# 20yr UST issuance and HG corporates

## Helpful, but not so important initially

US High Grade Strategy & Credit Derivatives Research

**Eric Beinstein** AC
(1-212) 834-4211
eric.beinstein@jpmorgan.com

**Kaveh Gharieh**
(1-212) 834-3493
kaveh.gharieh@jpmorgan.com

**Pavan D Talreja**
(1-212) 834-2051
pavan.talreja@jpmchase.com

**Sheila Xie**
(1-212) 834-3036
sheila.xie@jpmorgan.com

J.P. Morgan Securities LLC

- The US Treasury surprised the market last week with the announcement that a new 20-year bond was forthcoming. In this note, we review the implications of this for 20yr HG corporate bond supply, demand and valuation (Our colleagues in rates strategy have published their thoughts on this development here).
- Corporate borrowers have issued in the 20yr tenor for many years even without a UST benchmark. Last year 20yr issuance represented 7.4% of supply by non-Financials. A benchmark UST 20yr may increase this further, likely at the expense of 10yr issuance primarily, history suggests.
- Demand for 20yr corporates is already well established given the issuance over recent years. We believe the 20yr tenor is naturally attractive to both overseas investors and pension funds, so any increased issuance would be well absorbed.
- 20yr corporates have been challenging to value historically for several reasons: There has been no 20yr UST on-the-run bond, most 20yr bonds in the market are legacy 30yr bonds that have rolled down the curve, and the trading convention is to price them off of 30yr bonds. The new 20yr UST will address the first point but not the 2nd and 3rd, at least at first.
- Existing 20yr HG corporates have tended to screen cheap versus 30yr corporates. However, a certain degree of this cheapness is merely optical, as Bloomberg defaults to using an interpolated curve of on-the-run Treasuries (I25 curve) that currently underestimates the yield where we believe the new UST 20yr is likely to price. This leads to overestimation of G-spreads for 20-25yr corporate bonds. We recommend switching to the full on/off-the-run UST curve (I111 curve) now that an on-the-run UST 20yr is on the horizon.
- The on-the-run 20s30s spread curve is currently 6bp steep, while the average of off the run curves is -13bp (i.e., 13bp inverted). This is based on the off-the-run UST curve in 20yr. We believe the 5bp is reasonable at the current level of spreads and should not materially change when the new 20yr Treasury begins trading. Off-the-runs may benefit more from the new benchmark 20yr point, as some of their illiquidity premium could compress once a new UST 20yr becomes established
- We show valuations for the 20yr/30yr spread curve for more than 80 HG bond pairs as well as screen for bonds that will roll towards the 20yr point and may see their illiquidity spread premium compress as a result.

**See page 13 for analyst certification and important disclosures.**

Eric Beinstein
(1-212) 834-4211
eric.beinstein@jpmorgan.com



# 20yr UST issuance and HG corporates

# Helpful but not that important initially

## Valuations: Treasury throws a curve-ball at HG

The announcement by the US Treasury that they will begin issuance of 20yr bonds has renewed focus on valuation and issuance in the 20yr tenor. The 20yr sector has historically been more challenging to value than the rest of the credit spread curve for 3 primary reasons:

1) There is currently no on-the-run 20yr UST benchmark, so investors have been using different 20yr UST yield estimates to derive the spread of a 20yr corporate bond.

2) The majority (70%) of bonds in the 20yr range are 30yr bonds that have rolled down the curve. The result is a wide disparity of coupons, dollar prices and liquidity across bonds in this tenor.

3) The current trading convention is to quote 20yr bonds off of the 30yr UST curve.

The initial reaction to the announcement has been for 20yr corporate bond spreads to rally. JULI bonds between 16-20yr to maturity rallied 4bp on Friday while the 10yr bucket rallied 1bp. The rationale for this is that 20yr bonds have historically traded cheap in spread terms. The launch of 20yr Treasury will, in theory, make it clearer that 20yr bonds are cheap. Investors are buying the bonds ahead of this. We agree with this framework, but there is some uncertainty.

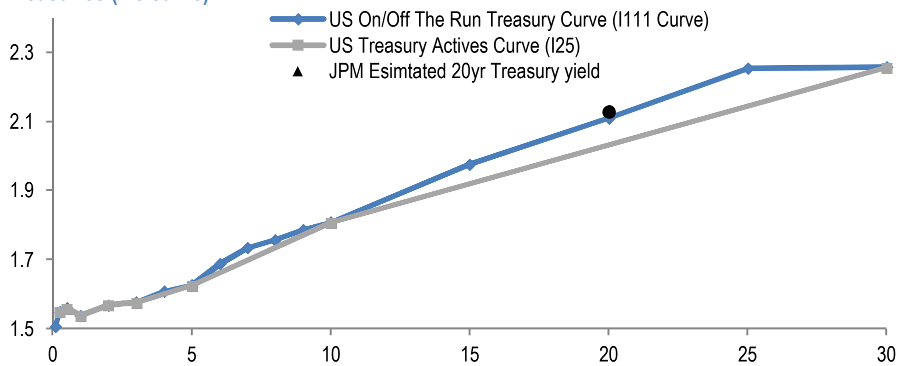
A key unknown is where the new 20yr Treasury will trade vs. 10yr and 30yr benchmark Treasuries. As of Friday, the 10yr UST was at 1.80% and 30yr was at 2.25%. The midpoint was 2.03%. This straight line interpolation is what the Bloomberg YAS screen defaults to for the interpolated Treasury curve, i.e. the US Treasury Active curve or the I25 curve. Investors who analyze a 20yr bond on Bloomberg will, by default, observe a G spread that is based on this level. However, the current off the run 20yr point is significantly wider, at 2.12% as of Friday. Using this level, the relative attractiveness of 20yr HG bonds is diminished.

JPM's rates strategists believe the new 20yr UST will actually trade slightly wider than the off-the-run 20yr point. This is because it will still be a small issue (at least at first) and because the current off the run 20yr bond is majority owned by the Fed, which is holding down its yield. See here for more details. If this is right, credit investors using a G-spread over the interpolated I25 curve may be misinterpreting the impact of a 20yr benchmark. Instead, it may validate a humped UST curve and therefore justify the historical pricing of 20yr bonds vs 30yr and 10yr, rather than catalyze a repricing tighter of these instruments.

Eric Beinstein
(1-212) 834-4211
eric.beinstein@jpmorgan.com



Exhibit 1: The On/Off-the-Run Treasury Curve (I111 Curve) is a better approximation for the 20-year Treasury yield based on our expectations compared to the Treasury Curve based on Active Treasuries (I25 curve)

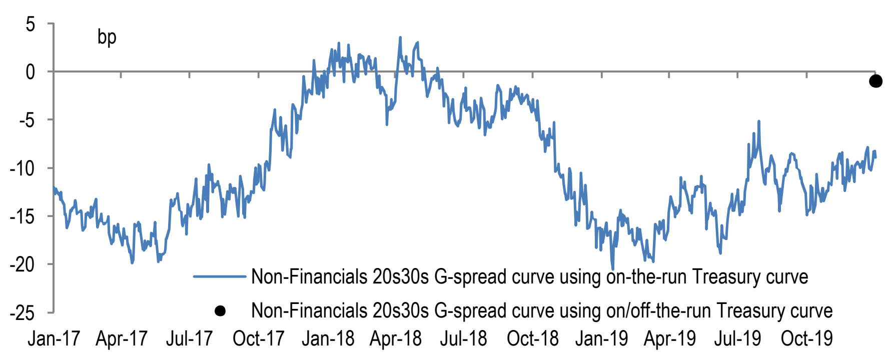



Source: J.P. Morgan

**Valuing the 20s30s spread curve:**

We calculate that the 20s30s G spread curve was inverted by 8bp as of Friday's close. This is based on using only the active UST curve, so the 20yr UST yield used to compute the 20yr spread is based on an interpolated straight line between the 10yr and 30yr. If one uses the on/off-the-run UST curve the 20s30s G spread is about flat. If the new 20yr spread begins trading even wider than the on/off-the-run bonds then the curve will be marginally upward sloping. This is based on bond pairs from the same issuer where both a 20 year and 30 year bond exists.

Exhibit 2: The 20s30s G-spread curve is 9bp inverted using the I25 curve while it is nearly flat if computed over the on/off the run Treasury curve




Source: J.P. Morgan

**Valuing the 20yr illiquidity discount:**

**High dollar price and lower liquidity on legacy 30yr bonds that have now rolled down to the 20 year point is a part of the reason the HG 20yr tenor bucket trades cheap.** HG bonds with maturities between 2036 and 2040 account for roughly $390bn (6.8%) of par outstanding within the JULI ex-EM index. Of these bonds, only $115bn were issued in the past 3 years (29.5% of the 20yr universe), while the remainder were issued nearly 10 years ago, on average. The legacy 30-year bonds that have rolled down to the 20 year point of the curve have higher coupons as they were issued when HG yields were significantly higher. These legacy bonds are currently trading at a significant premium as HG bond yields have

Eric Beinstein
(1-212) 834-4211
eric.beinstein@jpmorgan.com



rallied to record lows. Only 33% of 20yr bonds trade with a $ price of $120 or lower, with the remainder reaching as high as $170. Additionally, the legacy 30-year bonds tend to be less liquid on average, as most of the bonds are held by longer-term investors who typically hold these bonds to maturity.

**We believe some 20-year bonds are still relatively cheap after accounting for the Treasury curves and the high $ pricing/low liquidity in legacy 30-year bonds.** The regression below shows the relationship between spread difference and price difference for 20yr and 30yr issuer matched pairs. The blue circles are based on 20yr bonds that were initially issued as 30-year bonds, while the grey circles are 20-year bonds issued in the last 3 years. The size of the circles is based on the liquidity of the 20 year bonds i.e., pairs with less liquid 20 year bonds are represented by a smaller circle.

As expected, the regression shows that most of the 20yr bonds that were originally issued as 30-year bonds are trading at a higher dollar price and higher spread (inverted 20s30s spread curve) compared to a current 30 year bond from the same issuer. **Interestingly, there are several bond pairs with recently issued 20-year bonds (grey circles) that have a considerably flat or even inverted G-spread curve to the on/off-the run treasury curve despite having a lower dollar price compared to the 30 year bond and sufficient liquidity.**

**Exhibit 3: Many bonds in the 20yr tenor are legacy 30yr bonds which have high dollar prices. These bonds (in blue) usually have high dollar prices and wider spreads versus the more recently issued bonds (in grey) do not show this pattern**

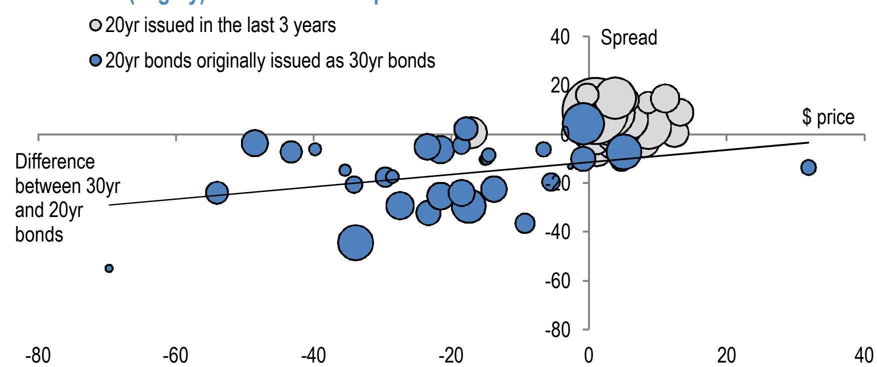



Chart 2 same as above without differential sizing

Source: J.P. Morgan

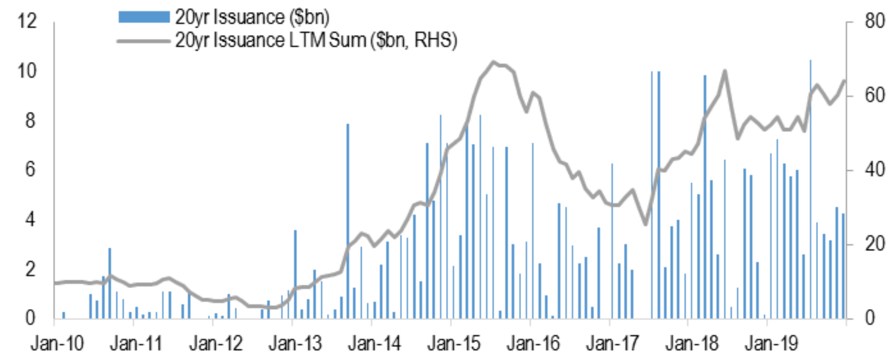
## Supply: 20-year issuance likely to increase

We expect an increase in 20yr corporate bond issuance as a result of Treasury's announcement. That said, more issuance in the 20yr part of the curve is by no means a new trend. We've observed a steady increase in such issuance since 2014, peaking in 2015 at the height of the M&A wave in HG with $69.4bn issued in the 12 months through July 2015 (Exhibit 1), representing 12% of overall issuance in the 10+yr part of the curve. That proportion has held relatively steady since then, with $64.bn in 20yr issuance in 2019 and 11% 'market share'. In our view, the fact that 20yr HG supply had been increasing long before discussions of a renewed UST 20yr began are proof that the 20yr segment is not structurally cheap for on-the-run bonds, as discussed above.

Eric Beinstein
(1-212) 834-4211
eric.beinstein@jpmorgan.com



Exhibit 4: 20yr HG corporate bond issuance has been increasingly steadily, well before talk of a 20yr UST benchmark

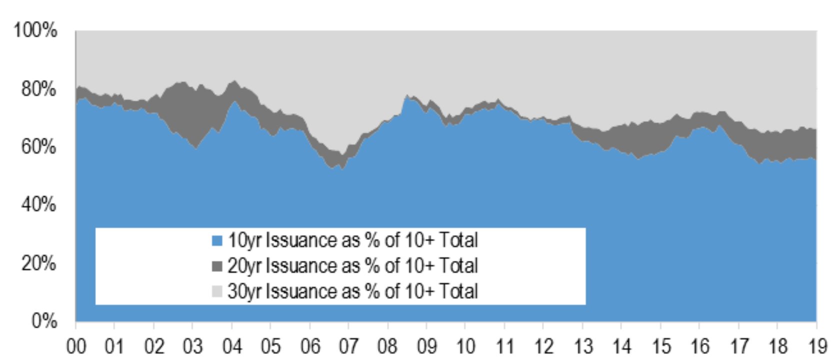



Source: J.P. Morgan, Dealogic

## Supply: 20 Year issuance might be at the expense of 10yr and not 30yr

Our initial intuition was that an increase in 20yr issuance would come at the expense of the 30yr point on the curve, given that most investors currently look at both segments in tandem. However, the data does not bear that notion out and in fact shows that every time 20yr issuance has increased over the past 20 years, it has been at the expense of the 10yr point on the curve and not the 30yr point. This was the case in 2003-04, when the proportion of 20yr issuance within the 10+yr bucket hit an all-time high of 21% and has been the case again since 2013 when 20yr corporate issuance resumed in earnest (Exhibit 2). That said, the increase in long-end issuance in 2003-04 was likely in reaction to the absence of any UST issuance past the 10-year point, as the 30yr UST was discontinued from 2001 until 2006. This is clearly not the case this time around.

Exhibit 5: Increases in 20yr 'market-share' usually come at the expense of 10yr issuance




Source: J.P. Morgan, Dealogic

Since 2013, 10yr issuance as a proportion of 10+yr issuance has declined from 70% to 56% today, while the proportion of 20yr increased 10% and the proportion of 30yr increased 4%. This shift was coincident with a sharp flattening on the UST curve and therefore continued 'market share' gains by the 20yr point will be heavily dependent on the shape of the curve going forward.

## Supply: Issuers that may benefit from a 20-year option

Thus far, much of the issuance in the 20yr part of the curve has been from mega-cap issuers looking to smooth out their maturity distribution and not overwhelm demand in the long end, where many buyers have relatively strict issuer caps. We believe a new UST 20yr will open the door to a broader swath of issuers.

Below, we screen for non-financial issuers with greater than $20bn of debt that have an elevated proportion of their overall debt in both the 10yr and 30yr point. These issuers could therefore look to the 20yr point as a means of smoothing out their maturity distribution. (A number of these issuers have already issued 20yr in recent years or have existing 20yr maturities as a result of off-the-run 30yr issuance that has rolled down the curve).

**Exhibit 6: Potential 20yr issuers: Non-financial issuers with $20+bn of debt and a high proportion of 10+30yr debt**

| Ticker | 1-6yr | 6-11yr | 11-16yr | 16-21yr | 21-26yr | 26-31yr | >31yr | 10s+30s as % of Total Debt | Total JULI Debt ($bn) |
|---|---|---|---|---|---|---|---|---|---|
| ABIBB | 13.50% | **19.98%** | 1.79% | 19.02% | 6.98% | **32.76%** | 5.97% | **52.74%** | 59 |
| VOD | 24.86% | **18.65%** | 2.46% | 13.44% | 6.97% | **31.12%** | 2.49% | **49.77%** | 20 |
| DELL | 44.58% | **38.55%** | 0.00% | 7.23% | 0.00% | **9.64%** | 0.00% | **48.19%** | 21 |
| CI | 43.77% | **26.07%** | 0.00% | 8.28% | 1.59% | **20.28%** | 0.00% | **46.35%** | 27 |
| VZ | 21.95% | **25.08%** | 10.38% | 11.69% | 4.19% | **21.24%** | 5.45% | **46.32%** | 61 |
| PEP | 40.79% | **20.44%** | 0.00% | 4.00% | 10.09% | **24.69%** | 0.00% | **45.12%** | 23 |
| CHTR | 30.82% | **12.56%** | 7.18% | 2.87% | 12.56% | **32.23%** | 1.79% | **44.78%** | 28 |
| DUK | 21.43% | **23.13%** | 4.34% | 15.05% | 14.99% | **21.06%** | 0.00% | **44.19%** | 40 |
| BRKHEC | 14.58% | **14.80%** | 5.62% | 24.95% | 11.01% | **29.05%** | 0.00% | **43.84%** | 23 |
| JNJ | 18.97% | **23.65%** | 6.65% | 28.33% | 3.94% | **18.47%** | 0.00% | **42.12%** | 20 |
| BMY | 41.10% | **25.00%** | 0.00% | 5.31% | 11.49% | **17.10%** | 0.00% | **42.10%** | 38 |
| AAPL | 44.73% | **26.18%** | 0.00% | 1.82% | 11.64% | **15.64%** | 0.00% | **41.82%** | 69 |
| MO | 32.50% | **22.73%** | 0.00% | 9.09% | 15.23% | **18.18%** | 2.27% | **40.91%** | 22 |
| INTC | 46.41% | **14.72%** | 3.40% | 0.00% | 9.69% | **25.78%** | 0.00% | **40.50%** | 22 |
| ABBV | 37.82% | **23.18%** | 4.37% | 8.75% | 9.27% | **16.62%** | 0.00% | **39.79%** | 57 |
| KHC | 21.57% | **18.81%** | 6.59% | 14.21% | 18.24% | **20.58%** | 0.00% | **39.39%** | 22 |
| HD | 26.18% | **21.68%** | 0.00% | 14.31% | 16.36% | **17.38%** | 4.09% | **39.06%** | 24 |
| CVS | 42.52% | **24.49%** | 1.17% | 9.79% | 7.64% | **14.38%** | 0.00% | **38.87%** | 56 |
| T | 26.39% | **18.13%** | 3.68% | 14.10% | 15.80% | **20.01%** | 1.89% | **38.14%** | 87 |
| SO | 27.57% | **15.51%** | 0.00% | 8.04% | 26.34% | **22.54%** | 0.00% | **38.06%** | 22 |

Source: J.P. Morgan

## Demand: US pension demand for 20yr should increase as plans close

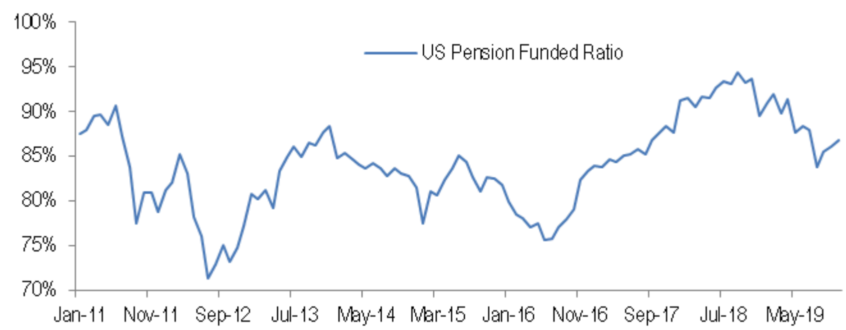
A significant driver of long-end demand in recent years has been from pension funds looking to derisk as they approach fully-funded status. We estimate that pension funds currently own approximately 11% of the HG corporate market, with most of that exposure concentrated at the long-end.

Eric Beinstein
(1-212) 834-4211
eric.beinstein@jpmorgan.com



Many companies have in recent years closed their pension plans to new employees. As a result, the duration of their liabilities should decrease over time, especially if rates stabilize or rise. This could lead to a preference for 20yr assets over the 30yr assets they have traditionally purchased. Milliman estimates that the 100 largest pension plans have approximately $1.6 trillion in assets and therefore even small shifts in the duration of their liability stream could be consequential in spurring demand for 20yr Treasuries and corporates. Estimates for the average duration of pension liabilities is approximately 12.5 years. Recently issued 20yr corporate bonds have an average duration of 13.3 years, so it is logical to expect pension funds to be interested in the 20yr tenor.

Exhibit 7: Improving pension funded ratio should spur demand for long-duration HG

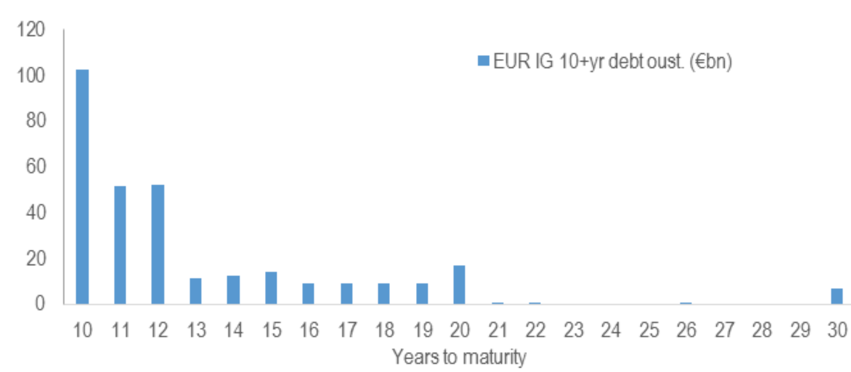



Source: J.P. Morgan, Milliman.

## Demand: Natural demand for 20yr from Europe should lead to more cross-currency trading

We believe further issuance of 20yr corporates will likely be well received abroad. In particular, our sense is that European investors have by and large shied away from 30yr paper thus far. We see evidence for this in the maturity stack of Euro IG debt, where issuance past the 20yr point is very much the exception (Exhibit 4). Increased USD 20yr issuance would also be beneficial for cross-currency trading opportunities further out the curve as it will increased the universe of on-the-run like for like EUR vs. USD bond pairs whereas currently high dollar prices or large maturity differences skew the comparison of many of these pairs past the 10yr point.

Exhibit 8: European demand doesn't really extend past the 20yr point




Source: J.P. Morgan, Bloomberg.

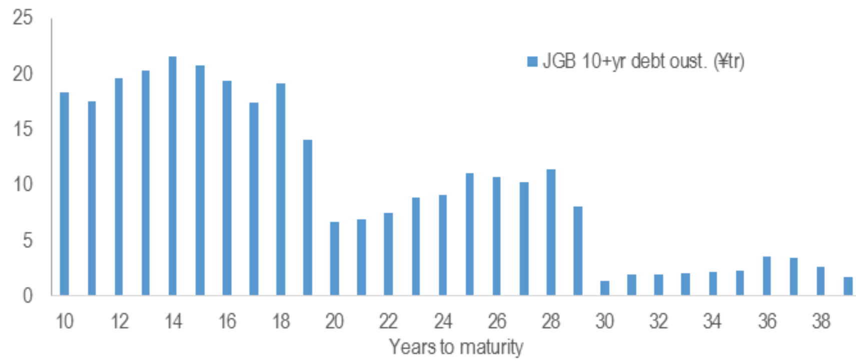
Eric Beinstein
(1-212) 834-4211
eric.beinstein@jpmorgan.com



## Demand: A more liquid 20 year point should attract JPY demand out the curve

A similar picture to Europe emerges when looking at Japan. The JGB market, despite being the second largest sovereign debt market in the world, is relatively limited in depth around the 30yr point, whereas there is significantly more debt outstanding around the 20yr point. Similarly, we believe this is reflective of demand side dynamics domestically, and therefore an increase in 20yr USD corporate issuance would likely be well received by Japanese investors that have thus far mostly avoided the 30yr part of the USD HG market.

Exhibit 9: The long end for Japan is focused on the 20yr point rather than 30yr




Source: J.P. Morgan, Bloomberg.

More broadly, we believe this same concept is true on a global scale. In other words, the definition of 'long-end' as being 30yr is somewhat of a historical aberration exclusive to the USD debt market. Looking at all non-USD investment grade debt globally, we observe that there is $568bn more debt in the 20yr bucket (2036-2040) than in the 30yr bucket (2046-2050). Therefore, more supply of 20yr HG corporates should be well received on a global scale, with the Eurozone and Japan at the forefront of that potential demand.

## How to position in HG for a new UST 20yr

**What should the 20s30s spread curve be? We believe 5bp upward sloping at current spread levels**

The 20s30s spread curve should be modestly upward sloping except for distressed credits, in our view. This is because both 20yr and 30yr credit risk is far enough away that it is difficult to think of situations where one would have a credit rationale for a very steep or inverted risk profile in those tenors. We have two sources of data on actual 20s30s curve shape which is somewhat clean – i.e., not distorted by the issues above.

The first is the actual curve shape for issuers who have both recently issued liquid 20yr bonds and 30yr bonds. These are shown in exhibit 10. The median 20s30s curve for these bonds is 6bp. This is based on the current off-the-run UST 20yr levels which we believe will be validated by the new on-the-run bonds.

The second source is the average 20s30s curve shape from our Spread Curves analyses. We calculate spread curves for about 300 issuers that have at least 6 bonds outstanding. The curve shape calculation takes into account all the traded bonds and weights those that trade more actively more heavily. The average 20s30s curve from this framework is 6bp, so a similar result. However, this is based on a G-spread off the I25 Treasury curve. Based on the differences between the I25 Treasury curve and the I111 Treasury curve, the interpolated Treasury level used to compute the 20 year spread should be about 10bp wider. Therefore the 20-year bond spread over the I111 Treasury curve would be about 10bp tighter than the current level implied by the spread curves. Adjusting for the differences in Treasury curve rates, the 20s30s curve would be about 16bp when computing the G-spread over the on/off the run Treasury curve.

**On the following pages, we highlight relative value opportunities in 20-year bonds both in terms of pair trades as well as for outright positions in bonds that may compress once UST 20yr issuance resumes.**

Eric Beinstein
(1-212) 834-4211
eric.beinstein@jpmorgan.com



Table 10 lists the 20s30s spread curve for various liquid bonds pairs from the same issuer where the 20yr bond is on the run (e.g., issued in the last 3 years).

**Exhibit 10: There are several liquid 20s30s bond pairs where the G-spread curve is inverted**

| 30yr Bond Description | 20yr Bond Description | 30yr G-spread | 20yr G-spread | **20s30s spread curve** | 30yr Price | 20yr Price | 30yr 1m avg liquidity ($mn/day)) | 20yr 1m avg liquidity | Year of issuance (20 yr bond) |
|---|---|---|---|---|---|---|---|---|---|
| OXY 4.4 08/15/49 | OXY 4.3 08/15/39 | 181 | 187 | -7 | 105.1 | 104.0 | 8.0 | 3.7 | 2019 |
| JNJ 3 3/4 03/03/47 | JNJ 3.4 01/15/38 | 61 | 65 | -4 | 115.3 | 109.3 | 0.5 | 2.9 | 2017 |
| BACARD 5.3 05/15/48 | BACARD 5.15 05/15/38 | 179 | 183 | -4 | 120.0 | 115.4 | 2.4 | 1.3 | 2018 |
| NESNVX 4 09/24/48 | NESNVX 3.9 09/24/38 | 73 | 76 | -3 | 118.4 | 114.6 | 2.4 | 0.5 | 2018 |
| TXN 4.15 05/15/48 | TXN 3 7/8 03/15/39 | 70 | 73 | -3 | 121.6 | 114.6 | 3.4 | 2.3 | 2019 |
| TRPCN 5.1 03/15/49 | TRPCN 4 3/4 05/15/38 | 147 | 150 | -3 | 123.2 | 115.2 | 4.5 | 3.8 | 2018 |
| XOM 3.095 08/16/49 | XOM 2.995 08/16/39 | 77 | 78 | -1 | 100.7 | 101.3 | 8.2 | 1.5 | 2019 |
| DD 5.419 11/15/48 | DD 5.319 11/15/38 | 173 | 174 | -1 | 123.5 | 119.3 | 13.8 | 8.3 | 2018 |
| DHR 3.4 11/15/49 | DHR 3 1/4 11/15/39 | 90 | 91 | -1 | 103.9 | 103.0 | 5.5 | 5.5 | 2019 |
| AMZN 4.05 08/22/47 | AMZN 3 7/8 08/22/37 | 70 | 70 | 0 | 119.4 | 115.2 | 13.9 | 3.2 | 2018 |
| UNP 4.3 03/01/49 | UNP 3.55 08/15/39 | 100 | 99 | 1 | 118.5 | 106.1 | 4.4 | 3.1 | 2019 |
| WMT 2.95 09/24/49 | WMT 3.95 06/28/38 | 65 | 64 | 1 | 100.2 | 117.3 | 9.7 | 3.8 | 2018 |
| KDP 5.085 05/25/48 | KDP 4.985 05/25/38 | 143 | 143 | 1 | 123.5 | 119.4 | 0.6 | 0.8 | 2019 |
| BAYNGR 4 7/8 06/25/48 | BAYNGR 4 5/8 06/25/38 | 150 | 148 | 2 | 118.3 | 114.0 | 6.8 | 8.9 | 2018 |
| MARS 3.95 04/01/49 | MARS 3 7/8 04/01/39 | 81 | 79 | 2 | 115.8 | 113.9 | 1.6 | 0.2 | 2019 |
| VZ 5 1/2 03/16/47 | VZ 5 1/4 03/16/37 | 114 | 111 | 3 | 136.1 | 127.4 | 11.4 | 7.9 | 2017 |
| MSFT 4 1/4 02/06/47 | MSFT 4.1 02/06/37 | 63 | 59 | 4 | 124.2 | 119.6 | 11.7 | 2.9 | 2017 |
| FOXA 5.576 01/25/49 | FOXA 5.476 01/25/39 | 162 | 157 | 5 | 128.4 | 124.0 | 12.1 | 6.2 | 2019 |
| ORCL 4 11/15/47 | ORCL 3.8 11/15/37 | 94 | 88 | 5 | 113.8 | 111.4 | 14.1 | 3.1 | 2017 |
| BSX 4.7 03/01/49 | BSX 4.55 03/01/39 | 113 | 107 | 6 | 123.0 | 118.9 | 1.9 | 1.5 | 2019 |
| BMY 4 1/4 10/26/49 | BMY 4 1/8 06/15/39 | 86 | 80 | 6 | 120.9 | 117.4 | 24.8 | 10.5 | 2019 |
| CVS 5.05 03/25/48 | CVS 4.78 03/25/38 | 158 | 152 | 6 | 119.9 | 115.4 | 67.0 | 10.4 | 2018 |
| ABIBB 5.55 01/23/49 | ABIBB 5.45 01/23/39 | 135 | 129 | 6 | 133.6 | 128.0 | 25.2 | 6.5 | 2019 |
| CAG 5.4 11/01/48 | CAG 5.3 11/01/38 | 162 | 156 | 6 | 125.2 | 121.7 | 11.1 | 3.6 | 2018 |
| MRK 4 03/07/49 | MRK 3.9 03/07/39 | 73 | 66 | 7 | 118.7 | 116.2 | 7.1 | 1.8 | 2019 |
| UNH 3.7 08/15/49 | UNH 3 1/2 08/15/39 | 97 | 90 | 7 | 108.1 | 106.7 | 8.1 | 5.9 | 2019 |
| CI 4.9 12/15/48 | CI 4.8 08/15/38 | 140 | 133 | 7 | 121.0 | 118.4 | 25.3 | 2.9 | 2019 |
| IBM 4 1/4 05/15/49 | IBM 4.15 05/15/39 | 107 | 99 | 8 | 116.6 | 114.8 | 24.2 | 6.4 | 2019 |
| CMCSA 3.45 02/01/50 | CMCSA 3 1/4 11/01/39 | 96 | 88 | 8 | 103.9 | 103.6 | 22.7 | 5.1 | 2019 |
| BATSLN 4.758 09/06/49 | BATSLN 4.39 08/15/37 | 208 | 200 | 8 | 106.4 | 104.1 | 12.7 | 9.5 | 2018 |
| SRE 4 02/01/48 | SRE 3.8 02/01/38 | 130 | 122 | 9 | 106.9 | 106.6 | 2.9 | 1.6 | 2018 |
| MO 5.95 02/14/49 | MO 5.8 02/14/39 | 216 | 207 | 9 | 124.0 | 120.8 | 15.2 | 8.8 | 2019 |
| TELEFO 5.52 03/01/49 | TELEFO 4.665 03/06/38 | 172 | 164 | 9 | 125.4 | 112.2 | 11.8 | 2.8 | 2018 |
| GIS 4.7 04/17/48 | GIS 4.55 04/17/38 | 127 | 117 | 9 | 119.9 | 117.3 | 6.3 | 2.4 | 2018 |
| ABBV 4 1/4 11/21/49 | ABBV 4.05 11/21/39 | 151 | 141 | 10 | 107.9 | 107.0 | 71.3 | 16.9 | 2019 |
| KHC 4 7/8 10/01/49 | KHC 4 5/8 10/01/39 | 216 | 204 | 13 | 106.7 | 106.0 | 14.6 | 3.4 | 2019 |
| GM 5.95 04/01/49 | GM 5.15 04/01/38 | 271 | 258 | 13 | 114.4 | 105.8 | 16.8 | 1.8 | 2017 |
| ETP 6 1/4 04/15/49 | ETP 5.8 06/15/38 | 265 | 251 | 14 | 119.9 | 114.5 | 24.0 | 2.4 | 2018 |
| MPLX 5 1/2 02/15/49 | MPLX 4 1/2 04/15/38 | 231 | 217 | 15 | 114.1 | 103.1 | 9.6 | 3.1 | 2018 |
| DISCA 5.3 05/15/49 | DISCA 5 09/20/37 | 187 | 172 | 15 | 119.0 | 115.2 | 5.7 | 6.7 | 2017 |
| BA 3 3/4 02/01/50 | BA 3 1/2 03/01/39 | 126 | 110 | 16 | 103.6 | 103.9 | 30.8 | 2.0 | 2019 |
| **Median** | | **130** | **122** | **6** | **119** | **115** | **11.1** | **3.2** | |

Source: J.P. Morgan. As of 1/21/20 *:00 am EST pricing

Eric Beinstein
(1-212) 834-4211
eric.beinstein@jpmorgan.com



Table 11 shows a similar list of bond pairs, though for off-the-run 20yr bonds that were initially issued as 30-year bonds.

**Exhibit 11: Table of 20s30s bond pairs consisting of 20 year bonds that were initially issued as 30yr bonds**

| 30yr Bond Description | 20yr Bond Description | 30yr G-spread | 20yr G-spread | 20s30s spread curve | 30yr Price | 20yr Price | 30yr 1m avg liquidity ($mn/day)) | 20yr 1m avg liquidity | Year of issuance (20 yr bond) |
|---|---|---|---|---|---|---|---|---|---|
| D 3.3 12/01/49 | D 8 7/8 11/15/38 | 84 | 139 | -55 | 103.0 | 172.7 | 3.5 | 0.2 | 2008 |
| IP 4.35 08/15/48 | IP 7.3 11/15/39 | 159 | 204 | -44 | 107.6 | 141.5 | 6.2 | 4.8 | 2009 |
| CNQCN 4.95 06/01/47 | CNQCN 6 1/4 03/15/38 | 131 | 167 | -36 | 123.0 | 132.3 | 8.0 | 1.5 | 2007 |
| MPC 4 1/2 04/01/48 | MPC 6 1/2 03/01/41 | 172 | 204 | -32 | 107.8 | 131.2 | 1.1 | 2.3 | 2011 |
| VLO 4.9 03/15/45 | VLO 6 5/8 06/15/37 | 159 | 189 | -29 | 116.0 | 133.5 | 5.0 | 4.4 | 2007 |
| OKE 4.45 09/01/49 | OKE 6.85 10/15/37 | 195 | 225 | -29 | 103.4 | 130.9 | 4.6 | 3.0 | 2007 |
| AZN 4 3/8 08/17/48 | AZN 6.45 09/15/37 | 92 | 117 | -25 | 121.2 | 142.8 | 3.4 | 2.8 | 2007 |
| HAL 5 11/15/45 | HAL 6.7 09/15/38 | 171 | 195 | -24 | 115.5 | 134.0 | 10.3 | 2.7 | 2008 |
| DIS 2 3/4 09/01/49 | DIS 6.65 11/15/37 | 68 | 92 | -24 | 95.8 | 149.8 | 9.6 | 1.9 | 2008 |
| CVECN 5.4 06/15/47 | CVECN 6 3/4 11/15/39 | 210 | 233 | -22 | 115.6 | 129.4 | 9.4 | 2.5 | 2010 |
| ENTERP 4.2 11/01/46 | ENTERP 7 10/15/37 | 135 | 156 | -21 | 109.1 | 143.2 | 1.6 | 1.1 | 2007 |
| DVN 5 06/15/45 | DVN 5.6 07/15/41 | 169 | 188 | -20 | 115.9 | 121.4 | 5.0 | 1.2 | 2011 |
| BNSF 3.55 02/15/50 | BNSF 5 3/4 05/01/40 | 86 | 104 | -18 | 107.5 | 137.1 | 6.5 | 1.5 | 2010 |
| AWK 4.15 06/01/49 | AWK 6.593 10/15/37 | 103 | 121 | -17 | 115.2 | 143.8 | 0.9 | 0.6 | 2008 |
| LMT 4.7 05/15/46 | LMT 5.72 06/01/40 | 79 | 95 | -16 | 128.6 | 138.7 | 1.9 | 0.0 | 2011 |
| SO 3.45 10/01/49 | SO 6 03/01/39 | 92 | 107 | -15 | 104.2 | 139.6 | 2.4 | 0.5 | 2009 |
| ENBCN 7 3/8 10/15/45 | ENBCN 5 1/2 09/15/40 | 170 | 183 | -14 | 152.5 | 120.7 | 1.6 | 0.9 | 2010 |
| KMI 5.2 03/01/48 | KMI 5 5/8 09/01/41 | 194 | 207 | -13 | 115.7 | 118.4 | 3.3 | 0.1 | 2011 |
| APA 5.35 07/01/49 | APA 5.1 09/01/40 | 246 | 257 | -11 | 109.3 | 104.6 | 14.4 | 1.8 | 2010 |
| UTX 4 5/8 11/16/48 | UTX 6 1/8 07/15/38 | 84 | 94 | -10 | 127.9 | 143.0 | 5.5 | 0.5 | 2008 |
| COP 5.95 03/15/46 | COP 6 1/2 02/01/39 | 97 | 107 | -10 | 146.0 | 146.8 | 1.4 | 2.3 | 2009 |
| ENELIM 4 3/4 05/25/47 | ENELIM 6 10/07/39 | 163 | 173 | -10 | 113.7 | 128.5 | 2.3 | 0.6 | 2009 |
| KR 5.4 01/15/49 | KR 5.4 07/15/40 | 177 | 186 | -10 | 122.4 | 118.6 | 6.5 | 0.5 | 2010 |
| BHI 4.08 12/15/47 | BHI 5 1/8 09/15/40 | 148 | 156 | -9 | 105.1 | 119.7 | 8.8 | 0.7 | 2010 |
| HES 5.8 04/01/47 | HES 5.6 02/15/41 | 208 | 215 | -7 | 122.3 | 117.2 | 3.5 | 4.7 | 2010 |
| PFE 4 03/15/49 | PFE 7.2 03/15/39 | 82 | 89 | -7 | 116.7 | 160.0 | 4.7 | 1.8 | 2009 |
| GILD 4.15 03/01/47 | GILD 5.65 12/01/41 | 109 | 115 | -6 | 113.2 | 134.7 | 5.4 | 2.9 | 2011 |
| AMGN 4.563 06/15/48 | AMGN 5.15 11/15/41 | 126 | 132 | -6 | 117.6 | 124.2 | 4.3 | 0.8 | 2011 |
| UPS 3.4 09/01/49 | UPS 6.2 01/15/38 | 99 | 105 | -6 | 102.1 | 141.9 | 6.2 | 0.6 | 2008 |
| EDF 5 09/21/48 | EDF 6.95 01/26/39 | 148 | 153 | -5 | 120.9 | 144.4 | 2.4 | 2.6 | 2009 |
| HD 4 1/2 12/06/48 | HD 5.95 04/01/41 | 91 | 96 | -5 | 123.8 | 142.4 | 8.3 | 1.1 | 2011 |
| RDSALN 3 1/8 11/07/49 | RDSALN 6 3/8 12/15/38 | 85 | 89 | -4 | 99.7 | 148.2 | 11.9 | 2.6 | 2008 |
| BRKHEC 4.45 01/15/49 | BRKHEC 5.95 05/15/37 | 104 | 102 | 2 | 120.3 | 138.2 | 2.0 | 2.1 | 2007 |
| T 5.15 02/15/50 | T 5.35 09/01/40 | 158 | 154 | 4 | 122.5 | 123.4 | 5.3 | 6.6 | 2011 |
| **Median** | | **133** | **153** | **-13** | **116** | **136** | **4.8** | **1.6** | |

Source: J.P. Morgan

Eric Beinstein
(1-212) 834-4211
eric.beinstein@jpmorgan.com



Table 12 lists bonds with maturities between 2041 and 2044 (21-24 years to maturity) with more than $500mn in par outstanding, average daily volumes over the past month of at least $500k and issued more than 3 years ago. We believe the introduction of the 20-year Treasury bond should lead to increased liquidity in these bonds over the coming years as they roll to the 20yr point on the curve and become susceptible to increased odds of new issue repricings. This makes these bonds attractive, in our view, as they currently offer some illiquidity premium in addition to the credit spread. Note that the G-spread quoted in the tables below are all calculated over the on/off-the-run Treasury curve (I111 curve), which we believe is the more appropriate curve to use based on the discussion above.

**Exhibit 12: Bonds that will roll-down to the 20 year point in the next few years should benefit from the increased liquidity in the 20year tenor**

| Bond description | G-spread | Price | Par | Year of issuance | 1m avg liquidity ($mn/day) | **Spread to issuer curve** |
|---|---|---|---|---|---|---|
| AMGN 4.95 10/01/41 | 126 | 122.4 | 600 | 2010 | 1.9 | **38** |
| WELL 6 1/2 03/15/41 | 166 | 137.8 | 400 | 2011 | 1.3 | **36** |
| MYL 5.4 11/29/43 | 225 | 113.2 | 500 | 2013 | 0.7 | **35** |
| AMGN 5.15 11/15/41 | 133 | 124.5 | 974 | 2011 | 0.8 | **35** |
| ETP 6 1/2 02/01/42 | 278 | 120.1 | 1000 | 2012 | 1.0 | **30** |
| EPD 5.95 02/01/41 | 165 | 130.4 | 750 | 2011 | 1.6 | **27** |
| UNP 4.3 06/15/42 | 108 | 115.5 | 300 | 2012 | 0.7 | **25** |
| ETP 5.95 10/01/43 | 274 | 112.5 | 450 | 2013 | 1.7 | **25** |
| ENBCN 4 1/2 06/10/44 | 148 | 111.8 | 500 | 2014 | 2.8 | **25** |
| CMCSA 4.45 01/15/43 | 108 | 118.1 | 1000 | 2012 | 0.5 | **24** |
| CAH 4 1/2 11/15/44 | 226 | 99.4 | 350 | 2014 | 2.2 | **23** |
| ETP 6.05 06/01/41 | 279 | 113.7 | 700 | 2011 | 1.0 | **23** |
| ETP 5.3 04/01/44 | 260 | 106.0 | 700 | 2014 | 6.2 | **22** |
| LYB 5 1/4 07/15/43 | 172 | 119.3 | 750 | 2013 | 0.8 | **22** |
| TSN 5.15 08/15/44 | 137 | 124.3 | 500 | 2014 | 0.7 | **22** |
| T 6 3/8 03/01/41 | 170 | 135.8 | 984 | 2016 | 1.4 | **22** |
| BNSF 5.4 06/01/41 | 111 | 131.8 | 500 | 2011 | 0.7 | **21** |
| CMCSA 5.95 04/01/41 | 113 | 140.0 | 1200 | 2011 | 0.6 | **20** |
| LYB 4 7/8 03/15/44 | 172 | 113.9 | 1000 | 2014 | 6.1 | **20** |
| VTR 5.7 09/30/43 | 162 | 127.7 | 300 | 2013 | 0.7 | **20** |

Source: J.P. Morgan

**Analyst Certification:** The research analyst(s) denoted by an "AC" on the cover of this report certifies (or, where multiple research analysts are primarily responsible for this report, the research analyst denoted by an "AC" on the cover or within the document individually certifies, with respect to each security or issuer that the research analyst covers in this research) that: (1) all of the views expressed in this report accurately reflect the research analyst's personal views about any and all of the subject securities or issuers; and (2) no part of any of the research analyst's compensation was, is, or will be directly or indirectly related to the specific recommendations or views expressed by the research analyst(s) in this report. For all Korea-based research analysts listed on the front cover, if applicable, they also certify, as per KOFIA requirements, that their analysis was made in good faith and that the views reflect their own opinion, without undue influence or intervention.

All authors named within this report are research analysts unless otherwise specified. In Europe, Sector Specialists may be shown on this report as contacts but are not authors of the report or part of the Research Department.

## Important Disclosures

**Company-Specific Disclosures:** Important disclosures, including price charts and credit opinion history tables, are available for compendium reports and all J.P. Morgan–covered companies by visiting https://www.jpmm.com/research/disclosures, calling 1-800-477-0406, or e-mailing research.disclosure.inquiries@jpmorgan.com with your request. J.P. Morgan's Strategy, Technical, and Quantitative Research teams may screen companies not covered by J.P. Morgan. For important disclosures for these companies, please call 1-800-477-0406 or e-mail research.disclosure.inquiries@jpmorgan.com.

**Explanation of Credit Research Valuation Methodology, Ratings and Risk to Ratings:**
J.P. Morgan uses a bond-level rating system that incorporates valuations (relative value) and our fundamental view on the security. Our fundamental credit view of an issuer is based on the company's underlying credit trends, overall creditworthiness and our opinion on whether the issuer will be able to service its debt obligations when they become due and payable. We analyze, among other things, the company's cash flow capacity and trends and standard credit ratios, such as gross and net leverage, interest coverage and liquidity ratios. We also analyze profitability, capitalization and asset quality, among other variables, when assessing financials. Analysts also rate the issuer, based on the rating of the benchmark or representative security. Unless we specify a different recommendation for the company's individual securities, an issuer recommendation applies to all of the bonds at the same level of the issuer's capital structure. This report also sets out within it the material underlying assumptions used.

We use the following ratings for bonds (issues) and issuers: Overweight (over the next three months, the recommended risk position is expected to outperform the relevant index, sector, or benchmark); Neutral (over the next three months, the recommended risk position is expected to perform in line with the relevant index, sector, or benchmark); and Underweight (over the next three months, the recommended risk position is expected to underperform the relevant index, sector, or benchmark). J.P. Morgan Emerging Markets Sovereign Research uses Marketweight, which is equivalent to Neutral. NR is Not Rated. In this case, J.P. Morgan has removed the rating for this particular security or issuer because of either a lack of a sufficient fundamental basis or for legal, regulatory or policy reasons. The previous rating no longer should be relied upon. An NR designation is not a recommendation or a rating. NC is Not Covered. An NC designation is not a rating or a recommendation.

For CDS, we use the following rating system: Long Risk (over the next three months, the credit return on the recommended position is expected to exceed the relevant index, sector or benchmark); Neutral (over the next three months, the credit return on the recommended position is expected to match the relevant index, sector or benchmark); and Short Risk (over the next three months, the credit return on the recommended position is expected to underperform the relevant index, sector or benchmark).

**J.P. Morgan Credit Research Ratings Distribution, as of January 02, 2020**

| | Overweight | Neutral | Underweight |
|---|---|---|---|
| Global Credit Research Universe | 26% | 56% | 18% |
| IB clients* | 66% | 63% | 60% |

*Percentage of subject companies within each of the "buy," "hold" and "sell" categories for which J.P. Morgan has provided investment banking services within the previous 12 months. Please note that the percentages might not add to 100% because of rounding.
The Credit Research Rating Distribution is at the issuer level. Issuers with an NR or an NC designations are not included in the table above. This information is current as of the end of the most recent calendar quarter.

**Analysts' Compensation:** The research analysts responsible for the preparation of this report receive compensation based upon various factors, including the quality and accuracy of research, client feedback, competitive factors, and overall firm revenues.

## Other Disclosures

J.P. Morgan is a marketing name for investment banking businesses of JPMorgan Chase & Co. and its subsidiaries and affiliates worldwide.

Eric Beinstein
(1-212) 834-4211
eric.beinstein@jpmorgan.com



Any data discrepancies in this report could be the result of different calculations and/or adjustments.

Any long form nomenclature for references to China; Hong Kong; Taiwan; and Macau within this research report are Mainland China; Hong Kong SAR, China; Taiwan, China; Macau SAR, China.

**Options and Futures related research:** If the information contained herein regards options or futures related research, such information is available only to persons who have received the proper options or futures risk disclosure documents. Please contact your J.P. Morgan Representative or visit https://www.theocc.com/components/docs/riskstoc.pdf for a copy of the Option Clearing Corporation's Characteristics and Risks of Standardized Options or http://www.finra.org/sites/default/files/Security_Futures_Risk_Disclosure_Statement_2018.pdf for a copy of the Security Futures Risk Disclosure Statement.

**Private Bank Clients:** Where you are receiving research as a client of the private banking businesses offered by JPMorgan Chase & Co. and its subsidiaries ("J.P. Morgan Private Bank"), research is provided to you by J.P. Morgan Private Bank and not by any other division of J.P. Morgan, including but not limited to the J.P. Morgan corporate and investment bank and its research division.

**Legal entity responsible for the production of research**: The legal entity identified below the name of the Reg AC research analyst who authored this report is the legal entity responsible for the production of this research. Where multiple Reg AC research analysts authored this report with different legal entities identified below their names, these legal entities are jointly responsible for the production of this research.

**Legal Entities Disclosures**
**U.S**.: JPMS is a member of NYSE, FINRA, SIPC and the NFA. JPMorgan Chase Bank, N.A. is a member of FDIC. **Canada**: J.P. Morgan Securities Canada Inc. is a registered investment dealer, regulated by the Investment Industry Regulatory Organization of Canada and the Ontario Securities Commission and is the participating member on Canadian exchanges. **U.K**.: JPMorgan Chase N.A., London Branch, is authorised by the Prudential Regulation Authority and is subject to regulation by the Financial Conduct Authority and to limited regulation by the Prudential Regulation Authority. Details about the extent of our regulation by the Prudential Regulation Authority are available from J.P. Morgan on request. J.P. Morgan Securities plc (JPMS plc) is a member of the London Stock Exchange and is authorised by the Prudential Regulation Authority and regulated by the Financial Conduct Authority and the Prudential Regulation Authority. Registered in England & Wales No. 2711006. Registered Office 25 Bank Street, London, E14 5JP. **Germany**: This material is distributed in Germany by J.P. Morgan Securities plc, Frankfurt Branch which is regulated by the Bundesanstalt für Finanzdienstleistungsaufsich and also by J.P. Morgan AG (JPM AG) which is a member of the Frankfurt stock exchange and is regulated by the Federal Financial Supervisory Authority (BaFin), JPM AG is a company incorporated in the Federal Republic of Germany with registered office at Taunustor 1, 60310 Frankfurt am Main, the Federal Republic of Germany. **South Africa**: J.P. Morgan Equities South Africa Proprietary Limited is a member of the Johannesburg Securities Exchange and is regulated by the Financial Services Board. **Hong Kong**: J.P. Morgan Securities (Asia Pacific) Limited (CE number AAJ321) is regulated by the Hong Kong Monetary Authority and the Securities and Futures Commission in Hong Kong and/or J.P. Morgan Broking (Hong Kong) Limited (CE number AAB027) is regulated by the Securities and Futures Commission in Hong Kong. JP Morgan Chase Bank, N.A., Hong Kong is organized under the laws of U.S.A. with limited liability. **Korea**: This material is issued and distributed in Korea by or through J.P. Morgan Securities (Far East) Limited, Seoul Branch, which is a member of the Korea Exchange(KRX) and is regulated by the Financial Services Commission (FSC) and the Financial Supervisory Service (FSS). **Australia**: J.P. Morgan Securities Australia Limited (JPMSAL) (ABN 61 003 245 234/AFS Licence No: 238066) is regulated by ASIC and is a Market, Clearing and Settlement Participant of ASX Limited and CHI-X. **Taiwan**: J.P. Morgan Securities (Taiwan) Limited is a participant of the Taiwan Stock Exchange (company-type) and regulated by the Taiwan Securities and Futures Bureau. **India:** J.P. Morgan India Private Limited (Corporate Identity Number - U67120MH1992FTC068724), having its registered office at J.P. Morgan Tower, Off. C.S.T. Road, Kalina, Santacruz - East, Mumbai – 400098, is registered with Securities and Exchange Board of India (SEBI) as a 'Research Analyst' having registration number INH000001873. J.P. Morgan India Private Limited is also registered with SEBI as a member of the National Stock Exchange of India Limited and the Bombay Stock Exchange Limited (SEBI Registration Number – INZ000239730) and as a Merchant Banker (SEBI Registration Number - MB/INM000002970). Telephone: 91-22-6157 3000, Facsimile: 91-22-6157 3990 and Website: www.jpmipl.com. For non local research reports, this material is not distributed in India by J.P. Morgan India Private Limited. **Thailand**: This material is issued and distributed in Thailand by JPMorgan Securities (Thailand) Ltd., which is a member of the Stock Exchange of Thailand and is regulated by the Ministry of Finance and the Securities and Exchange Commission and its registered address is 3rd Floor, 20 North Sathorn Road, Silom, Bangrak, Bangkok 10500. **Indonesia**: PT J.P. Morgan Sekuritas Indonesia is a member of the Indonesia Stock Exchange and is regulated by the OJK a.k.a. BAPEPAM LK. **Philippines**: J.P. Morgan Securities Philippines Inc. is a Trading Participant of the Philippine Stock Exchange and a member of the Securities Clearing Corporation of the Philippines and the Securities Investor Protection Fund. It is regulated by the Securities and Exchange Commission. **Brazil**: Banco J.P. Morgan S.A. is regulated by the Comissao de Valores Mobiliarios (CVM) and by the Central Bank of Brazil. **Mexico**: J.P. Morgan Casa de Bolsa, S.A. de C.V., J.P. Morgan Grupo Financiero is a member of the Mexican Stock Exchange and authorized to act as a broker dealer by the National Banking and Securities Exchange Commission. **Singapore:** This material is issued and distributed in Singapore by or through J.P. Morgan Securities Singapore Private Limited (JPMSS) [MCI (P) 058/04/2019 and Co. Reg. No.: 199405335R], which is a member of the Singapore Exchange Securities Trading Limited and/or JPMorgan Chase Bank, N.A., Singapore branch (JPMCB Singapore) [MCI (P) 070/09/2019], both of which are regulated by the Monetary Authority of Singapore. This material is issued and distributed in Singapore only to accredited investors, expert investors and institutional investors, as defined in Section 4A of the Securities and Futures Act, Cap. 289 (SFA). This material is not intended to be issued or distributed to any retail investors or any other investors that do not fall into the classes of "accredited investors," "expert investors" or "institutional investors," as defined under Section 4A of the SFA. Recipients of this document are to contact JPMSS or JPMCB Singapore in respect of any matters arising from, or in connection with, the document. **Japan**: JPMorgan Securities Japan Co., Ltd. and JPMorgan Chase Bank, N.A., Tokyo Branch are regulated by the Financial Services Agency in Japan. **Malaysia**: This material is issued and distributed in Malaysia by JPMorgan Securities (Malaysia) Sdn Bhd (18146-X) which is a Participating Organization of Bursa Malaysia Berhad and a holder of Capital Markets Services License issued by the Securities Commission in Malaysia. **Pakistan**: J. P. Morgan Pakistan Broking (Pvt.) Ltd is a member of the Karachi Stock Exchange and regulated by the Securities and Exchange Commission of Pakistan. **Dubai**: JPMorgan Chase Bank, N.A., Dubai Branch is regulated by the Dubai Financial Services Authority (DFSA) and its registered address is Dubai International Financial Centre - Building 3, Level 7, PO Box 506551, Dubai, UAE. **Russia:** CB J.P. Morgan Bank International LLC is regulated by the Central Bank of Russia.

**Argentina:** JPMorgan Chase Bank Sucursal Buenos Aires is regulated by Banco Central de la República Argentina (“BCRA”- Central Bank of Argentina) and Comisión Nacional de Valores (“CNV”- Argentinian Securities Commission”)

**Country and Region Specific Disclosures**
**U.K. and European Economic Area (EEA):** Unless specified to the contrary, issued and approved for distribution in the U.K. and the EEA by JPMS plc. Investment research issued by JPMS plc has been prepared in accordance with JPMS plc's policies for managing conflicts of interest arising as a result of publication and distribution of investment research. Many European regulators require a firm to establish, implement and maintain such a policy. Further information about J.P. Morgan's conflict of interest policy and a description of the effective internal organisations and administrative arrangements set up for the prevention and avoidance of conflicts of interest is set out at the following link https://www.jpmorgan.com/jpmpdf/1320742677360.pdf. This report has been issued in the U.K. only to persons of a kind described in Article 19 (5), 38, 47 and 49 of the Financial Services and Markets Act 2000 (Financial Promotion) Order 2005 (all such persons being referred to as "relevant persons"). This document must not be acted on or relied on by persons who are not relevant persons. Any investment or investment activity to which this document relates is only available to relevant persons and will be engaged in only with relevant persons. In other EEA countries, the report has been issued to persons regarded as professional investors (or equivalent) in their home jurisdiction. **Australia:** This material is issued and distributed by JPMSAL in Australia to "wholesale clients" only. This material does not take into account the specific investment objectives, financial situation or particular needs of the recipient. The recipient of this material must not distribute it to any third party or outside Australia without the prior written consent of JPMSAL. For the purposes of this paragraph the term "wholesale client" has the meaning given in section 761G of the Corporations Act 2001. J.P. Morgan’s research coverage universe spans listed securities across the ASX All Ordinaries index, securities listed on offshore markets, unlisted issuers and investment products which Research management deem to be relevant to the investor base from time to time. J.P. Morgan seeks to cover companies of relevance to the domestic and international investor base across all GIC sectors, as well as across a range of market capitalisation sizes. **Germany:** This material is distributed in Germany by J.P. Morgan Securities plc, Frankfurt Branch which is regulated by the Bundesanstalt für Finanzdienstleistungsaufsicht. **Korea:** This report may have been edited or contributed to from time to time by affiliates of J.P. Morgan Securities (Far East) Limited, Seoul Branch. **Singapore:** As at the date of this report, JPMSS is a designated market maker for certain structured warrants listed on the Singapore Exchange where the underlying securities may be the securities discussed in this report. Arising from its role as designated market maker for such structured warrants, JPMSS may conduct hedging activities in respect of such underlying securities and hold or have an interest in such underlying securities as a result. The updated list of structured warrants for which JPMSS acts as designated market maker may be found on the website of the Singapore Exchange Limited: http://www.sgx.com. In addition, JPMSS and/or its affiliates may also have an interest or holding in any of the securities discussed in this report – please see the Important Disclosures section above. For securities where the holding is 1% or greater, the holding may be found in the Important Disclosures section above. For all other securities mentioned in this report, JPMSS and/or its affiliates may have a holding of less than 1% in such securities and may trade them in ways different from those discussed in this report. Employees of JPMSS and/or its affiliates not involved in the preparation of this report may have investments in the securities (or derivatives of such securities) mentioned in this report and may trade them in ways different from those discussed in this report. **Taiwan**: Research relating to equity securities is issued and distributed in Taiwan by J.P. Morgan Securities (Taiwan) Limited, subject to the license scope and the applicable laws and the regulations in Taiwan. According to Paragraph 2, Article 7-1 of Operational Regulations Governing Securities Firms Recommending Trades in Securities to Customers (as amended or supplemented) and/or other applicable laws or regulations, please note that the recipient of this material is not permitted to engage in any activities in connection with the material which may give rise to conflicts of interests, unless otherwise disclosed in the “Important Disclosures” in this material. **India:** For private circulation only, not for sale. **Pakistan:** For private circulation only, not for sale. **New Zealand:** This material is issued and distributed by JPMSAL in New Zealand only to "wholesale clients" (as defined in the Financial Advisers Act 2008). The recipient of this material must not distribute it to any third party or outside New Zealand without the prior written consent of JPMSAL. **Canada:** This report is distributed in Canada by or on behalf of J.P.Morgan Securities Canada Inc. The information contained herein is not, and under no circumstances is to be construed as an offer to sell securities described herein, or solicitation of an offer to buy securities described herein, in Canada or any province or territory thereof. The information contained herein is under no circumstances to be construed as investment advice in any province or territory of Canada and is not tailored to the needs of the recipient. **Dubai:** This report has been distributed to persons regarded as professional clients or market counterparties as defined under the DFSA rules. **Brazil:** Ombudsman J.P. Morgan: 0800-7700847 / ouvidoria.jp.morgan@jpmorgan.com.

**General:** Additional information is available upon request. Information has been obtained from sources believed to be reliable but JPMorgan Chase & Co. or its affiliates and/or subsidiaries (collectively J.P. Morgan) do not warrant its completeness or accuracy except with respect to any disclosures relative to JPMS and/or its affiliates and the analyst's involvement with the issuer that is the subject of the research. All pricing is indicative as of the close of market for the securities discussed, unless otherwise stated. Opinions and estimates constitute our judgment as of the date of this material and are subject to change without notice. Past performance is not indicative of future results. This material is not intended as an offer or solicitation for the purchase or sale of any financial instrument. The opinions and recommendations herein do not take into account individual client circumstances, objectives, or needs and are not intended as recommendations of particular securities, financial instruments or strategies to particular clients. The recipient of this report must make its own independent decisions regarding any securities or financial instruments mentioned herein. JPMS distributes in the U.S. research published by non-U.S. affiliates and accepts responsibility for its contents. Periodic updates may be provided on companies/industries based on company specific developments or announcements, market conditions or any other publicly available information. Clients should contact analysts and execute transactions through a J.P. Morgan subsidiary or affiliate in their home jurisdiction unless governing law permits otherwise.

"Other Disclosures" last revised January 01, 2020.