J.P.Morgan

Rise and Fall

How to trade fallen angels

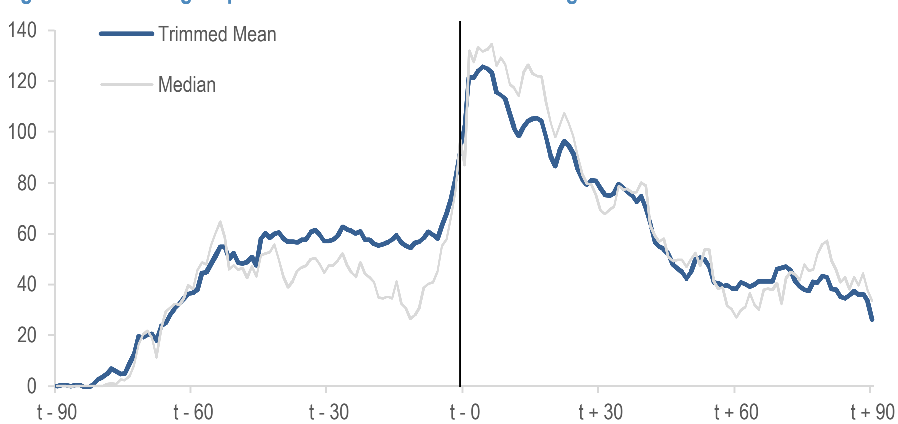
- **Fallen angels typically widen in the run-up to being downgraded, and then rally after moving to high yield.**
- **We recommend that investors buy fallen angels within a few days of the downgrade date, which has historically produced an average return of 4.5% over the next 90 days.**
- **We find that it is best to buy bonds whose spreads have widened by more than 50% after adjusting for the market beta. This has been successful 63 out of 69 times.**

In *Fall from Grace, 11th October 2018*, we warned that €100 - 120bn of euro corporate bonds could be downgraded from investment grade to high yield in the next recession. For a mandate constrained investor who is forced to sell fallen angels, we estimated that this could lead to a portfolio credit loss of approximately 108bp.

However, not all investors are forced to sell on downgrade. Many investment grade asset managers are able to allocate 5 - 10% of their portfolio to lower-rated bonds. Insurers will have to hold more capital against sub-investment grade debt. That begs the question: how should less constrained investors trade fallen angels?

Unsurprisingly, the obvious (and not very helpful) answer is: “sell early”. On average, fallen angels widen by 93bp over the three months prior to downgrade, with around two-fifths of this coming in the two weeks preceding the rating change. On the day of the downgrade event, they then widen by a further 10bp on average, followed by an additional 19bp on the next day (Figure 1).

Figure 1: Fallen Angel Spread Moves Before and After Downgrade



Source: J.P. Morgan, Bloomberg, Markit Group. Mean of 25 – 75th percentile.

European Credit Strategy
Matthew Bailey AC
(44-20) 7134-2384
matthew.a.bailey@jpmorgan.com
Daniel Lamy
(44-20) 7134-0467
daniel.lamy@jpmorgan.com
Madhubala Sriram
(44-20) 7134-1291
madhubala.sriram@jpmorgan.com
Saul Doctor
(44-20) 7134-1539
saul.doctor@jpmorgan.com
Moritz Duembgen
(44-20) 7742-7956
moritz.duembgen@jpmorgan.com
Dmytro Shelukhin, CFA
(44-20) 7134-2151
dmytro.shelukhin@jpmorgan.com
Shivam Ghosh
(44-20) 7742-4342
shivam.ghosh@jpmorgan.com
J.P. Morgan Securities plc

In this note, we look at the performance of approximately 160 European fallen angel senior bonds from 50 issuers since 2010. We define a fallen angel as a bond migrating from the iBoxx EUR Corporates to the iBoxx EUR High Yield benchmark.

In all charts and data, we define the downgrade date (t = 0) as the day on which the average rating on the bond moved to high yield, in accordance with the methodologies for the iBoxx and ICE BAML indices.

Matthew Bailey
(44-20) 7134-2384
matthew.a.bailey@jpmorgan.com

The second best answer, however, is to wait until the dust has settled. Based on our analysis, **fallen angels typically rally after moving to high yield**, with spreads tightening by 100bp from the peak on average in the following three months.

What explains this? We think that the early widening is probably fundamentally driven, resulting from either single-name credit deterioration or stress within the sector. It is also likely that at least one rating agency takes the credit rating down to high yield within this period, even though the average is still investment grade, and the name may also be on negative watch.

In our view, investors then begin to anticipate the name falling out of the investment grade indices, potentially due to another sudden negative headline or earnings release. As a result, mandate constrained investors sell down their remaining positions, with the risk being transferred to a combination of dealers, hedge funds and some early high yield funds. This selling appears to peak in the few days immediately before and after the rating change.

However, after a week or so, the selling starts to dry up. Gradually, the risk begins to move out of liquidity providers and into more high yield funds and other long-term holders who are comfortable buying at lower prices. As a result, spreads slowly begin to retrace from the wides. While not every case follows this pattern exactly, it has been broadly followed many times, such as Anglo American in 2016 and Teva in 2017 (Figure 2 and Figure 3).

In our view, existing holders of the bond who are unable to cut their position early should therefore wait until at least 50 days after the downgrade before selling. On average, we find that most of the retracement has already taken place within this timeframe.

Figure 2: AALLN 1.5% '20 Price, pts

Source: J.P. Morgan, Bloomberg. Dotted line is downgrade date.

Figure 3: TEVA 0.375% '20 Price, pts

Source: J.P. Morgan, Bloomberg. Dotted line is downgrade date.

Leaving without saying "goodbye"

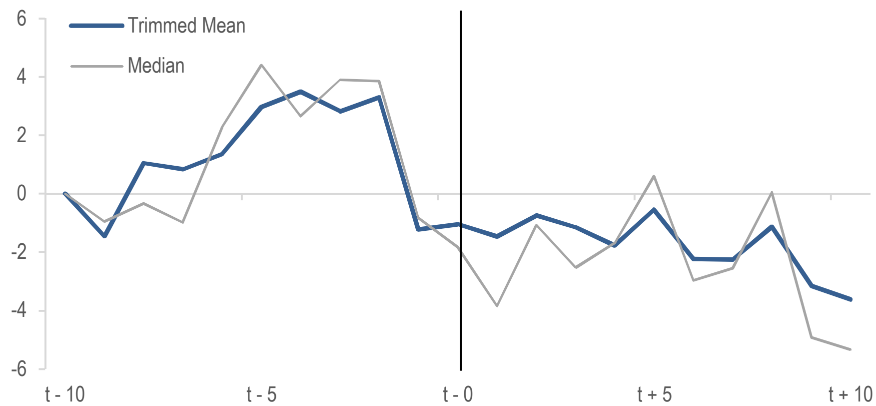
Notably, the bonds will not actually leave the investment grade indices until the end of the month that they are downgraded[1], between 3 to 25 business days later, by which time many of them have already started rallying. We therefore find little evidence that the actual transition from the investment grade to the high yield index

[1] Or the following month if the downgrade is within two business days of the end of the month under the iBoxx rules, or three business days under the ICE BAML rules.

Matthew Bailey
(44-20) 7134-2384
matthew.a.bailey@jpmorgan.com

has any additional negative impact on pricing (Figure 4). This suggests that investors who need – or want – to sell tend to do so on the ratings change event, and not when the bond leaves the index.

Figure 4: Fallen Angel Spread Moves Before and After Leaving the Index



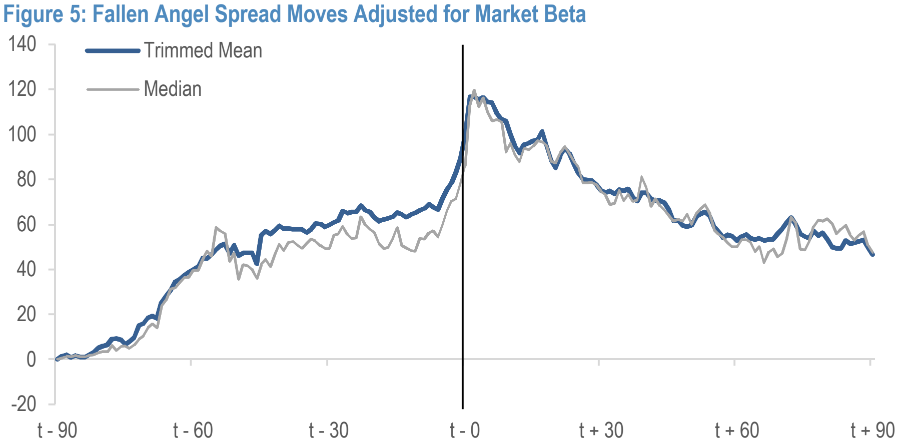
Source: J.P. Morgan, Bloomberg, Markit Group. T=0 is the last day the bond is in the investment grade index.

Is it all just the market?

One potential theory for the 'rise and fall' pattern of fallen angel spreads is that it is being driven by market cycles. It could be argued that rating agencies tend to downgrade bonds during periods of broad credit stress when the market as a whole is trending wider, but that volatility episodes tend to be short-lived and so, naturally, the fallen angel bonds tend to retrace their weakness.

If we adjust the spread moves for the market beta of each bond, we do find some evidence for this (Figure 5). While the underperformance on the move wider looks very similar, the retracement is more limited. Rather than reversing part of the early 'credit deterioration' related underperformance, only the 'index technical' sell-off in the few days immediately surrounding the downgrade event is retraced. The remainder of the rally is driven by the broader market.

Figure 5: Fallen Angel Spread Moves Adjusted for Market Beta



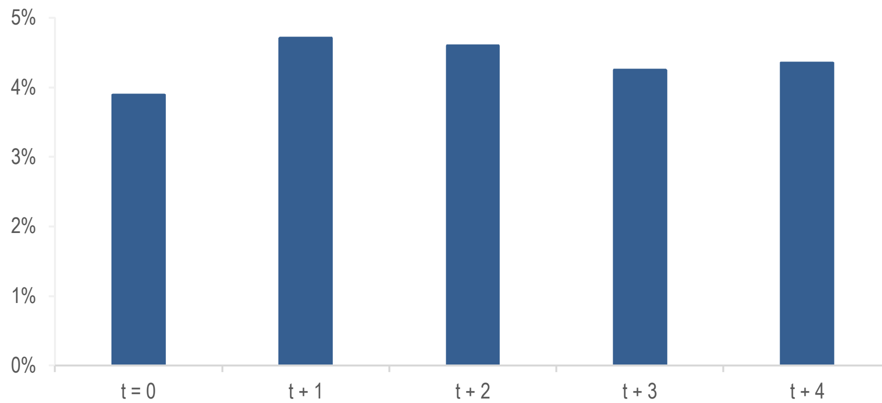
Source: J.P. Morgan, Bloomberg, Markit Group. Mean of 25 – 75th percentile.

Matthew Bailey
(44-20) 7134-2384
matthew.a.bailey@jpmorgan.com

An opportunity in every problem

Given the spread moves, we find that it is very attractive to buy fallen angels within a few days of the downgrade date. **Historically, this has generated an excess return of approximately 4.5% on average over the next ninety days**, with a positive return 75% of the time, or for 121 out of 161 bonds (Figure 6). Effectively, we think that this can be considered as the compensation for facilitating the transfer of risk out of investment grade holders and into high yield funds.

Figure 6: Average 90 Day Return for Buying Fallen Angels, % by purchase date

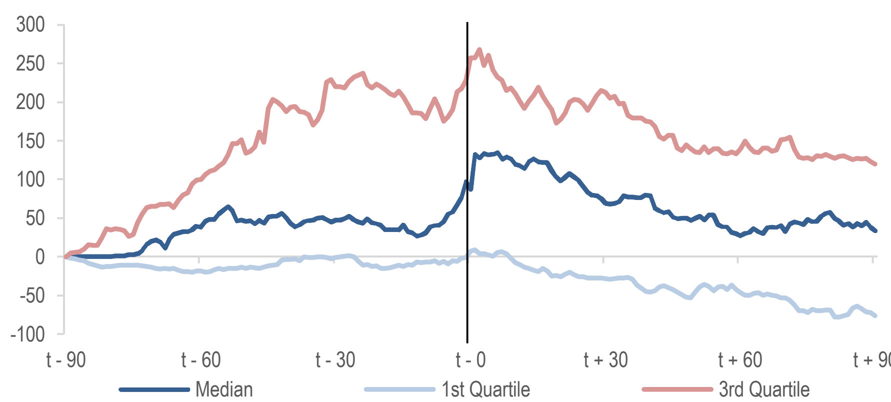


Source: J.P. Morgan, Bloomberg, Markit Group.

The harder you fall, the higher you bounce

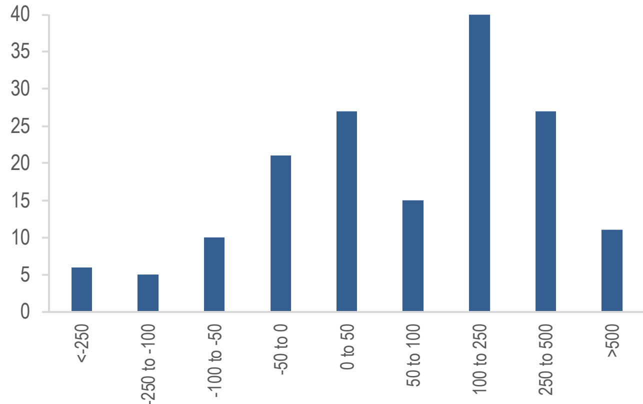
While it is useful to look at the averages, not every fallen angel follows the same pattern. In some cases, the downgrade is widely expected in advance, while in others the rating change can come as a total surprise to the market. Indeed, if we look at the dispersion of spread moves for fallen angels, it is extremely wide: one quarter of bonds widen by more than 200bp before falling into high yield, while another quarter do not widen at all (Figure 7, Figure 8 and Figure 9).

Figure 7: Fallen Angel Spread Moves, bp 1st – 3rd quartile range



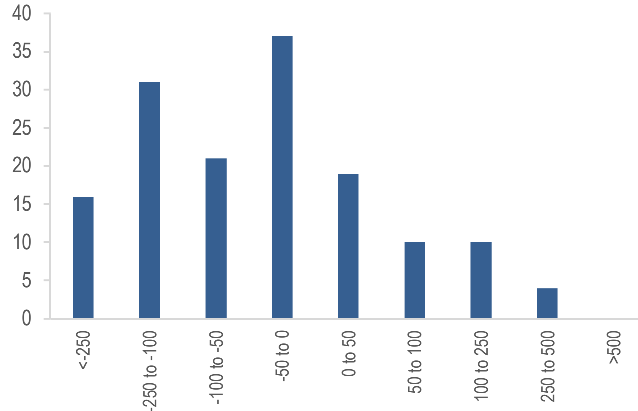
Source: J.P. Morgan, Bloomberg, Markit Group.

Figure 8: Distribution of Spread Moves Before Downgrade, # bonds



Source: J.P. Morgan, Bloomberg, Markit Group. t – 90 to t -1 inclusive.

Figure 9: Distribution of Spread Moves After Downgrade, # bonds



Source: J.P. Morgan, Bloomberg, Markit Group. t = 0 to t + 90 inclusive.

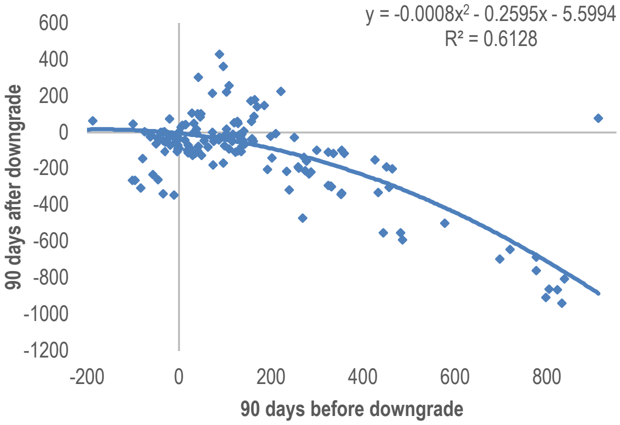
If we plot moves for individual bonds in the three months before and after being downgraded to high yield, we find a strong relationship between the size of the initial widening and the size of the following retracement (Figure 10). Further, the line of best fit is quadratic, which suggests that **bonds which see the largest falls tend to see the biggest retracement in percentage terms**. Indeed, of the 37 bonds which widened by more than 250bp before downgrade, 36 of them rallied in the three months afterward by an average of 380bp. The exception was Steinhoff, which eventually moved into default.

However, we find only limited evidence that 'surprise' downgrades, where the bond tightens in the ninety days before the rating change, see a much greater volume of forced selling. In fact, many of these actually continue to rally over the next three months, although most of them do sell off temporarily in the three days after being downgraded (Figure 11). In our view, this shows that investors' perception of credit quality can often trump the index technicals.

Instead, it is bonds which have widened by 0 – 200bp prior to downgrade which tend to perform the worst afterward, both in the immediate aftermath and over the next few months. This category tended to see the biggest immediate three day reaction to the downgrade, and in a number of individual cases they were still trading wider three months later.

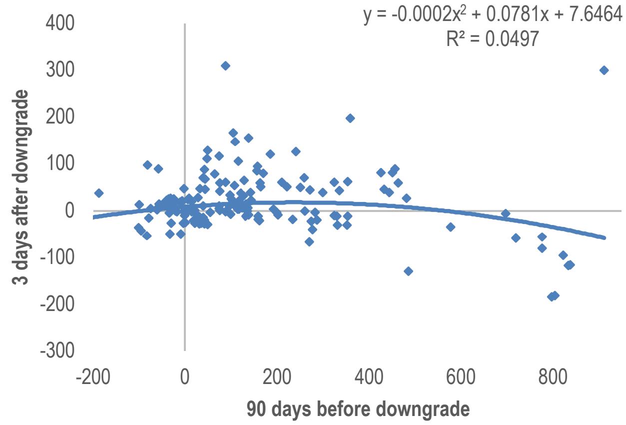
Matthew Bailey
(44-20) 7134-2384
matthew.a.bailey@jpmorgan.com

Figure 10: Fallen Angel Spread Move, 90d before vs 90d after



Source: J.P. Morgan, Bloomberg, Markit Group. t = 0 to t + 90 inclusive.

Figure 11: Fallen Angel Spread Move, 90d before vs 3d after



Source: J.P. Morgan, Bloomberg, Markit Group. t = 0 to t + 2 inclusive.

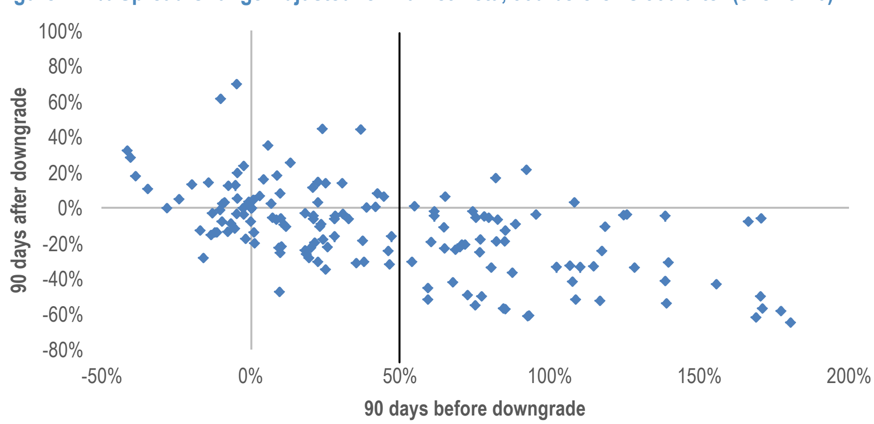
Trading rules of thumb

While the simple strategy of buying fallen angels within a few days of downgrade generates good credit returns, it is worth asking whether there are any strategies which are even more effective. In our view, there is a good rule of thumb: **buy fallen angels whose spreads have widened by more than 50% over the previous three months after adjusting for the market beta.**

By this, we mean subtracting the percentage change in market spreads over the previous three months from the percentage chance in the fallen angel spread. So, for example, if the fallen angel widens by 100%, and the market has only widened by 20%, we would say that the market adjusted spread widening is 80%, and a buy signal has been triggered.

This has generated a historical excess return of 7.6% on average, with a positive return 88% of the time, for 63 out of 69 bonds.

Figure 12: % Spread Change Adjusted for Market Beta, 90d before vs 90d after (excl. t = 0)



Source: J.P. Morgan, Bloomberg, Markit Group. Dotted line is trade signal.

Analyst Certification: All authors named within this report are research analysts unless otherwise specified.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 his or her 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, 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.

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 April 06, 2019

	Overweight	Neutral	Underweight
Global Credit Research Universe	25%	58%	17%
IB clients*	67%	63%	57%

*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.
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.

Registration of non-US Analysts: Unless otherwise noted, the non-US analysts listed on the front of this report are employees of non-US affiliates of J.P. Morgan Securities LLC, may not be registered as research analysts under FINRA rules, may not be associated persons of

J.P. Morgan Securities LLC, and may not be subject to FINRA Rule 2241 or 2242 restrictions on communications with covered companies, public appearances, and trading securities held by a research analyst account.

Other Disclosures

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

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

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 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. **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) 046/09/2018], 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. **Saudi Arabia**: J.P. Morgan Saudi Arabia Ltd. is authorized by the Capital Market Authority of the Kingdom of Saudi Arabia (CMA) to carry out dealing as an agent, arranging, advising and custody, with respect to securities business under licence number 35-07079 and its registered address is at 8th Floor, Al-Faisaliyah Tower, King Fahad Road, P.O. Box 51907, Riyadh 11553, Kingdom of Saudi Arabia. **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.

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 April 20, 2019.