treasury_10-15-2015.pdf

Exhibit 1: Treasury curve RMSE has retraced from the extreme levels observed during the financial crisis...

Off-the-run Treasury curve RMSE, 1-month moving average; bp

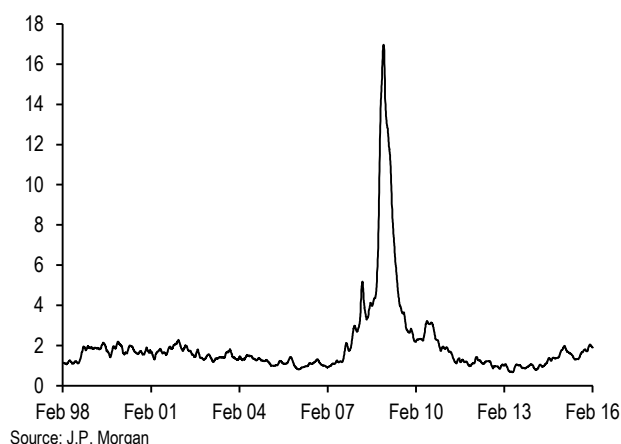


Exhibit 2: ...but has risen over the last 3 years and is close to its highest level in 5 years

Off-the-run Treasury curve RMSE, 1-month moving average; bp



and find that off-the-runs have been steadily cheapening over the last couple of years. Finally, we discuss potential solutions which can prevent further deterioration in liquidity for off-the-runs.

Measuring off-the-run liquidity

In contrast to on-the-run securities, where bid/offer spreads, trading volumes, and market depth are readily available, very little liquidity data exist for off-the-run securities. In light of this, we can instead look at indirect metrics:

Exhibit 1 shows the Root Mean Squared Error (RMSE) of the Treasury curve relative to our fitted par curve over the last 20 years, which is our measure of dispersion of yields along the Treasury curve. From a high-level perspective, RMSE has compressed substantially from the extreme levels seen during the financial crisis and currently is more in line with its longer-term average. However, yield curve

dispersion has more than doubled over the last 3 years and is currently close to 5-year highs (**Exhibit 2**).

What has driven the pickup in Treasury curve dispersion? **First**, during periods of QE, the Fed preferred to purchase off-the-run securities that traded cheap to the broader curve, effectively becoming the largest relative value trader in the market. However, since QE3 ended in October 2014, the Fed's absence has led to a pickup in dispersion along the curve. **Second**, yield curve dislocations tend to increase as market liquidity (observed via market depth) declines. Market depth has recovered from the historically low levels in early 2015 but remains depressed relative to the average levels observed following the financial crisis.

Finally, reduced risk appetite among the primary dealer community has also contributed to increased dispersion along the Treasury curve. Dealer positions across Treasuries, Agency debt, MBS, and corporates are currently close to their lowest levels in 15 years and are roughly one-third of the pre-crisis peak (**Exhibit 3**). Certainly reduced risk tolerance has been a significant driver of shrinking inventories, as the experience of the financial crisis has led dealers to pare back on the risk profile of their trading books. However, regulatory-driven balance sheet constraints have led to reduced holdings of even the safest assets. As of 3Q15, roughly 70% of CCAR banks, weighted by Treasury holdings, are constrained by leverage ratios in a stress scenario (see [Interest Rate Derivatives, US Fixed Income Markets 2016 Outlook](#), 11/25/15). As such, banks have become constrained not just by the composition of their balance sheets (i.e. risk-weighted assets), but also by the sheer size.

As a result, low-margin, balance sheet-intensive businesses, such as repo finance, are becoming more expensive to manage. This increased cost has manifested itself recently in the widening spread between GCF repo (where dealers borrow from each other) and traditional triparty repo. This spread can be thought of as bid/offer in the repo market: while dealers can still borrow from end users such as money market funds at relatively cheap levels, the marginal lenders are charging more to gross up their balance sheets and finance other dealers via the GCF market. **Exhibit 4** shows the GCF/triparty spread has become more volatile and has trended wider over the last two years, at the same time that the balance of Treasury repo outstanding has declined. To the extent that off-the-run Treasuries trade less frequently and with lower volume than on-the-runs, they are more financing-intensive, as dealers who provide liquidity to buyers and sellers need to hold the securities on their balance sheet at least temporarily. As a result, increased repo costs, observable via widening GCF/triparty spreads, are also contributing to greater dislocations in off-the-run Treasury yields.

Exhibit 3: Primary dealer positions in fixed income have declined to their lowest levels in 15 years

Aggregate magnitude of primary dealer positions across Treasuries, Agencies, MBS and corporates; 4-week moving average; \$bn

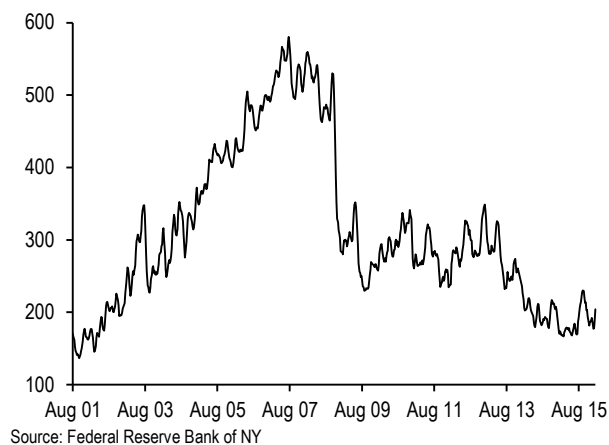
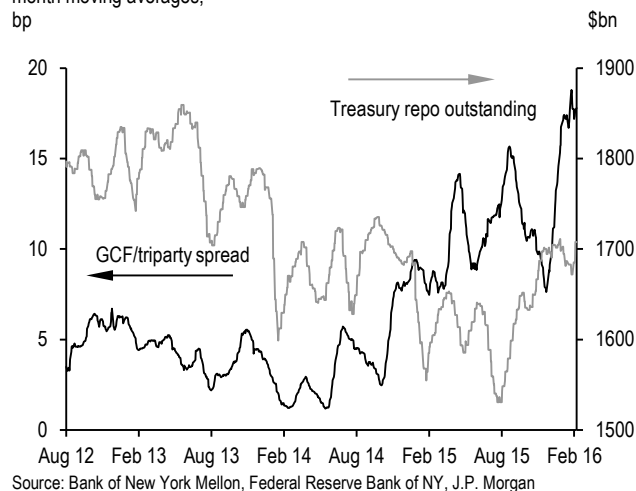


Exhibit 4: The GCF/triparty spread has become more volatile and trended wider, reflecting increased balance sheet costs

Overnight GCF/triparty repo spread versus Treasury repo balance outstanding, 1-month moving averages; bp



Putting the pieces together, we can model aggregate Treasury curve dispersion as a function of these four factors (**Exhibit 5**). **Yield curve dispersion tends to increase as dealer inventories fall, market depth declines, the Fed's balance sheet shrinks, and dealer financing becomes more expensive, and vice versa.** These factors explain more than 76% of the variation in Treasury RMSE over the last four years, and each \$100bn decline in dealer inventory (the most significant driver of dispersion) tends to increase Treasury curve dispersion by 0.3bp. What can we say about dispersion going forward? Despite near-term recession concerns, the odds of further QE are low, so the Fed likely will not play a role in normalizing off-the-run valuations.

In addition, regulatory pressures and reduced risk appetite are unlikely to dissipate, and dealers are unlikely to ramp up their balance sheets materially from current levels. Finally, market depth remains below its post-crisis average and tends to disappear more rapidly in times of heightened volatility. **Given this backdrop, it is likely that the increase in Treasury curve dispersion will persist, resulting in cheaper off-the-run valuations.**

What sectors have been most impacted?

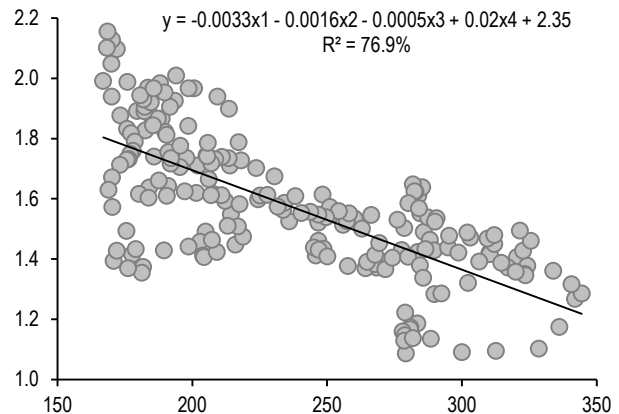
The drift higher in Treasury curve dispersion in recent years has not been uniform in nature. **Exhibit 6** displays RMSE by sector of the curve and shows the pickup in curve dispersion was first evident in intermediates and the long end: dispersion increased rapidly in the 5- to 10-year and 10- to 30-year sectors in late 2014. Interestingly, these parts of the curve also coincide with the Fed's main areas of activity. During QE3, 57% of the monthly Fed purchases were focused in the 5- to 10-year sector and another 29% were concentrated in maturities greater than 10 years. More recently, dislocations have actually declined in these sectors, while dispersion at the front end has increased. This result is unsurprising: FX reserves have declined by \$1tn from their peak in the summer of 2014, accelerating in 2H15. In response, reserve managers have liquidated their Treasury holdings—the TIC data show foreign official institutions sold \$105bn Treasuries over the 6 months through November 2015 (the latest available data). These liquidations have likely contributed to cheapening at the front end, where most foreign official institutions tend to concentrate their Treasury holdings. We have found that global FX reserves are a significant driver of 2-year Treasury yields (see [Treasuries](#), *US Fixed Income Markets Weekly*, 1/29/16).

Off-the-runs are cheapening relative to on-the-runs

The backdrop we have discussed suggests that Treasury curve dispersion is unlikely to reverse lower over the near term, but it does not give us insight into valuations for individual off-the-run Treasuries. For this, we can look at off-the-run yield errors—the difference between a bond's actual yield and the model yield from our par-fitted Treasury curve. We can use yield error spreads of off-the-run issues relative to their closest maturity on-the-run as a relative valuation tool. **Exhibit 7** displays yield error spreads between near off-the-run Treasuries and their closest maturity on-the-runs. We can make a few observations. **First**, off-the-runs have cheapened relative to their on-the-run counterparts and are substantially cheaper than averages observed in the post-crisis era. This is particularly pronounced for monthly new-issue 2-, 3-, 5-, and 7-year notes. **Second**, the opposite is true in the

Exhibit 5: Treasury curve dispersion tends to rise as dealer inventories fall, the Fed reduces its balance sheet, market depth declines, and dealer financing becomes more expensive

1-month moving average of Treasury RMSE regressed on the 1-month moving average of magnitude of dealer positions (\$bn), 1-month moving average of 10-year Treasury market depth* (\$mn), 6-month change in the Fed's balance sheet (\$bn), and 1-month average of 1-month GCF/OIS spread (bp); weekly regression over the last four years; bp

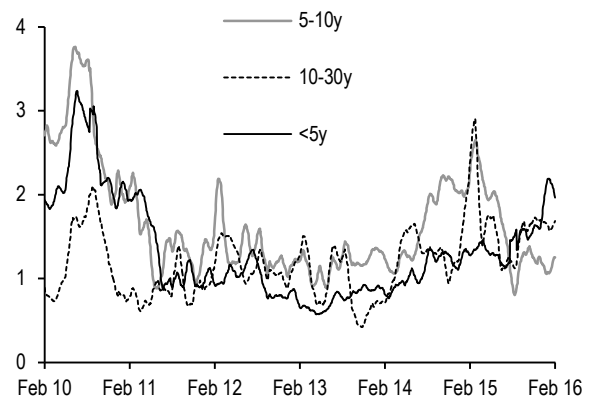


Absolute value of dealer positions, 1m moving average; \$bn

* Market depth is the sum of the three bids and offers by queue position, using the top 3 bids and offers in Treasury notes and bonds, averaged between 8:30 and 10:30am daily
Source: Federal Reserve Bank of NY, J.P. Morgan

Exhibit 6: Increased Treasury curve dispersion was first evident in intermediates and the long end, as the Fed tapered. More recently, dislocations have increased at the front end, likely driven by reserve manager selling

Treasury curve RMSE by sector; bp



Source: J.P. Morgan

quarterly new-issue 10s and 30s. Intuitively, this makes sense: since 10s and 30s are reopened twice in the subsequent two months after a new-issue auction, on-the-runs in this sector enjoy smaller liquidity premia than their monthly counterparts. **Third**, this cheapening is more pronounced in more deeply-aged issues: **Exhibit 8** shows the yield error spread between on-the-runs and off-the-runs in the 5-year sector over the last 10 years. Off-the-run 5-

Exhibit 7: Off-the-runs have cheapened relative to on-the-runs, particularly for monthly new-issues...

Off-the-run/on-the-run yield error* spreads, 1-month average levels versus 2014-2016 and 2010-2016 averages; bp

2y	2016 avg	2014-2016 avg	2010-2016 avg
Olds	1.5	0.8	0.6
2x olds	2.7	1.0	0.9
3x olds	3.4	1.2	1.1
3y			
Olds	1.0	1.0	0.6
2x olds	2.2	1.4	0.9
3x olds	2.4	1.9	1.3
5y			
Olds	0.4	1.2	0.6
2x olds	1.7	1.9	1.1
3x olds	2.3	2.4	1.5
7y			
Olds	-0.1	0.4	0.2
2x olds	0.5	0.8	0.4
3x olds	0.6	1.1	0.6
10y			
Olds	2.0	1.6	1.9
2x olds	2.6	2.3	2.9
3x olds	3.0	2.7	3.5
30y			
Olds	0.7	0.7	0.6
2x olds	1.3	1.3	1.1
3x olds	0.7	1.5	1.3

* Yield error is defined as actual Treasury yield less par-fitted yield
Source: J.P. Morgan

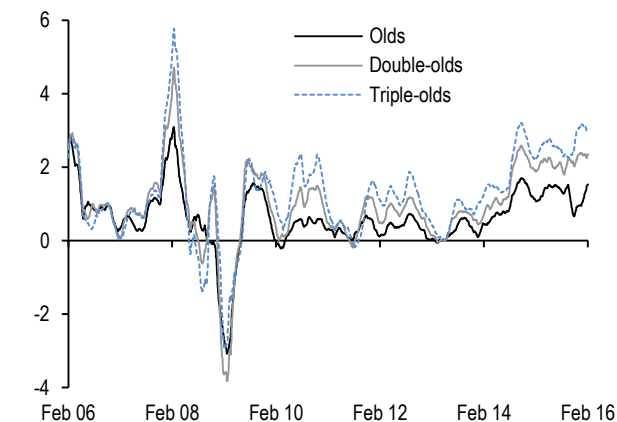
year notes have cheapened 1-2bp over the past two years and double- and triple-old 5s are now trading at their cheapest levels since 2008 relative to on-the-run 5s. To be clear, auction sizes can impact valuations, and on-the-runs tend to display greater liquidity premium when auction sizes are reduced. While Treasury has announced a \$1bn cut to the monthly 5-year auction size, this will not occur until later this month, and prior to this change, 5-year auction sizes have been unchanged at \$35bn since 2010.

Potential solutions and trading opportunities

Given a relative dearth of pricing data and transparency, it is more difficult to glean information on how liquidity dynamics have changed in off-the-run Treasuries. However, we can observe that dispersion has risen along the Treasury curve, and this is likely to be persistent, given reduced dealer risk appetite, less resilient market depth, and increased balance sheet costs. Moreover, we find that off-

Exhibit 8: ...and this cheapening has become more pronounced over the last two years and has been most severely felt in double- and triple-olds

Three-month moving average of yield error* spread for 5s/old 5s, 5s/double-old 5s, and 5s/triple-old 5s; bp



* Yield error is defined as actual Treasury yield less par-fitted yield
Source: J.P. Morgan

the-runs have steadily cheapened to on-the-runs over the last few years, with this phenomenon most visible in more deeply off-the-run issues. What are the implications of these developments? Increased dispersion and ongoing cheapening in off-the-runs may incentivize end users to own fewer off-the-runs and own on-the-runs instead: pricing is more transparent in these instruments and on-the-runs enjoy a liquidity premium. Alternatively, end users could instead choose to transact in futures: our derivatives strategists have found Treasury futures trading volumes have increased meaningfully relative to cash. Last year they exceeded trading volume in hot-run Treasuries for the first time on a notional-weighted basis, and increased even more dramatically on a duration-weighted basis (see [24 hour party people redux: Global liquidity in U.S. Treasury futures](#), Joshua Younger et al, 1/27/16). Either outcome would only act to further impair off-the-run valuations and liquidity.

Going forward, can anything be done to improve liquidity in off-the-run Treasuries? We think there are two solutions to consider. **First, widening GCF/triparty spreads have led market participants to consider the benefits of a centrally-cleared repo market**, in an effort to maintain the availability of repo financing for a wide variety of market participants and improve Treasury market liquidity. Given their financing-intensive nature, off-the-runs would benefit in such an outcome. This potential solution has gained further traction with market participants after Fed Governor Jerome Powell spoke on the topic in

November.⁴ However, as our Short-Term Fixed Income strategists have discussed, there are a number of hurdles to overcome before central clearing becomes a viable solution, and they place relatively low odds of this happening in 2016, although it remains a focus among regulators (see [Short-Term Fixed Income 2016 Outlook](#), 11/25/15).

Second, Treasury could utilize buybacks in order to repurchase off-the-run securities. To be clear, Treasury's primary debt management objective is to be a regular and predictable borrower, while funding the federal government at the "least expected cost over time." However, Treasury is also focused on the liquidity of its instruments in the secondary market, and the Treasury Borrowing Advisory Committee (TBAC) has discussed the use of buybacks as a debt management tool. This was presented in the context of maintaining larger on-the-run issue sizes, but TBAC also noted that regular buybacks could improve liquidity for off-the-run issues.⁵ This seems like an elegant potential solution, as Treasury could retire cheaper off-the-run debt. However, buybacks also present a number of concerns. Market participants could express concern over Treasury's role in secondary markets. Additionally, the fiscal picture has deteriorated somewhat, and CBO now expects budget deficits to rise in FY16 and beyond. This would increase Treasury's funding needs and require increased new-issue auction sizes over time, limiting the scale of a potential buyback program.

While both these solutions could improve pricing and liquidity for off-the-run Treasuries, neither appears forthcoming over the near term. As a result, we expect off-the-run yield dislocations to persist and valuations to remain cheap until a solution can be implemented. While trading deeply off-the-run issues may be challenging in an environment of lower market liquidity, real money investors can use yield errors to identify cheap issues along the curve and take advantage of relative value opportunities (see [Treasuries](#), *US Fixed Income Markets 2016 Outlook*, 11/30/16). **Moreover, we think this should present trading opportunities in Treasury rolls.** Exhibit 9 shows that Treasury rolls across the curve have traded in a wider range over the past 2 years than over the past 5 years. This increase has been most focused in the 2- to 5-year sector, where the range has increased 0.2-0.8bp over the course of the auction cycle, while the range in the 10- and 30-year rolls have actually declined.

Accordingly, the cyclical nature of Treasury rolls has become more pronounced. Exhibit 10 shows the 5s/old 5s spread

Exhibit 9: Treasury rolls at the front end have traded in a wider range over the past two years

Trading range* of Treasury rolls in new-issue auction cycles**; average of the past 2 years versus past 5 years; bp

Maturity	5-year Avg	2-year Avg
2y	1.62	2.46
3y	1.34	1.51
5y	1.21	1.54
7y	0.97	0.93
10y	1.79	1.57
30y	0.94	0.72

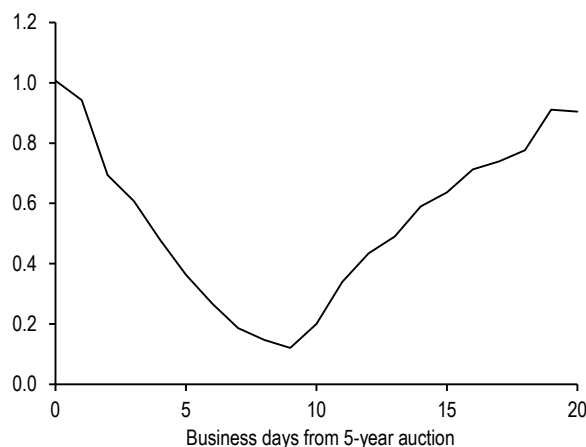
* Maximum over auction cycle less minimum over auction cycle

** Uses monthly auction cycle for 2-, 3-, 5-, and 7-year notes, quarterly cycles for 10-year notes and 30-year bonds

Source: J.P. Morgan

Exhibit 10: The 5-year roll tends to richen early in the auction cycle before cheapening in the following weeks

5s/old 5s spread averaged around the day of the 5-year auction; average of the past 12 auction cycles; bp



Source: J.P. Morgan

over the course of the monthly 5-year auction cycle. On-the-run 5s tend to outperform old 5s by approximately 0.8bp in the two weeks following the 5-year auction, before cheapening 0.7bp in the two weeks leading up to the next auction. **Therefore, given the more persistent cheapening of off-the-runs, investors should stay in more liquid, on-the-run issues.** We recommend they roll their positions in the 2- to 5-year sector where new issues are auctioned monthly, while they can be more patient in 10s and 30s, where reopening auctions tend to cheapen the on-the-runs over the course of the auction cycle.

⁴ <http://www.federalreserve.gov/newsevents/speech/powell20151117a.htm>

⁵ <https://www.treasury.gov/press-center/press-releases/Pages/jl9762.aspx>

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