Investment Insights

UBS Asset Management

For professional clients/institutional investors only | February 2018

The correlation between equites and bonds has been particularly volatile in recent weeks as concerns about a step change in inflation and interest rates grow. *Investment Insights* considers the long-term correlation between equities and bonds, its drivers and the likelihood that we are entering a new and higher correlation regime between these two core asset classes.

If you would like to learn more about the ways we can help you meet your investment challenges, please contact your UBS representative or visit **www.ubs.com/am**.

Relationship troubles

Erin Browne, Louis Finney, Dan Heron

- The correlation between asset classes lies at the very core of strategic asset allocation and the search for improved risk-adjusted returns in multi asset portfolios
- We identify four equity/bond correlation 'regimes' over the past ninety years of US equity/bond data and further show the sensitivity of the relationship to key macroeconomic variables
- Our analysis reveals that the level of inflation and the volatility of inflation have been the most influential drivers historically to the equity/bond relationship in the US
- A new regime? As output gaps close and inflation edges upwards we expect a higher rolling 5yr equity/bond correlation than investors have been used to for most of the past decade
- Rising term premium in US Treasuries may also reflect investors' belief that the diversification benefits and safe haven utility of bonds are reducing
- We expect the rolling five year correlation to edge further towards zero but given the on-going structural forces weighing on inflation we do not see markets returning to the strong positive correlation regime of the 1970s to late 1990s

Global investors are learning quickly to be careful what they wish for. Over the past two years equity markets have been supported by accelerating economic growth and by the stronger-than-expected corporate profits that growth has generated.

But as evidence of the global demand impulse broadens and as output gaps in developed economies close, investors have started to consider whether such demand strength can continue without stirring a more meaningful and sustained pick-up in consumer prices than has been evident to-date. Will inflationary pressures require the Federal Reserve to raise rates quicker and to a higher terminal rate than investors previously thought?

These questions and the shifting macroeconomic narrative have seen the correlation between developed world equities and government bonds oscillate wildly in recent weeks. To multi asset investors this presents both challenge and opportunity.

This month's *Investment Insights* considers the long-term correlation between equities and bonds, the macroeconomic catalysts to major multi-year changes in the relationship, and considers the likelihood that we are entering a new regime for equity/bond correlations in the developed world as inflation expectations rise.

UBS

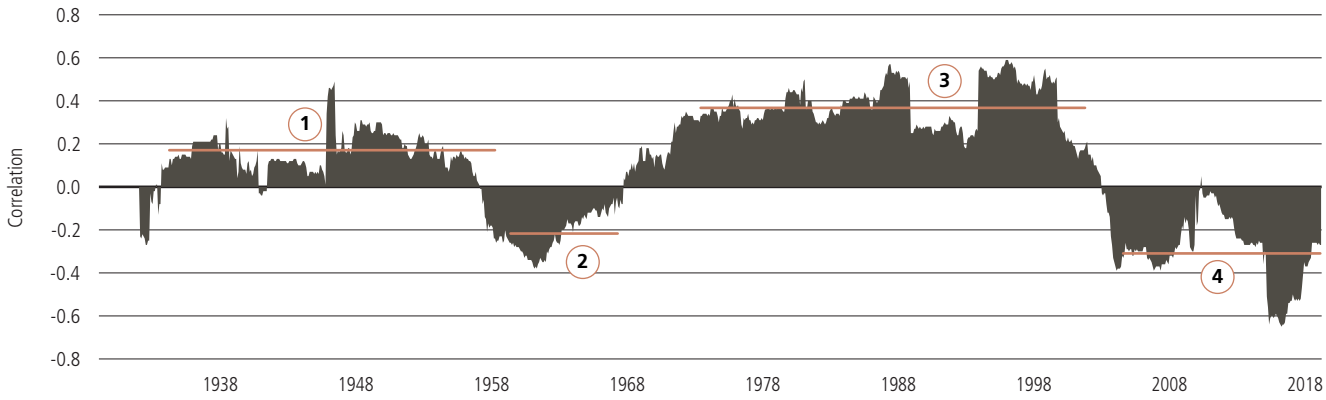
Long-term correlation history
The long-run history of rolling 5-year correlation between large cap US stocks and 10yr US nominal Treasuries ("equity/bond correlation") is presented in exhibits 1 and 2 below.

For the entire 89-year period the correlation is 0.08. But taken in isolation this headline long-term figure hides what the charts show very clearly: first, how dynamic and variable the relationship between these two key asset classes has been over time; second, that there have been several clearly identifiable "regimes" of equity/bond correlation in the US historically.

1. From 1931 to 1955, the correlation between the two was slightly positive at 0.16.
2. From 1956 to 1964, the correlation was -0.22, hitting a low of -0.38 in 1960.
3. The correlation rose steadily to become positive again in 1966. From 1970 to 1998, the correlation was 0.37
4. Since the late 1990s, the correlation has been -0.30.

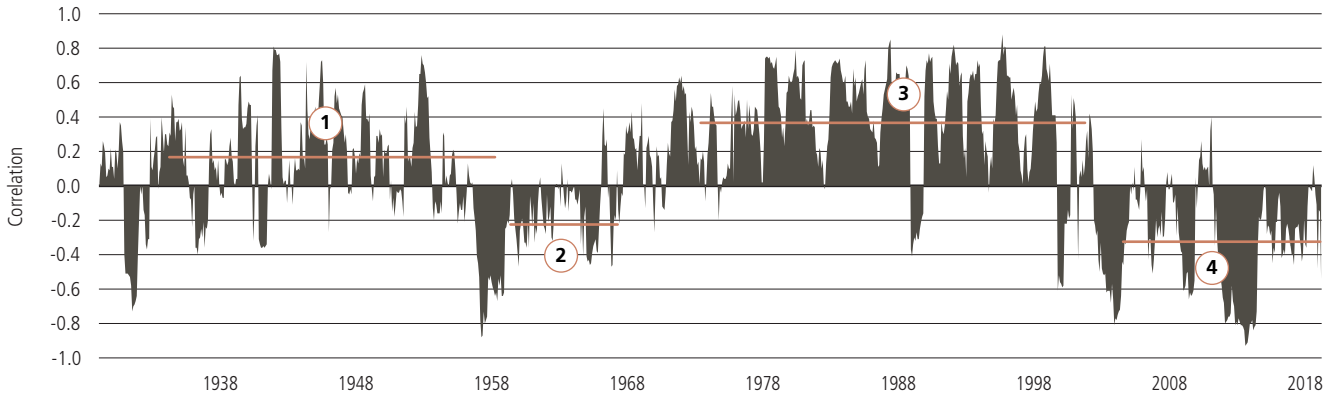
Outside the US, we see a similar relationship. Going into the 1990s, the stock-government bond correlation was positive for major developed markets. (See exhibit 3.) It turned negative first for Japan in the early 1990s, just after the bursting of the Japanese equity and real estate bubble created a disinflationary environment. Lagging the US by a few years, Australia, Switzerland and the United Kingdom saw declining correlations in the late 1990s and the relationship turned negative in the early 2000s. Recently, several of these have turned positive once more. The one exception is Canada, where the relationship remained positive through the entire time period.

Exhibit 1: Rolling 5-year correlation US Large Cap Stocks–10y nominal US Treasuries (1932–2017)



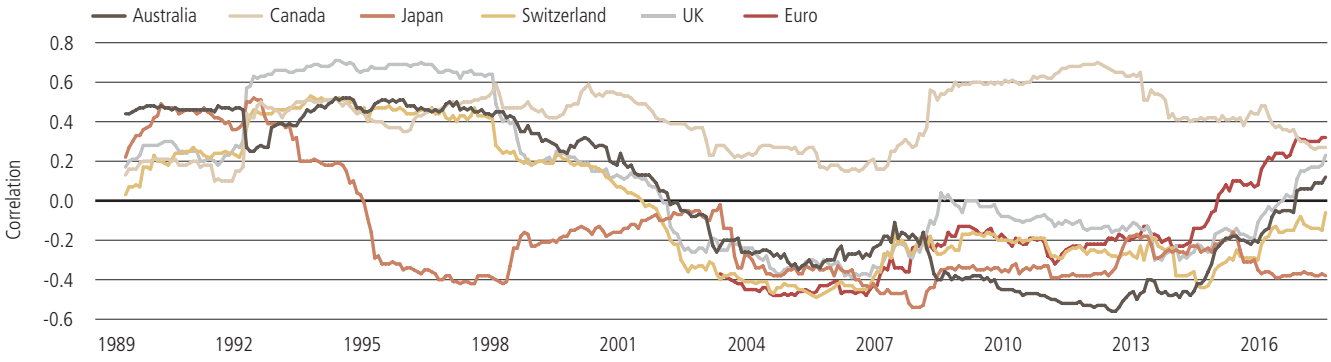
Source: Morningstar Direct, Stocks-Bonds Blls and Inflation

Exhibit 2: Rolling 1-year correlation US Large Cap Stocks–10y nominal US Treasuries (1928–2017)



Source: Morningstar Direct, Stocks-Bonds Blls and Inflation

Exhibit 3: Developed World ex US rolling 5yr stock-govt bond correlation



Source: MSCI, Bloomberg, Barclays

So what macroeconomic factors have been the most important in determining these stock/bond correlation 'regimes' historically?

Perhaps a little surprisingly, our analysis suggests no meaningful statistical relationship between the equity/bond correlation in the past. Our hypothesis is that this largely reflects equities' complex relationship with the growth backdrop via both the earnings and PE multiple channels—and economic growth's interconnectivity with inflation and interest rates.

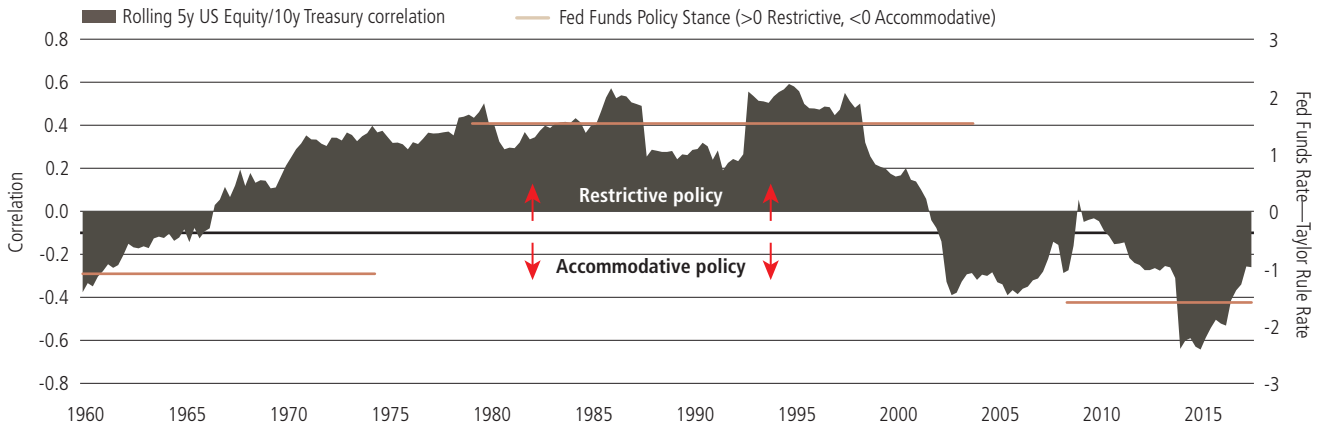
The relationship between the equity/bond correlation and short-term interest rates is also nuanced. Prima facie, we would expect both asset classes to demonstrate a positive correlation to the level of interest rates. The net present value of both asset classes is derived from future cashflows accruing to the asset owner (coupons to bondholders, dividends to shareholders), discounted by the time value of money as relevant to each security type. All else equal, higher rates should lead to higher discount rates and to lower valuations for both equities and bonds; lower short-term rates should lead to lower discount rates and higher valuations based on the discounted cashflow methodology.

But as we have seen in markets over most of the past two years, rising short-term interest rates are not a de facto negative for equities if they are accompanied by strong earnings growth.

It was this common exposure to the discount rate factor that supported the conventional wisdom of asset allocation in the 1990s that there should be a slight positive correlation between stocks and bonds. This premise also fits the 25 year historical experience of positive correlation that prevailed in the 1990s—but conveniently ignored that the correlation between equities and bonds had been negative for protracted periods prior to this regime. But as we have seen in markets over most of the past two years, rising short-term interest rates are not a de facto negative for equities if they are accompanied by strong earnings growth.

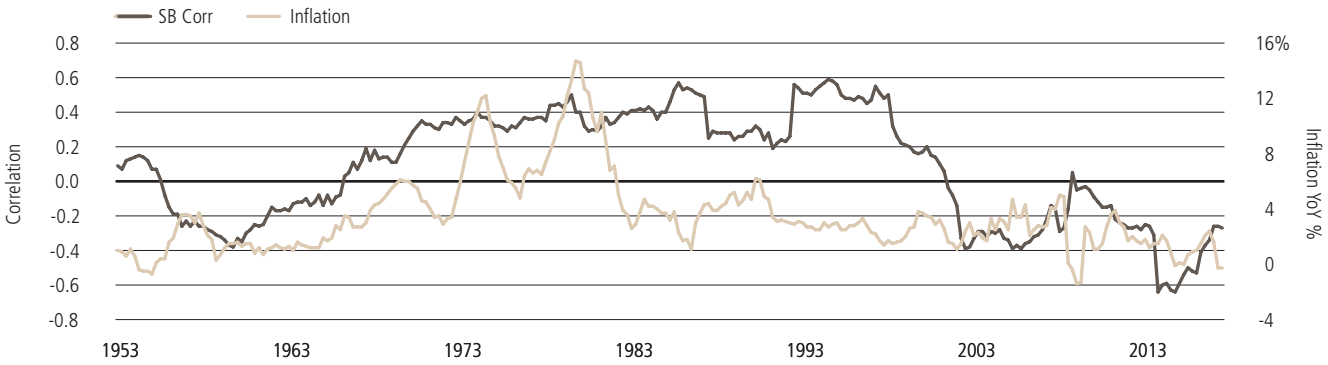
Our analysis shows a much stronger relationship between the overall policy stance, and whether the prevailing rate is restrictive or accommodative, than the absolute level of rates. In exhibit 4, we show rolling five year US stock/bond correlation against the Fed Funds rate relative to where rates should be according to the widely used Taylor Rule.

Exhibit 4: Correlation vs Monetary Policy Stance: Rolling 5yr stock-bond correlation (LHS) vs Monetary policy relative to Taylor Rule (RHS, % point difference between Fed Funds Rate and Taylor Rule implied rate, average over each discrete period)



Source: Atlanta Federal Reserve Bank
The Taylor Role is best described as a yardstick for monetary policy. Created by Stamford University economist John Taylor the 'rule' is a formula for forecasting short-term interest rates based on inflation relative to the central bank's target and output relative to potential. The official Federal Funds rate is therefore often compared to the rate derived by the Taylor Rule—and described as 'restrictive' if higher than the Taylor Rule derived rate, and 'accommodative' if lower than the Taylor Rule derived rate.

Exhibit 5: Rolling 5-year stock-bond correlation (LHS) vs inflation, (RHS), monthly data



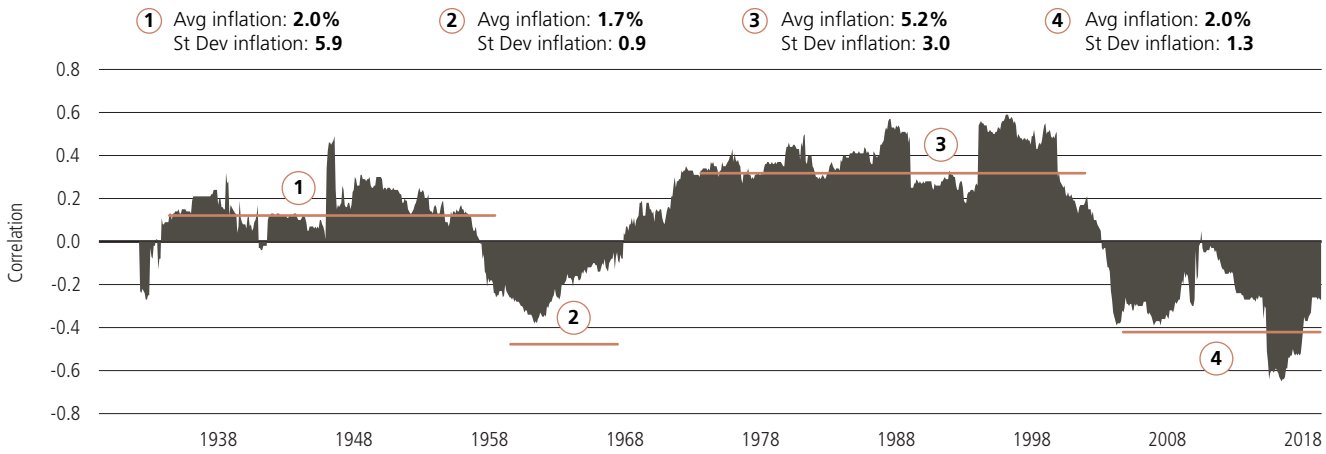
Source: Morninstar Directi, Stocks, Bonds, Bills and Inflation.

Indeed, there appears to be a strong statistical relationship between the four equity/bond correlation regimes historically and the prevailing inflation backdrop. Our analysis (exhibit 6) shows that it is both the level of inflation and the volatility of inflation together that appear to have a strong link with the equity/bond correlation regime. This appears to reflect on one side, the obvious negative impact of higher inflation on nominal bond prices, and on the other the strong negative statistical relationship between higher macroeconomic uncertainty and equity PE multiples.

1. From 1931 to 1955, the US equity/bond correlation was slightly positive at 0.16. While the average annual inflation rate over this period was relatively low in an historical context, the volatility of inflation was extremely high. The Standard Deviation of annual CPI inflation figures during this era was 5.9

Indeed, there appears to be a strong statistical relationship between the four equity/bond correlation regimes historically and the prevailing inflation backdrop.

Exhibit 6. Rolling 5-Year US stocks/bonds correlation (LHS) v inflation regimes (average inflation*St Dev of inflation for discrete period)



Source: Morningstar Direct, Stocks-Bonds BIlls and Inflation

2. From 1956 to 1964, the US equity/bond correlation was -0.22, hitting a low of -0.38 in 1960. At 1.7%, the average level of annual inflation during this period was broadly similar to that of the prior period. Importantly however, the level of inflation volatility was very low, with the Standard Deviation of annual inflation just 0.9
3. From 1970 to 1998, the US equity/bond correlation was strongly positive at 0.37. Both the level of average inflation (5.2%) and the Standard Deviation of inflation (3.0) across this period were high
4. Since the late 1990s, the US equity/bond correlation has been -0.30. Like the second period, the past two decades have been witness to low average inflation (2.0%) and very low inflation volatility (Standard Deviation 1.3)

Academic studies

Unsurprisingly given that equities and government bonds often represent the core of investors' portfolios, the relationship between these two core asset classes has been subject to a plethora of academic analysis. Among the best known are Shiller and Beltratti 1992 and Campbell and Ammer 1993. Both studies focus on the discount rate for stocks and bonds as the primary determinant of volatility and comovement.

Unsurprisingly given that equities and government bonds often represent the core of investors' portfolios, the relationship between these two core asset classes has been subject to a plethora of academic analysis.

Ilmanen (2003) goes into greater detail trying to classify the relationship by type of regime. He notes "…negative correlation makes government bonds excellent hedges against major systematic risks—recession, deflation, equity weakness, and other financial market crises—and this attractive feature may justify an exceptionally low bond risk premium…". Ilmanen moves on to note that at high levels of inflation changes in discount rates dominate the relationship, while stable discount rates (i.e. low inflation), growth concerns dominate and produces low correlation and flights to quality will produce a negative correlation.

Overall the academic literature now accepts that the correlation between equities and government bonds is non-stationary and varies with the prevailing economic regime.

Why it matters: asset allocation

The benefits of diversification are highly dependent on the correlation of asset classes. Alongside volatility and expected return, the interaction between asset classes as measured by correlations is a critical input into strategic asset allocation. Any significant shift in the equity/bond correlation 'regime', therefore has potentially significant implications for the behavior of multi asset portfolios, for multi asset return expectations and for the portfolio optimization process.

Looking forward, we see inflation ticking higher as global output gaps close and as wage growth rises from its current very low base in the developed world.

Shifting correlations also impact potential returns. In theory, the correlation between asset classes should be reflected in embedded risk premia and in expected returns. This simply reflects that rational investors expect higher returns during periods when correlations are high to compensate for lower diversification benefits, and accept lower expected returns when correlations are low because the diversification benefits are more significant. In markets there are strong arguments that the recent rise in the term premia in US Treasuries—the compensation investors receive for holding long-term bonds over and above expectation for rates—reflects that investors see bonds offering a lower safe haven utility and diversification benefit and therefore want a lower price and higher yield. This concept is embedded in the widely adopted Black-Litterman formula that helps formulate equilibrium market views (Idzorek 2004) and lies at the heart of modern strategic asset allocation.

For specific investor groups, there are more precise and complex implications. For liability sensitive investors like defined benefit pension plans, a negative correlation between equities and government bonds results in higher funding volatility compared to positive correlation regimes as liabilities increase and asset values fall. These sensitivities make the difficult task of pension risk management all the more complex and we believe that pension plan managers need to incorporate more comprehensive mechanisms to control funded status volatility than those that are focused solely on the asset/growth portfolio.

The bottom line: investment implications

What proportion of a portfolio to allocate to specific assets is the essential quandary facing all multi asset investors—a quandary further complicated by the deliberate role central bank Quantitative Easing programs have played in supporting all risk assets and distorting the correlations that play such an important role in the asset allocation process.

On our analysis, the long run correlation of large cap US equities to 10yr nominal US treasuries is 0.08.We therefore believe that long term investors should probably start with the presumption of zero correlation of stock and bonds.

But recognizing that correlations are dynamic and time varying is essential to efficient portfolio construction. This variability is captured in our own asset allocation modelling using correlation matrices. We do not attempt to call daily changes to investor risk aversion or the equity-bond correlation, but instead focus on the potential for regime change in the statistical relationship between equities and bonds over multi-year periods based on clear evidence historically.

Looking forward, we see inflation ticking higher as global output gaps close and as wage growth rises from its current very low base in the developed world. This is exactly what should be happening at this point in the cycle. We see this modest repricing of inflation as a support not a threat to corporate profitability and to equity prices. We view the probability of a violent shift higher in global bond yields as unlikely in the context of powerful demographic drivers and the on-going expansion of central bank balance sheets globally.

Against this backdrop we expect the rolling 5yr US equity/bond correlation to also edge higher. By definition, this is likely to mean that bonds are not as effective a portfolio diversifier as they are when the equity/bond correlation is strongly negative. But importantly we do not currently expect a return to the sort of strongly positive correlation regime that would likely necessitate major asset allocation rebalancing for investors without a more meaningful and sustained pick-up in inflationary pressures and macroeconomic volatility.

Further reading

If you would like to learn more about the ways we can help you meet your investment challenges, please contact your UBS representative or visit **www.ubs.com/am.**

References

- Campbell, John, and John Ammer; "What Moves the Stock and Bond Markets? A Variance Decomposition of Long Term Asset Returns." Journal of Finance, 48, pp 3-37, 1993
- Idzorek, Thomas M. "A Step-by-Step Guide to the Black-Litterman Model." Zephyr Associates, Inc. July, 2004.
- Ilmanen, Antti, "Stock-Bond Correlations", The Journal of Fixed Income, 13,2, September 2003
- Johnson, Nicholas; Naik, Vasant; Pedersen, Neils; Sapra, Steve, "The Stock-Bond Correlation", Quantitative Research, PIMCO, November 2013
- Shiller, Robert, and Beltratti, Andrea, "Stock Prices and Bond Yields—Can their Comovement be Explained in Terms of Present Value Models?", Journal of Monetary Economics 30, pp25-46, 1992

You are advised to exercise caution in relation to this document. The information in this document does not constitute advice and does not take into consideration your investment objectives, legal, financial or tax situation or particular needs in any other respect. Investors should be aware that past performance of investment is not necessarily indicative of future performance. Potential for profit is accompanied by possibility of loss. If you are in any doubt about any of the contents of this document, you should obtain independent professional advice.

Australia
This document is provided by UBS Asset Management (Australia) Ltd, ABN 31 003 146 290 and AFS License No. 222605.

China
The securities may not be offered or sold directly or indirectly in the People's Republic of China (the "PRC"). Neither this document or information contained or incorporated by reference herein relating to the securities, which have not been and will not be submitted to or approved/verified by or registered with the China Securities Regulatory Commission ("CSRC") or other relevant governmental authorities in the PRC pursuant to relevant laws and regulations, may be supplied to the public in the PRC or used in connection with any offer for the subscription or sale of the Securities in the PRC. The securities may only be offered or sold to the PRC investors that are authorized to engage in the purchase of Securities of the type being offered or sold. PRC investors are responsible for obtaining all relevant government regulatory approvals/licenses, verification and/or registrations themselves, including, but not limited to, any which may be required from the CSRC, the State Administration of Foreign Exchange and/or the China Banking Regulatory Commission, and complying with all relevant PRC regulations, including, but not limited to, all relevant foreign exchange regulations and/or foreign investment regulations.

Hong Kong
This document and its contents have not been reviewed by any regulatory authority in Hong Kong. No person may issue any invitation, advertisement or other document relating to the Interests whether in Hong Kong or elsewhere, which is directed at, or the contents of which are likely to be accessed or read by, the public in Hong Kong (except if permitted to do so under the securities laws of Hong Kong) other than with respect to the Interests which are or are intended to be disposed of only to persons outside Hong Kong or only to "professional investors" within the meaning of the Securities and Futures Ordinance (Cap. 571) and the Securities and Futures (Professional Investor) Rules made thereunder.

Japan
This document is for informational purposes only and is not intended as an offer or a solicitation to buy or sell any specific financial products, or to provide any investment advisory/management services.

Korea
The securities may not be offered, sold and delivered directly or indirectly, or offered or sold to any person for re-offering or resale, directly or indirectly, in Korea or to any resident of Korea except pursuant to the applicable laws and regulations of Korea, including the Capital Market and Financial Investment Business Act and the Foreign Exchange Transaction Law of Korea, the presidential decrees and regulations thereunder and any other applicable laws, regulations or rules of Korea. UBS Asset Management has not been registered with the Financial Services Commission of Korea for a public offering in Korea nor has it been registered with the Financial Services Commission for distribution to non-qualified investors in Korea.

Taiwan
This document and its contents have not been reviewed by, delivered to or registered with any regulatory or other relevant authority in the Republic of China (R.O.C.). This document is for informational purposes and should not be construed as an offer or invitation to the public, direct or indirect, to buy or sell securities. This document is intended for limited distribution and only to the extent permitted under applicable laws in the Republic of China (R.O.C.). No representations are made with respect to the eligibility of any recipients of this document to acquire interests in securities under the laws of the Republic of China (R.O.C.).

Source for all data and charts (if not indicated otherwise): UBS Asset Management

18-0155 2/18
www.ubs.com/am

For professional clients/institutional investors only.