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# Liquidity and the pricing of long end Treasuries

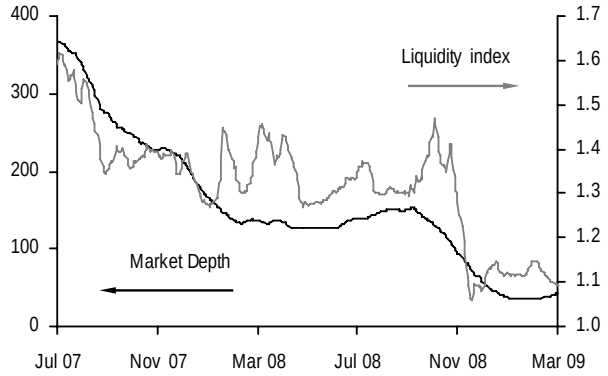
- **Valuations in the off-the-run bond sector remain pressured by poor liquidity; with a view toward identifying value, we develop a market-observable liquidity metric for bonds in the sector as well as an aggregate liquidity index for the whole sector**
- **Our liquidity metric passes the "smell test," and compares well to other market condition metrics such as market depth …**
- **… and its empirical relationship to RV hedge fund returns and dealer positions suggests that liquidity has suffered due to pullbacks by hedge funds and dealer balance sheet constraints**
- **Finally, our framework for quantifying liquidity allows us to determine relative value in the sector; adjusted for liquidity in addition to yield levels and curve, 5.25% Nov-28s appear cheap while the Feb-23 P-STRIPS appear rich**

## Liquidity and its market implications

As is well known by now, off-the-run bonds in the >10 year sector of the curve, as well as STRIPS in those maturity sectors, have remained persistently cheap, with several of those securities trading with spreads of 50-60bp over the swaps curve. The cheapness of this sector is widely acknowledged to be the result of a combination of deleveraging flows and dealer balance sheet constraints, which have resulted in poor liquidity (and thus cheap valuations) in this sector. While this is anecdotally accepted as being true, without a framework for measuring liquidity and quantifying its impact on the sector, it is difficult to take advantage of opportunities that may exist in the sector.

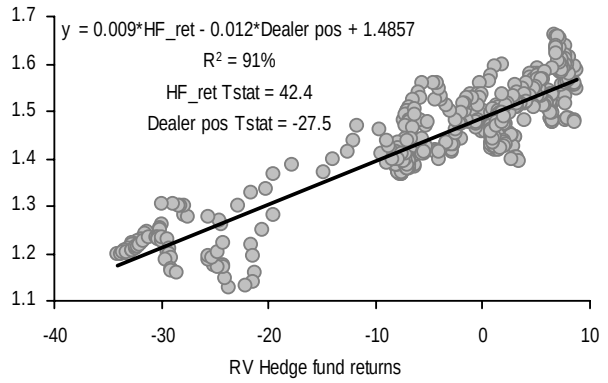
Can we define a metric that allows a timely and accurate measure for liquidity at the level of each bond? We do so here through an approach that is as follows. We begin by noting that it is fairly common practice to fit a smooth yield curve that minimizes the sum of squared "yield errors" (or price errors) of

**Chart 1: A market-observable metric for liquidity conditions in the off-the-run bond sector**
J.P. Morgan Liquidity index* vs.3M moving average of market depth**
$mn




* Defined as the 6-month standard deviation of rolling weekly changes in its yield error (with respect to the J.P. Morgan Treasury par curve), multiplied by the square root of 4 and divided by the 6-month standard deviation of rolling 1-month changes in its yield error.
** Market depth is calculated as half the sum of the top three bids and offers for the 10-year hot-run Treasury note, averaged between 8:30 am and 10:30 am daily.

**Chart 2: The liquidity index has been well explained by lagged RV hedge fund returns…**
J.P. Morgan liquidity index adjusted for 6-month changes in primary dealer positions in Treasury coupon securities greater than 11 years in maturity regressed against 6-month RV hedge fund returns lagged 1-month; 03/07–03/09




Source: HFRI, J.P. Morgan

**Liquid Markets Strategy**

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various bonds. In other words, the fitted curve is by construction a smooth term structure of yields implied by market prices of all securities used in constructing the curve; again, by construction, there will necessarily be bonds that are cheap to this par curve and bonds that are rich to this curve. A bond with a positive yield error (i.e., with a yield that lies above the curve) is therefore "cheap," and a negative yield error corresponds to a "rich bond."

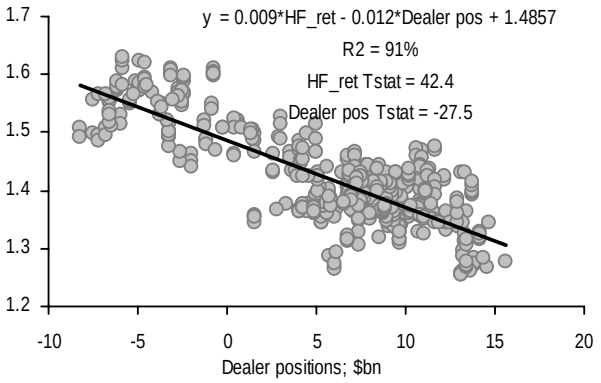
In a highly liquid market, with no balance sheet constraints, investors would take advantage of such mispricings by buying cheap bonds and selling rich bonds; thus, the yield error of any given bond may be expected to be highly mean-reverting under liquid market conditions. Of course, for any highly mean-reverting time series, volatility measures based on lower sampling frequencies (or larger sampling intervals) would be expected to be much lower than volatility measured at a higher sampling frequency (or lower sampling interval). Thus, **based on the simple observation that a liquid market implies mean-reverting yield errors for any given bond (with respect to a curve fitted to the market), we arrive at a metric for liquidity**— specifically, we define a bond's liquidity coefficient as the 6-month standard deviation of rolling weekly changes in its yield error (with respect to the J.P. Morgan Treasury par curve), multiplied by the square root of 4 and divided by the 6-month standard deviation of rolling 1-month changes in its yield error. The higher this index, the more mean-reverting the yield error, which would likely be the case only if the bond were to be considerably liquid.

### Drivers of liquidity

Does this metric pass the "smell test"? One way to see this is to create an aggregate liquidity conditions index for that market sector, which we do by taking the average of the liquidity coefficient of a sampling of bonds at the long end of the curve. A chart of this liquidity conditions index is shown in **Chart 1**; this index shows a drop in liquidity in the later part of 2007, when the credit crunch began, and then again points to a sharp drop in liquidity in 4Q08, which are both consistent with anecdotal evidence. Moreover, our liquidity conditions index for the long end of the bond curve also appears consistent with a completely different measure of market conditions. As is also seen in the same chart, our index has a reasonably good correspondence with a measure of market depth (which we measure as the size of the top three bids and offers for the 10-year hot-run Treasury note, averaged between 8:30 a.m. and 10:30 a.m. daily). Thus, our liquidity conditions index appears to jibe with other measures as well as anecdotal evidence.

**Chart 3: …as well as changes in dealer positions of long-end Treasuries**

J.P. Morgan liquidity index adjusted for 6-month RV hedge fund returns lagged 1-month regressed against 6-month changes in dealer positions in Treasury coupon securities greater than 11 years in maturity; 03/07 – 03/09




Source: HFRI, J.P. Morgan

**Table 1: Richness/cheapness of bonds and STRIPS at the long end of the curve after adjusting for yield levels, curve, and each bond's liquidity coefficient**

Residual from regressing yields on each security vs. 10-year yields, 2s/10s curve, and the security's liquidity coefficient, along with the partial beta and T-stat with respect to the liquidity coefficient, and R-squared of the 3-variable regression, for various issues in the off-the-run bond sector;

| Coupon | Maturity | Residual (bp) | Liquidity beta | Liquidity tstat | R-squared |
|---|---|---|---|---|---|
| P | May 15 2030 | 9.4 | -0.90 | -7.77 | 95% |
| P | Feb 15 2027 | 8.8 | -0.56 | -5.52 | 96% |
| P | Aug 15 2029 | 7.3 | -0.78 | -9.51 | 96% |
| P | Aug 05 2027 | 6.8 | -0.60 | -8.56 | 96% |
| 5.25 | Nov 15 2028 | 6.6 | -0.42 | -4.78 | 97% |
| 5.5 | Aug 15 2028 | 6.4 | -0.36 | -6.14 | 97% |
| 6.625 | Feb 15 2027 | 5.5 | -0.35 | -3.95 | 97% |
| P | Nov 15 2027 | 5.1 | -0.58 | -7.49 | 96% |
| 6.125 | Nov 15 2027 | 3.9 | -0.68 | -6.44 | 97% |
| 7.5 | Nov 15 2024 | 3.2 | -0.17 | -3.00 | 97% |
| 6.375 | Aug 15 2027 | 2.6 | -0.94 | -11.71 | 98% |
| P | Nov 15 2028 | 1.5 | -0.60 | -10.62 | 97% |
| P | Feb 15 2029 | 0.7 | -0.59 | -8.75 | 96% |
| P | Aug 15 2028 | 0.0 | -0.61 | -12.87 | 97% |
| 8.5 | Feb 15 2020 | -2.5 | -0.29 | -4.78 | 98% |
| 8.75 | May 15 2020 | -2.6 | -0.21 | -3.57 | 98% |
| P | Feb 15 2023 | -3.7 | -0.33 | -4.58 | 97% |
| P | Nov 15 2022 | -3.8 | -0.17 | -3.16 | 97% |

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Having defined a metric for liquidity conditions, it is of course natural to attempt to understand the drivers of liquidity. To be sure, liquidity conditions are the result of a complex set of factors; however, it is reasonable to hypothesize that the rise of relative value hedge funds and their convergence trade activity likely played a key role in creating liquidity in that sector (which is otherwise less actively trafficked). On the flip side, it is again reasonable to suppose that the severe losses experienced by relative value hedge funds in recent months and the resulting redemptions and downsizing of trading activity have been detrimental to liquidity.

Empirical evidence of this hypothesis is striking, and hedge fund returns have tended to impact liquidity conditions with a lag. A second statistically significant factor is dealer holdings of Treasuries; as might be expected, as dealer holdings of long-end Treasuries rise in a balance-sheet-constrained environment, liquidity would likely suffer. As seen in **Charts 2 and 3**, rolling relative value hedge fund returns and dealer positions have both clearly been significant drivers of liquidity conditions, together explaining over 90% of the variability in our liquidity conditions index.

**Trading implications**

Looking ahead, with RV hedge fund returns still significantly negative and with dealer holdings of long-end Treasuries at high levels, liquidity conditions are unlikely to improve in the near term. However, our purpose in quantifying liquidity was to explore the relative richness/cheapness of bonds and STRIPS at the long end after adjusting for liquidity. **Table 1** presents a list of bonds/P-STRIPS at the long end along with their richness/cheapness after adjusting for yield levels, the curve, and its liquidity coefficient. Indeed, as the table shows, there is a reasonable amount of variation in the yield levels of these issues when controlled for these factors, presenting an opportunity to enter into issue switches to take advantage of the relative value. In particular, the 5.25% Nov-28s are trading about 6.6bp cheap after adjusting for their liquidity coefficient as well as yields and curve, while the Feb-23 P-STRIPS are trading 3.7bp rich on the same basis. In addition, these two issues have similar partial betas (as well as significant t-stats) with respect to liquidity, making them favorable candidates for a roughly liquidity-neutral switch. Finally, the spread between these two has minimal exposure to yields or the curve over recent history. Therefore, we recommend investors buy 5.25% Nov-28s and sell Feb-23 Ps (see Trade recommendations).

## Trade recommendations

- **Buy 5.25% Nov-28s versus Feb-23 Ps**
  Yield movements of bonds and STRIPS as the long end of the Treasury curve have been well explained by the level of rates, the curve, and our liquidity index. After controlling for these factors, the 5.25% Nov-28s are trading cheap while the Feb-23 Ps are trading rich, leading us to recommend this switch.
  – **Buy** 100% risk, or $100mn notional 5.25% Nov-28s (yield 3.74%; bpv $1566.2/mn)
  – **Sell** 100% risk, of $196.1mn notional Feb-23 Ps (yield 3.945%; bpv $793.5/mn)
  **Overall**, the spread is -20.5bp. This trade is flat carry and roll.