Deutsche Bank
Research

North America
United States

Economics

US Economic Perspectives

Date
23 April 2019

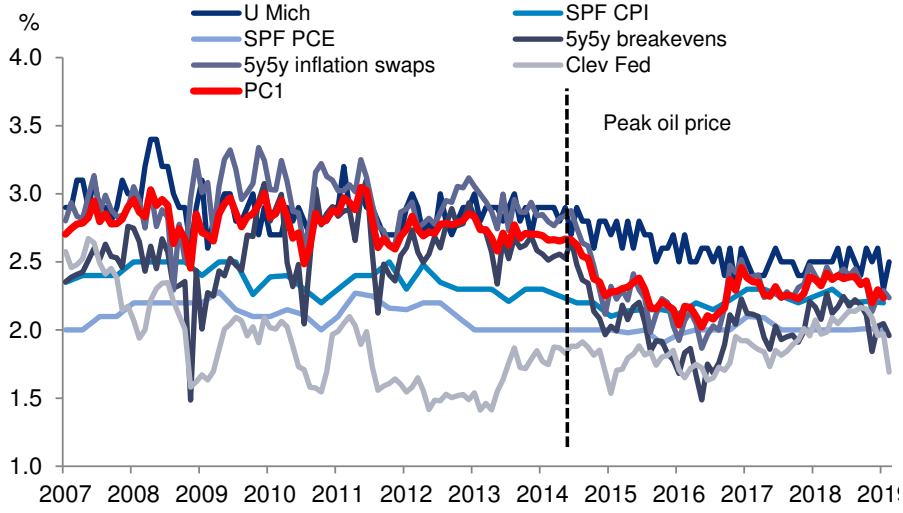
Inflated fears about falling inflation expectations?

Matthew Luzzetti
Chief US Economist
+1-212-250-6161

Avik Chattopadhyay
Research Associate

- As inflation has once again disappointed in recent months, Fed officials have expressed greater concern about the possibility that persistently below-target inflation could erode what have been, at least up until now, well-anchored inflation expectations. With low inflation expectations acting as a catalyst for the Fed's framework re-think, we discuss three observations that, at the margin, argue that the perceived slippage in inflation expectations is less worrying.
- These observations include: inflation expectations fell in response to the 2014 oil price decline but have stabilized; lower inflation expectations are driven by a compression of the upper end of the inflation expectations distribution for surveys and the inflation risk premium for market measures; and market measures of inflation compensation have been driven primarily by oil price fluctuations.

Figure 1: Inflation expectations fell with oil price shock but have been stable



Note: PC1 is the first principal component from a PCA on different measures of inflation expectations. Source : Univ. of Michigan, FRB Philadelphia, FRB Cleveland, Bloomberg Finance LP, Haver Analytics, Deutsche Bank

Introduction

As inflation has once again disappointed in recent months, Fed officials have expressed greater concern about the possibility that persistently below-target inflation could erode what have been, at least up until now, well-anchored inflation expectations. Indeed, the minutes to the March FOMC meeting highlighted that, "Several participants suggested that longer-term inflation expectations could be at levels somewhat below those consistent with the Committee's 2 percent inflation objective and that this might make it more difficult to achieve that objective on a sustained basis."

In normal times, a modest undershoot of the Fed's inflation objective – core PCE inflation rose 1.8% over the twelve months through January – and a few tenths slippage in inflation expectations would have little impact on the direction of Fed policy. These are not normal times. The Fed is in the midst of a review of their policy framework, including whether a redefinition of the 2% inflation objective could improve their ability to meet their dual mandate objectives. Under consideration are "make up" strategies, in which the Fed should aim to hit above 2% inflation following periods when inflation has run persistently below 2%.

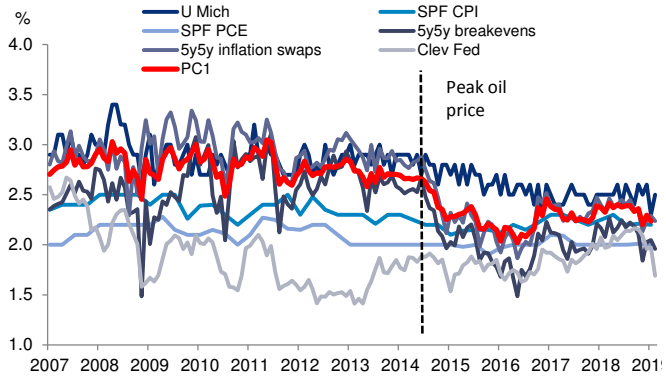
With low inflation expectations acting as a catalyst for the Fed's framework re-think, we discuss three observations that, at the margin, argue that the perceived slippage in inflation expectations is less worrying.

1. A regime change: Expectations lower but stable after 2014 oil shock

Inflation expectations are not gradually grinding lower as inflation continues to fall short of the Fed's objective. Instead, the recent experience with inflation expectations is better described as a regime change triggered by the sharp plunge in oil prices in 2014. This oil price shock led to a reassessment of inflation risks and a decline in inflation expectations to a new, lower level. Since that initial reassessment inflation expectations have generally remained stable within their new range. This experience mirrors the mid-1980s, the last time when a supply-side shock caused an oil price decline (see Trapped in a low inflation expectations regime? Lessons from the 60s and 80s).

Figure 2 shows this history from a time series perspective. We use a principal component analysis on six measures of long-term inflation expectations – University of Michigan consumer expectations, Survey of Professional Forecasters (SPF) CPI expectations, SPF PCE expectations, Cleveland Fed expectations, 5-year, 5-year (5y5y) breakevens, and 5y5y inflation swaps – to summarize the experience across the various measures. Evident is the fact that inflation expectations have remained broadly stable since falling in 2014. This lesson is clear in Figure 3 as well, which extends a table presented by NY Fed President Williams at the US Monetary Policy Forum in February. There is little evidence that inflation expectations declined compared to their pre-crisis levels prior to 2014. Nearly all of this decline occurred post that period.

Figure 2: Inflation expectations fell with oil price shock but have been stable



Note: PC1 is the first principal component from a PCA on different measures of inflation expectations.
Source : Univ. of Michigan, FRB Philadelphia, FRB Cleveland, Bloomberg Finance LP, Haver Analytics, Deutsche Bank

Figure 3: Inflation expectations were steady through 2013

Measures of Expected inflation

	2005- 2007 (a)	2012 - 2013 (b)	2017 - 2018 (c)	(b) - (a)	(c) - (b)
Michigan survey (5 year)	2.97	2.9	2.5	-0.07	-0.40
Philly Fed SPF CPI inflation expectations (10 year)	2.46	2.32	2.25	-0.14	-0.07
Philly Fed SPF PCE inflation expectations (10 year)	2.05	2.08	2.025	0.03	-0.06
Cleveland Fed inflation expectations (10 year)	2.48	1.57	1.98	-0.91	0.41
Breakeven inflation rate (5y5y)	2.47	2.66	2.1	0.19	-0.56
Breakeven inflation swap (5y5y)	2.9	2.9	2.4	0.00	-0.50

Note: The above table displays average values for various measures of expected inflation, over periods listed in each column.

Source : Univ. of Michigan, FRB Philadelphia, FRB Cleveland, Bloomberg Finance LP, Haver Analytics, Deutsche Bank

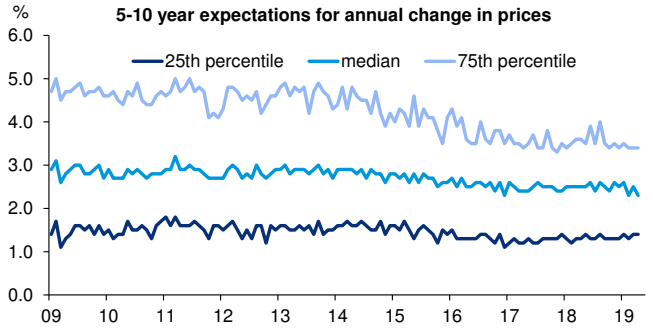
The fact that the decline in inflation expectations in recent years was triggered by the 2014 oil price shock and that, since that time, inflation expectations have stabilized at lower levels, could provide some comfort to Fed officials. So far at least, it does not appear that inflation expectations are slowly grinding lower as inflation persists below 2%.

2. Lower expectations driven by a lower inflation risk premium

Lower inflation expectations reflect a collapse in the upper-end of the inflation expectations distribution more than a downward migration in the entire distribution. In other words, the decline in inflation expectations is more about lower expectations for those that had historically expected higher inflation than everyone believing inflation will be lower going forward.

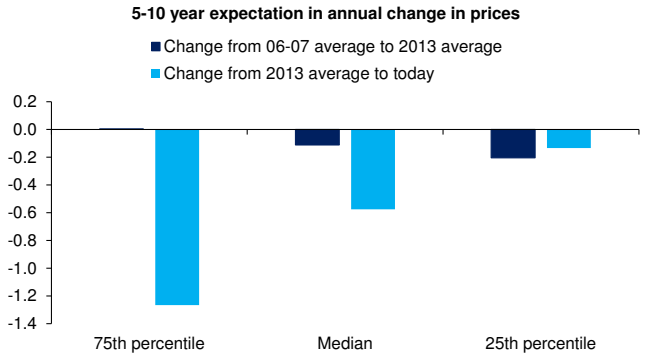
This fact is evident from the long-term inflation expectations in the University of Michigan consumer survey. The 75th percentile of inflation expectations has fallen about 125bp from its 2013 average level, while the bottom 25th percentile has only drifted slightly lower (Figures 4 and 5). Moreover, there is some tentative evidence that inflation expectations at the bottom of the distribution are actually moving higher. After bottoming around mid-2017 on a 6-month average basis, the 25th percentile of inflation expectations has actually moved about 14bp higher, reaching its highest level in nearly three years (Figure 6).

Figure 4: Inflation expectations have fallen more for upper end of distribution (i.e., those that historically expected higher inflation)



Source : Univ. of Michigan, Haver Analytics, Deutsche Bank

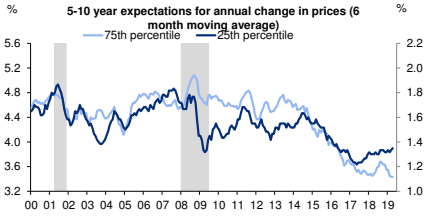
Figure 5: This reassessment of inflation risks occurred post-2013



Source : Univ. of Michigan, Haver Analytics, Deutsche Bank

A similar story is true for market measures of breakeven compensation. A decomposition from the NY Fed staff indicates that virtually all of the decline in long-term market breakevens is due to a lower inflation risk premium, not lower expected inflation (Figure 7). In fact, expected inflation has been remarkably stable for more than a decade near 2%. While this result is model-dependent, the fact that it is corroborated by the consumer survey data helps to reinforce the message.

Figure 6: Lower end of inflation expectations distribution trending higher



Source : Univ. of Michigan, Haver Analytics, Deutsche Bank

Figure 7: Inflation risk premium explains nearly all movements in breakevens

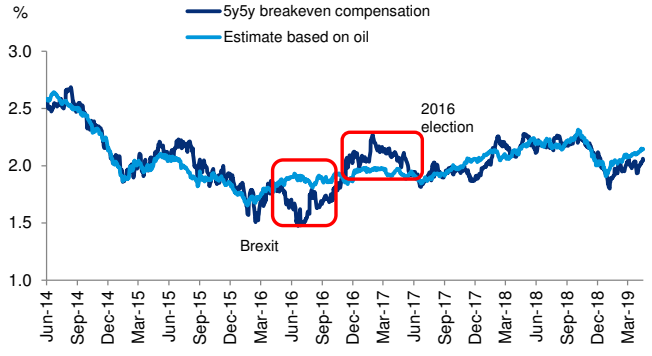
Source : FRB NY, Deutsche Bank

Should the Fed be more comfortable with lower average inflation expectations if it is driven by a "pricing out" of high inflation risks, i.e. a decline in the inflation risk premium, rather than a broad downward adjustment of inflation expectations? We think so, but so far we have not heard Fed officials use this observation as a reason to discount the apparent decline in inflation expectations.

3. Market inflation "expectations" all about oil

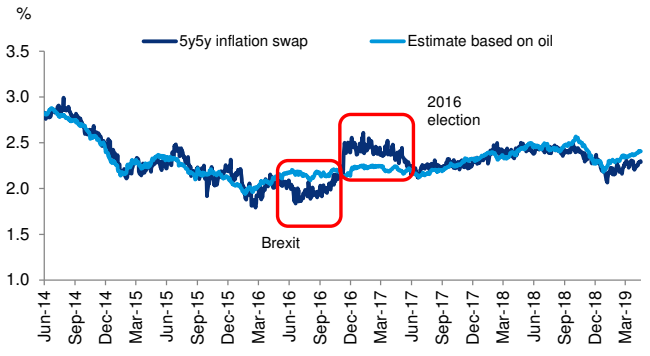
Fluctuations in 5y5y breakevens and inflation swaps can almost entirely be explained by oil prices since 2014 . The correlations between Brent oil prices and these measures of market inflation compensation are about 85% since the oil price peak in mid-2014 (Figures 8 and 9). The only two periods where a large disconnect emerged between oil prices and inflation compensation are in response to Brexit, when market measures collapsed, and following the 2016 US election when inflation compensation spiked as the "reflation trade" was in full swing.

Figure 8: Oil can explain nearly all of the fluctuations in 5y5y breakevens…



Source : Bloomberg finance LP, Deutsche Bank

Figure 9: …and the same is true for 5y5y inflation swaps



Source : Bloomberg finance LP, Deutsche Bank

Based on this relationship, long-term breakevens and inflation swaps remain below earlier levels because oil prices are well short of the 2014 peak, not because the market doubts the Fed's ability to hit its inflation objective over the longer run. This observation, along with the fact that the collapse in the inflation risk premium likely explains much, if not all, of the decline in measures of inflation compensation, may suggest that the market's long-term expected inflation rate has not fallen materially.

Appendix 1

Important Disclosures

*Other information available upon request

*Prices are current as of the end of the previous trading session unless otherwise indicated and are sourced from local exchanges via Reuters, Bloomberg and other vendors . Other information is sourced from Deutsche Bank, subject companies, and other sources. For disclosures pertaining to recommendations or estimates made on securities other than the primary subject of this research, please see the most recently published company report or visit our global disclosure look-up page on our website at https://research.db.com/Research/Disclosures/CompanySearch. Aside from within this report, important risk and conflict disclosures can also be found at https://research.db.com/Research/Topics/Equities?topicId=RB0002. Investors are strongly encouraged to review this information before investing.

Analyst Certification

The views expressed in this report accurately reflect the personal views of the undersigned lead analyst(s). In addition, the undersigned lead analyst(s) has not and will not receive any compensation for providing a specific recommendation or view in this report. Matthew Luzzetti, Avik Chattopadhyay.

Additional Information

The information and opinions in this report were prepared by Deutsche Bank AG or one of its affiliates (collectively 'Deutsche Bank'). Though the information herein is believed to be reliable and has been obtained from public sources believed to be reliable, Deutsche Bank makes no representation as to its accuracy or completeness. Hyperlinks to third-party websites in this report are provided for reader convenience only. Deutsche Bank neither endorses the content nor is responsible for the accuracy or security controls of those websites.

If you use the services of Deutsche Bank in connection with a purchase or sale of a security that is discussed in this report, or is included or discussed in another communication (oral or written) from a Deutsche Bank analyst, Deutsche Bank may act as principal for its own account or as agent for another person.

Deutsche Bank may consider this report in deciding to trade as principal. It may also engage in transactions, for its own account or with customers, in a manner inconsistent with the views taken in this research report. Others within Deutsche Bank, including strategists, sales staff and other analysts, may take views that are inconsistent with those taken in this research report. Deutsche Bank issues a variety of research products, including fundamental analysis, equity-linked analysis, quantitative analysis and trade ideas. Recommendations contained in one type of communication may differ from recommendations contained in others, whether as a result of differing time horizons, methodologies, perspectives or otherwise. Deutsche Bank and/or its affiliates may also be holding debt or equity securities of the issuers it writes on. Analysts are paid in part based on the profitability of Deutsche Bank AG and its affiliates, which includes investment banking, trading and principal trading revenues.

Opinions, estimates and projections constitute the current judgment of the author as of the date of this report. They do not necessarily reflect the opinions of Deutsche Bank and are subject to change without notice. Deutsche Bank provides liquidity for buyers and sellers of securities issued by the companies it covers. Deutsche Bank research analysts sometimes have shorter-term trade ideas that may be inconsistent with Deutsche Bank's existing longer-term ratings. Some trade ideas for equities are listed as Catalyst Calls on the Research Website (https://research.db.com/Research/) , and can be found on the general coverage list and also on the covered company's page. A Catalyst Call represents a high-conviction belief by an analyst that a stock will outperform or underperform the market and/or a specified sector over a time frame of no less than two weeks and no more than three months. In addition to Catalyst Calls, analysts may occasionally discuss with our clients, and with Deutsche Bank salespersons and traders, trading strategies or ideas that reference catalysts or events that may have a near-term or medium-term impact on the market price of the securities discussed in this report, which impact may be directionally counter to the analysts' current 12-month view of total return or investment return as described herein. Deutsche Bank has no obligation to update, modify or amend this report or to otherwise notify a recipient thereof if an opinion, forecast or estimate changes or becomes inaccurate. Coverage and the frequency of changes in market conditions and in both general and company-specific economic prospects make it difficult to update research at defined intervals. Updates are at the sole discretion of the coverage analyst or of the Research Department Management, and the majority of reports are published at irregular intervals. This report is provided for informational purposes only and does not take into account the particular investment objectives, financial situations, or needs of individual clients. It is not an offer or a solicitation of an offer to buy or sell any financial instruments or to participate in any particular trading strategy. Target prices are inherently imprecise and a product of the analyst's judgment. The financial instruments discussed in this report may not be suitable for all investors, and investors must make their own informed investment decisions. Prices and availability of financial instruments are subject to change without notice, and investment transactions can lead to losses as a result of price fluctuations and other factors. If a financial instrument is denominated in a currency other than an investor's currency, a change in exchange rates may adversely affect the investment. Past performance is not necessarily indicative of future results. Performance calculations exclude transaction costs, unless otherwise indicated. Unless otherwise indicated, prices are current as of the end of the previous trading session and are sourced from local exchanges via Reuters, Bloomberg and other vendors. Data is also sourced from Deutsche Bank, subject companies, and other parties.

The Deutsche Bank Research Department is independent of other business divisions of the Bank. Details regarding our organizational arrangements and information barriers we have to prevent and avoid conflicts of interest with respect to our research are available on our website (https://research.db.com/Research/) under Disclaimer.

Macroeconomic fluctuations often account for most of the risks associated with exposures to instruments that promise to pay fixed or variable interest rates. For an investor who is long fixed-rate instruments (thus receiving these cash flows), increases in interest rates naturally lift the discount factors applied to the expected cash flows and thus cause a loss. The longer the maturity of a certain cash flow and the higher the move in the discount factor, the higher will be the loss. Upside surprises in inflation, fiscal funding needs, and FX depreciation rates are among the most common adverse macroeconomic shocks to receivers. But counterparty exposure, issuer creditworthiness, client segmentation, regulation (including changes in assets holding limits for different types of investors), changes in tax policies, currency convertibility (which may constrain currency conversion, repatriation of profits and/or liquidation of positions), and settlement issues related to local clearing houses are also important risk factors. The sensitivity of fixed-income instruments to macroeconomic shocks may be mitigated by indexing the contracted cash flows to inflation, to FX depreciation, or to specified interest rates – these are common in emerging markets. The index fixings may – by construction – lag or mis-measure the actual move in the underlying variables they are intended to track. The choice of the proper fixing (or metric) is particularly important in swaps markets, where floating coupon rates (i.e., coupons indexed to a typically short-dated interest rate reference index) are exchanged for fixed coupons. Funding in a currency that differs from the currency in which coupons are denominated carries FX risk. Options on swaps (swaptions) the risks typical to options in addition to the risks related to rates movements.

Derivative transactions involve numerous risks including market, counterparty default and illiquidity risk. The appropriateness

of these products for use by investors depends on the investors' own circumstances, including their tax position, their regulatory environment and the nature of their other assets and liabilities; as such, investors should take expert legal and financial advice before entering into any transaction similar to or inspired by the contents of this publication. The risk of loss in futures trading and options, foreign or domestic, can be substantial. As a result of the high degree of leverage obtainable in futures and options trading, losses may be incurred that are greater than the amount of funds initially deposited – up to theoretically unlimited losses. Trading in options involves risk and is not suitable for all investors. Prior to buying or selling an option, investors must review the 'Characteristics and Risks of Standardized Options", at http://www.optionsclearing.com/about/publications/character-risks.jsp. If you are unable to access the website, please contact your Deutsche Bank representative for a copy of this important document.

Participants in foreign exchange transactions may incur risks arising from several factors, including the following: (i) exchange rates can be volatile and are subject to large fluctuations; (ii) the value of currencies may be affected by numerous market factors, including world and national economic, political and regulatory events, events in equity and debt markets and changes in interest rates; and (iii) currencies may be subject to devaluation or government-imposed exchange controls, which could affect the value of the currency. Investors in securities such as ADRs, whose values are affected by the currency of an underlying security, effectively assume currency risk.

Unless governing law provides otherwise, all transactions should be executed through the Deutsche Bank entity in the investor's home jurisdiction. Aside from within this report, important conflict disclosures can also be found at https://research.db.com/Research/ on each company's research page. Investors are strongly encouraged to review this information before investing.

Deutsche Bank (which includes Deutsche Bank AG, its branches and affiliated companies) is not acting as a financial adviser, consultant or fiduciary to you or any of your agents (collectively, "You" or "Your") with respect to any information provided in this report. Deutsche Bank does not provide investment, legal, tax or accounting advice, Deutsche Bank is not acting as your impartial adviser, and does not express any opinion or recommendation whatsoever as to any strategies, products or any other information presented in the materials. Information contained herein is being provided solely on the basis that the recipient will make an independent assessment of the merits of any investment decision, and it does not constitute a recommendation of, or express an opinion on, any product or service or any trading strategy.

The information presented is general in nature and is not directed to retirement accounts or any specific person or account type, and is therefore provided to You on the express basis that it is not advice, and You may not rely upon it in making Your decision. The information we provide is being directed only to persons we believe to be financially sophisticated, who are capable of evaluating investment risks independently, both in general and with regard to particular transactions and investment strategies, and who understand that Deutsche Bank has financial interests in the offering of its products and services. If this is not the case, or if You are an IRA or other retail investor receiving this directly from us, we ask that you inform us immediately.

In July 2018, Deutsche Bank revised its rating system for short term ideas whereby the branding has been changed to Catalyst Calls ("CC") from SOLAR ideas; the rating categories for Catalyst Calls originated in the Americas region have been made consistent with the categories used by Analysts globally; and the effective time period for CCs has been reduced from a maximum of 180 days to 90 days.

United States: Approved and/or distributed by Deutsche Bank Securities Incorporated, a member of FINRA, NFA and SIPC. Analysts located outside of the United States are employed by non-US affiliates that are not subject to FINRA regulations.

Germany: Approved and/or distributed by Deutsche Bank AG, a joint stock corporation with limited liability incorporated in the Federal Republic of Germany with its principal office in Frankfurt am Main. Deutsche Bank AG is authorized under German Banking Law and is subject to supervision by the European Central Bank and by BaFin, Germany's Federal Financial Supervisory Authority.

United Kingdom: Approved and/or distributed by Deutsche Bank AG acting through its London Branch at Winchester House, 1 Great Winchester Street, London EC2N 2DB. Deutsche Bank AG in the United Kingdom is authorised by the Prudential Regulation Authority and is subject to limited regulation by the Prudential Regulation Authority and Financial Conduct Authority. Details about the extent of our authorisation and regulation are available on request.

Hong Kong: Distributed by Deutsche Bank AG, Hong Kong Branch or Deutsche Securities Asia Limited (save that any research relating to futures contracts within the meaning of the Hong Kong Securities and Futures Ordinance Cap. 571 shall be distributed solely by Deutsche Securities Asia Limited). The provisions set out above in the 'Additional Information' section shall apply to the fullest extent permissible by local laws and regulations, including without limitation the Code of Conduct for Persons Licensed or Registered with the Securities and Futures Commission.

India: Prepared by Deutsche Equities India Private Limited (DEIPL) having CIN: U65990MH2002PTC137431 and registered office at 14th Floor, The Capital, C-70, G Block, Bandra Kurla Complex Mumbai (India) 400051. Tel: + 91 22 7180 4444. It is registered by the Securities and Exchange Board of India (SEBI) as a Stock broker bearing registration nos.: NSE (Capital Market Segment) - INB231196834, NSE (F&O Segment) INF231196834, NSE (Currency Derivatives Segment) INE231196834, BSE (Capital Market Segment) INB011196830; Merchant Banker bearing SEBI Registration no.: INM000010833 and Research Analyst bearing SEBI Registration no.: INH000001741. DEIPL may have received administrative warnings from the SEBI for breaches of Indian regulations. The transmission of research through DEIPL is Deutsche Bank's determination and will not make a recipient a client of DEIPL. Deutsche Bank and/or its affiliate(s) may have debt holdings or positions in the subject

company. With regard to information on associates, please refer to the "Shareholdings" section in the Annual Report at: https://www.db.com/ir/en/annual-reports.htm.

Japan: Approved and/or distributed by Deutsche Securities Inc.(DSI). Registration number - Registered as a financial instruments dealer by the Head of the Kanto Local Finance Bureau (Kinsho) No. 117. Member of associations: JSDA, Type II Financial Instruments Firms Association and The Financial Futures Association of Japan. Commissions and risks involved in stock transactions - for stock transactions, we charge stock commissions and consumption tax by multiplying the transaction amount by the commission rate agreed with each customer. Stock transactions can lead to losses as a result of share price fluctuations and other factors. Transactions in foreign stocks can lead to additional losses stemming from foreign exchange fluctuations. We may also charge commissions and fees for certain categories of investment advice, products and services. Recommended investment strategies, products and services carry the risk of losses to principal and other losses as a result of changes in market and/or economic trends, and/or fluctuations in market value. Before deciding on the purchase of financial products and/or services, customers should carefully read the relevant disclosures, prospectuses and other documentation. 'Moody's', 'Standard Poor's', and 'Fitch' mentioned in this report are not registered credit rating agencies in Japan unless Japan or 'Nippon' is specifically designated in the name of the entity. Reports on Japanese listed companies not written by analysts of DSI are written by Deutsche Bank Group's analysts with the coverage companies specified by DSI. Some of the foreign securities stated on this report are not disclosed according to the Financial Instruments and Exchange Law of Japan. Target prices set by Deutsche Bank's equity analysts are based on a 12-month forecast period..

Korea: Distributed by Deutsche Securities Korea Co.

South Africa: Deutsche Bank AG Johannesburg is incorporated in the Federal Republic of Germany (Branch Register Number in South Africa: 1998/003298/10).

Singapore: This report is issued by Deutsche Bank AG, Singapore Branch or Deutsche Securities Asia Limited, Singapore Branch (One Raffles Quay #18-00 South Tower Singapore 048583, +65 6423 8001), which may be contacted in respect of any matters arising from, or in connection with, this report. Where this report is issued or promulgated by Deutsche Bank in Singapore to a person who is not an accredited investor, expert investor or institutional investor (as defined in the applicable Singapore laws and regulations), they accept legal responsibility to such person for its contents.

Taiwan: Information on securities/investments that trade in Taiwan is for your reference only. Readers should independently evaluate investment risks and are solely responsible for their investment decisions. Deutsche Bank research may not be distributed to the Taiwan public media or quoted or used by the Taiwan public media without written consent. Information on securities/instruments that do not trade in Taiwan is for informational purposes only and is not to be construed as a recommendation to trade in such securities/instruments. Deutsche Securities Asia Limited, Taipei Branch may not execute transactions for clients in these securities/instruments.

Qatar: Deutsche Bank AG in the Qatar Financial Centre (registered no. 00032) is regulated by the Qatar Financial Centre Regulatory Authority. Deutsche Bank AG - QFC Branch may undertake only the financial services activities that fall within the scope of its existing QFCRA license. Its principal place of business in the QFC: Qatar Financial Centre, Tower, West Bay, Level 5, PO Box 14928, Doha, Qatar. This information has been distributed by Deutsche Bank AG. Related financial products or services are only available only to Business Customers, as defined by the Qatar Financial Centre Regulatory Authority.

Russia: The information, interpretation and opinions submitted herein are not in the context of, and do not constitute, any appraisal or evaluation activity requiring a license in the Russian Federation.

Kingdom of Saudi Arabia: Deutsche Securities Saudi Arabia LLC Company (registered no. 07073-37) is regulated by the Capital Market Authority. Deutsche Securities Saudi Arabia may undertake only the financial services activities that fall within the scope of its existing CMA license. Its principal place of business in Saudi Arabia: King Fahad Road, Al Olaya District, P.O. Box 301809, Faisaliah Tower - 17th Floor, 11372 Riyadh, Saudi Arabia.

United Arab Emirates: Deutsche Bank AG in the Dubai International Financial Centre (registered no. 00045) is regulated by the Dubai Financial Services Authority. Deutsche Bank AG - DIFC Branch may only undertake the financial services activities that fall within the scope of its existing DFSA license. Principal place of business in the DIFC: Dubai International Financial Centre, The Gate Village, Building 5, PO Box 504902, Dubai, U.A.E. This information has been distributed by Deutsche Bank AG. Related financial products or services are available only to Professional Clients, as defined by the Dubai Financial Services Authority.

Australia and New Zealand: This research is intended only for 'wholesale clients' within the meaning of the Australian Corporations Act and New Zealand Financial Advisors Act, respectively. Please refer to Australia-specific research disclosures and related information at https://australia.db.com/australia/content/research-information.html Where research refers to any particular financial product recipients of the research should consider any product disclosure statement, prospectus or other applicable disclosure document before making any decision about whether to acquire the product. In preparing this report, the primary analyst or an individual who assisted in the preparation of this report has likely been in contact with the company that is the subject of this research for confirmation/clarification of data, facts, statements, permission to use company-sourced material in the report, and/or site-visit attendance. Without prior approval from Research Management, analysts may not accept from current or potential Banking clients the costs of travel, accommodations, or other expenses incurred by analysts attending site visits, conferences, social events, and the like. Similarly, without prior approval from Research Management and Anti-Bribery and Corruption ("ABC") team, analysts may not accept perks or other items of value for their personal use from

issuers they cover.

Additional information relative to securities, other financial products or issuers discussed in this report is available upon request. This report may not be reproduced, distributed or published without Deutsche Bank's prior written consent.

David Folkerts-Landau
Group Chief Economist and Global Head of Research

Pam Finelli
Global Chief Operating Officer
Research

Michael Spencer
Head of APAC Research

Steve Pollard
Head of Americas Research
Global Head of Equity Research

Anthony Klarman
Global Head of
Debt Research

Kinner Lakhani
Head of EMEA
Equity Research

Joe Liew
Head of APAC
Equity Research

Jim Reid
Global Head of
Thematic Research

Francis Yared
Global Head of Rates Research

George Saravelos
Head of FX Research

Peter Hooper
Global Head of
Economic Research

Andreas Neubauer
Head of Germany Research

Spyros Mesomeris
Global Head of Quantitative
and QIS Research

International Production Locations

Deutsche Bank AG
Deutsche Bank Place
Level 16
Corner of Hunter & Phillip Streets
Sydney, NSW 2000
Australia
Tel: (61) 2 8258 1234

Deutsche Bank AG
Equity Research
Mainzer Landstrasse 11-17
60329 Frankfurt am Main
Germany
Tel: (49) 69 910 00

Deutsche Bank AG
Filiale Hongkong
International Commerce Centre,
1 Austin Road West,Kowloon,
Hong Kong
Tel: (852) 2203 8888

Deutsche Securities Inc.
2-11-1 Nagatacho
Sanno Park Tower
Chiyoda-ku, Tokyo 100-6171
Japan
Tel: (81) 3 5156 6770

Deutsche Bank AG London
1 Great Winchester Street
London EC2N 2EQ
United Kingdom
Tel: (44) 20 7545 8000

Deutsche Bank Securities Inc.
60 Wall Street
New York, NY 10005
United States of America
Tel: (1) 212 250 2500