UBS

10 December 2019, 10:00AM UTC
Chief Investment Office GWM
Investment Research

Negative interest rates and the pension system: pension funds face major challenges

Swiss economy

Authors: Jackie Bauer, Economist, UBS Switzerland AG; Alessandro Bee, Economist, UBS Switzerland AG; Veronica Weisser, Analyst, UBS Switzerland AG

- The performance of pension fund portfolios has benefited thus far from declining interest rates.
- The bigger challenges are yet to come – if interest rates stay low for longer, but also if they rise again.
- The rising live expectancy is an additional challenge, declining pension benefits may be a consequence.

A survey in the UBS Outlook Switzerland (November 2019) on the impact of negative interest rates shows that more than half of the responding companies are concerned about the deteriorating financial situation of their pension fund. This is surprising given the solid performance of pension funds in recent years. Respondents were probably thinking more about future performance and the demographic challenges faced by the second pillar.

The Swiss pension system manages almost CHF 1,100 billion in assets. The capital of the first pillar's Social Security Fund contributes the smallest part, at around CHF 45 billion. In the pay-as-you-go financed old-age and survivors' insurance (OASI, AHV) the current income should be sufficient for current pension payments.

This makes the first pillar theoretically independent of financial markets. However, due to the decline in birth rates, expenditure has been exceeding contributions for some time, and so the financial market return is of some importance after all. In order to guarantee the promised AHV pensions in the future, the reserves should at the same time achieve a higher as well as a safer return. The former suggests a riskier investment strategy and the latter a lower-risk strategy. The AHV Social Security Fund invests a large part in safe bonds, although in foreign currency with higher interest rates and higher risk (Fig. 1).

Fig. 1: Investment strategy of the AHV Social Security Fund

Asset class	Allocation 2019	Range
Loans CHF	8%	5% - 15%
Bonds CHF	13%	7% - 17%
Bonds foreign currency	44%	38% - 48%
Equities	24%	17% - 27%
Real Estate	9%	6% - 12%
Precious metals	2%	0% - 4%
Cash	0%	0% - 5%

Source: Compenswiss, UBS

The second pillar, at around CHF 900 billion, retains the largest share of pension capital. The funding principle behind this part of the system is like forced savings. The capital saved individually during an individual’s working life should, on average, be sufficient for each generation to finance pension payments in retirement. In addition to the contributions of employees and employers, the so-called "third contributor", the returns on managed capital, is also a very important component. The law imposes

This report has been prepared by UBS Switzerland AG. Please see important disclaimers and disclosures at the end of the document.

investment guidelines on pension funds. The effective investment strategy of pension funds (Fig. 2) shows that they invest less in high-risk and illiquid investments than the legislator allows. About one third of the capital is in bonds. Negative interest rates, however, call into question the security of bonds investments.

Fig. 2: Investment guidelines not exhausted

Extract of investment rules from BVV2, Chapter 4, Section 3 and average allocation according to UBS Pension Fund Performance 2019

Asset class	Allocation 2019	Allocation boundaries
Bonds	35%	max. 100%
Real Estate	20%	max. 30%
Equities	30%	max. 50%
Alternative investments	10%	max. 15%

Source: BVV2, UBS

Pillar 3a is becoming increasingly important. Today, more than CHF 120 billion have been saved in voluntary pension provision. Collectively, the same investment guidelines apply to 3a pension foundations as to the second pillar. The 3a foundations are also far from pushing the legal limits, as private investors also prefer bonds and 3a interest-rate accounts. Their yields are likely to be negative in the coming years after deducting inflation. From an investment angle, pillars two and 3a face the same challenges: low interest rates and low growth opportunities make it difficult to find a secure income.

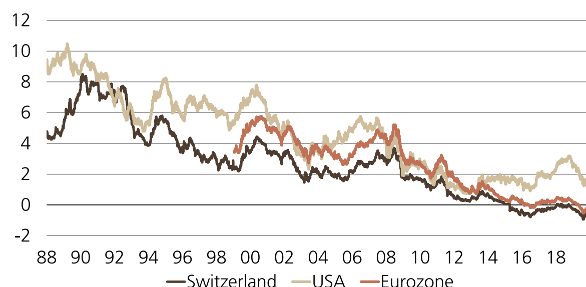
In the second pillar, demographic change is an additional challenge. As this is the most important source of income in retirement for most insured persons, the focus is on occupational pension funds below.

Looking back: negative interest rates unequal negative yields

Interest rates in the industrialized countries have been trending downward for decades (Fig. 3).

Fig. 3: Interest rates on a downward trend

5-year swap interest rates of different countries, in percent



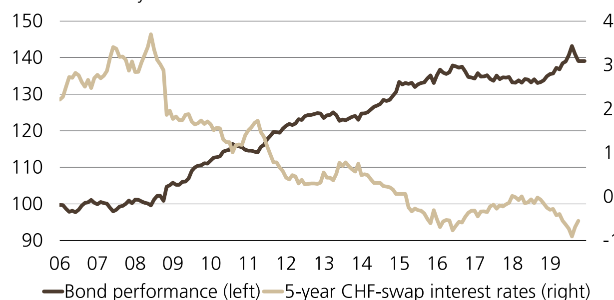
Source: Macrobond, UBS

The global financial crisis reinforced this trend and has brought Switzerland the lowest key interest rates in the world. The lower the key interest rates, the lower the interest rates on longer-term bonds usually fall. As a result, the current interest income (coupon payments) of pension funds, especially recently, has been lower than in the past and the "safe return" is smaller.

However, thus far the positive effects of falling interest rates have been much greater. Falling interest rates mean rising bond prices (Fig. 4), even for interest rates in negative territory. This inverse relationship can be explained by the fact that bonds already issued have a higher value when interest rates fall, since they yield a larger coupon than newly issued ones. On the other hand: If interest rates rise, newly issued bonds with a higher coupon are more attractive to the investor, which reduces the value of previously issued bonds.

Fig. 4: Interest rates and bond value move in the opposite direction

5-year CHF swap interest rate in percent and cumulative performance of the CHF bond portfolio according to UBS Pension Fund Performance indexed January 2006



Source: Macrobond, UBS

The decline in interest rates over the past ten years has increased the value of bonds in the portfolios of pension funds: the average annual performance of high-quality Swiss franc bonds has been 3.5 percent. Falling interest rates have also had a positive impact on other asset classes. Thanks to falling interest rates, expected profits must be discounted at lower rates. Swiss and global equities have additionally benefited from a booming global economy. The US stock market has made the largest contribution with a return of around 11 percent per year, while other major markets, as well as Switzerland, have also delivered considerable returns, with an average of eight percent per year.

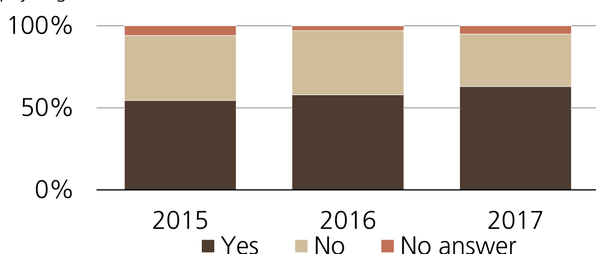
The Swiss real estate market has also benefited from lower interest rates, as well as from the rising demand for housing due to immigration. The average return has

been six percent. Because of the ever-lower interest rates, real estate has been and remains an important source of returns for pension funds. Alternative investments such as hedge funds, private equity and commodities have also contributed to a diversified performance, but are a less important source of return with less than ten percent weight in the portfolio. Overall, the pension funds regularly monitored by UBS have achieved an average of 4.2 percent performance per year since 2009.

The bottom line is that the performance of pension fund assets has benefited from falling capital market interest rates, but they are nonetheless feeling the effects of negative interest rates. A majority of pension funds pay negative interest on their cash deposits (Fig. 5). Although cash positions account for a small part of the total capital at around five percent, the costs amount to CHF 400 million per year, according to the Swiss Pension Fund Association (Asip).

Fig. 5: Nearly two-thirds of pension funds pay negative interest on cash deposits

Results of Swisscanto's Swiss Pension Fund Study 2019; Question: Do you pay negative interest?



Source: Swisscanto Vorsorge AG, UBS

What next for pension fund performance?

While falling interest rates have so far supported pension funds, the big challenges are yet to come. This will be the case whether interest rates remain low for a long time or whether they start to rise again.

Baseline scenario: a gradual rise in interest rates

In our baseline scenario, we expect slightly negative returns for Swiss Eidgenossen and CHF-denominated bonds with a high credit rating over an investment horizon of seven years – a sobering view compared to returns in recent years.

While we expect interest rates to rise, we expect them to rise slowly and to a very moderate level by historical standards. The coverage ratio of a pension fund in this scenario would decline initially due to the fall in the bond portfolio's value. Although most pension funds hold their bonds until the end of the term and losses would primarily be a book effect, it would still lead to a fall in asset value, which would harm the health of the pension fund and thus negatively affect future investment behavior. Initial price losses would be compensated by the gradual increase in coupons over the long term.

Falling interest rates have supported real estate investment as they have driven an increase in property prices. A moderate rise in interest rates would imply the high capital gains on real estate are likely to be a thing of the past. Nevertheless, we expect that a high-quality real estate portfolio should generate a reasonable rental return and achieve an attractive return of around three percent compared to Swiss bonds.

A rise in wages leads to margin compression and could dampens stock market performance, so that over the seven-year investment horizon, they will, on average, yield only about half as much per year as in previous years. For a typical pension fund portfolio, we therefore expect an average annual return of 2.3 percent over the next seven years.

Alternative scenario: negative interest rates for the foreseeable future

If interest rates remain in negative territory for the foreseeable future, this will also be a problem for pension funds. While a bond portfolio would not initially lose value – and even benefit from further falls in interest rates – the return prospects for highly rated bonds would be negative for a long time to come.

The impact of long-term negative interest rates on other asset classes depends on why interest rates fail to rise. If the environment of recent years repeats itself – a loose central bank policy with a moderately positive economic environment and low inflation – one can expect positive returns on real estate and equities, albeit not at the same level as in previous years. If negative or possibly even falling interest rates trigger an economically weak environment, yields on real estate and equities could also be very weak.

Which interest rate trend is the least bad?

It turns out that each scenario has its challenges. If we look only at the development of interest rates, a rapid rise in interest rates is the best possible scenario. The loss would be high at first, but short-lived, like a single bad investment year. Initial negative returns on the bond

portfolio would be offset by higher long-term return expectations. However, it would be important to consider why interest rates were rising and what impact an interest rate rise would have on other asset classes.

If inflation were to rise rapidly, it would likely have a negative impact on equity returns. We would expect a slightly negative effect on property yields; the negative price trend would be offset by rent increases. Pensions would lose purchasing power, and higher bond yields could lead to expectations of pension increases.
A rise in interest rates that was associated with a good economic situation and moderate inflation, and thus with good stock and real estate yields, would be the dream scenario. If the increase in interest rates takes a long time, the losses per year are smaller, but drag on for a much longer period.

Demographics as a second challenge

The remaining life expectancy of a new pensioner has risen from 13 years in 1948, when the first pillar was established, to more than 23 years today. Since the legal founding of occupational pensions in 1985, life expectancy has increased by almost five years. These changes call for appropriate adjustments.

For the second pillar, the conversion rate is the lever, which should ensure that, on average, each insured person receives the same amount of pension benefits as he or she has saved through contributions and investment income. If life expectancy increases, existing capital must finance pensions over a longer period of time if the retirement age remains the same. Accordingly, the conversion rate should fall and lead to a smaller monthly pension. As this has not been done sufficiently, current workers have to finance part of the current pensions by accepting a lower interest on their retirement assets and by increasing contributions – which is equivalent to a redistribution not intended by the law. This redistribution is estimated by the Occupational Pensions Supervisory Commission (OPSC) to be CHF 6.7 billion per year in recent years.

Conversion rate explained: this percentage is used to calculate the annual old-age pension from the retirement capital. The BVG minimum conversion rate stipulates how the compulsory retirement capital is converted into a pension at the time of the ordinary retirement age (currently 65 for men and 64 for women). It is currently 6.8 percent. There are no requirements for retirement assets above the obligatory level and the conversion rate is often lower (Federal Social Insurance Office, FSO).

The very good returns of recent decades have masked this redistribution. However, the increasingly unfavorable age structure for pension funds means that they must take less risk on the asset side. This suggests a higher allocation to safe bonds and explains why the scope offered by the investment guidelines for riskier investments is not being fully exploited. In a low interest rate environment, this means lower returns. Thus, the minimum interest rate, i.e. the interest rate set by the law as the minimum return on the retirement assets of the insured, will fall. It currently stands at 1 percent. Even in a better economic situation, the performance of recent years should not be repeated and the asset side cannot expect any relief.

Minimum interest rate explained: interest rate at which the BVG retirement assets must be at least interest-bearing. The minimum interest rate is determined by the Federal Council, who takes into account the return development of various assets. Currently, the minimum interest rate is 1 percent. Retirement assets above the obligatory level may be subject to lower interest rates (FSO).

With higher life expectancy, the obligations of the pension fund (passive side) automatically increase. These must also be discounted in order to be able to list the present value of the retirement capital in the balance sheet. The technical interest rate set by the Board of Trustees is used for this purpose. This is loosely based on a formula calculated based on the average performance of the pension fund and the 10- year Eidgenossen over the last ten years.

Technical interest explained: interest rate used for discounting future benefits. The lower the technical interest, the higher the retirement capital of a pension fund. The technical interest rate must be chosen in such a way that it can be financed by the capital gains (FSO).

A lower technical interest rate means a higher obligation in the balance sheet of pension funds and thus a deterioration in their financial situation – and vice versa. In order to view the health of a pension fund objectively, it is therefore important to assess the coverage ratio in conjunction with the technical interest used. How realistic the technical interest rate is can be deduced from its level compared to the long-term return on safe bonds.

Coverage ratio explained: the coverage ratio of a pension fund corresponds to the ratio of pension assets to its

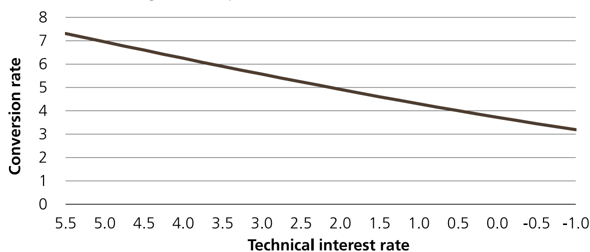
obligations. If the obligations of a pension fund are higher than its assets, the pension fund is under-funded and must be rehabilitated (FSO).

In theory, pensioners who do not carry investment risk because of safe pensions promised to them should receive a lower return than those who are risk-exposed and also bear investment risk because of the redistribution. In practice, however, the technical interest rate is rarely set negatively, although the realistically obtainable return on capital that bears no risk is negative today.

Many pension funds face the problem of making promises to their policyholders that they cannot keep. At the moment, this problem is being obscured by the fact that the strong returns on the financial markets are not credited to workers, but are used for current pension payments. Thus, even a rise in interest rates would not improve the situation in the future, as it is at best represents the technical interest rate more realistically. The technical interest rate is also crucial in order to calculate the conversion rate, which should therefore fall not only because of longer life expectancy, but also because of the investment challenges (Fig. 6).

Fig. 6: Relationship between technical interest and conversion rate

The lower the technical interest rate, the lower the conversion rate should be at retirement age 65, in percent



Assumptions: Generational death table BVG 2015 for year 1955, entitlement to spouse's pension 70%, entitlement to orphan/child pension 20%, percentage of men 70%.
Source: UBS

How to respond to the challenges?

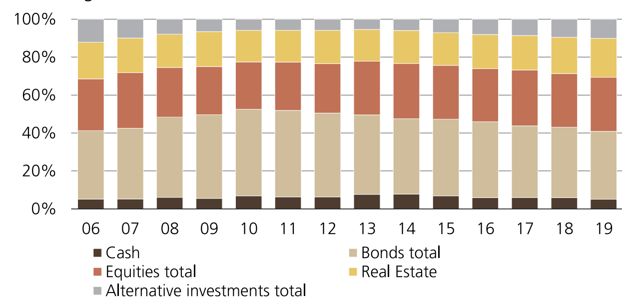
Pension funds

Lower interest rates and the aging of society are two structural trends that pose challenges for pension funds. Many are already reacting to the changed environment within the legal framework. On the benefit side, they have reduced the conversion rate on the over-compulsory capital, raised the retirement age for women to 65, demand contributions from their insured persons from the age of 20 and reduce the interest credits on the retirement savings.

On the investment side, there is a slight shift away from cash and bonds to alternative investments, real estate and equities (Fig. 7). This is where the premiums of illiquid investments, on which we see the greatest return opportunities in the future, could be better siphoned off. However, this room is limited, as the legal framework requires a lower-risk investment strategy as liabilities increase. Therefore it is important to establish sound policies to increase the options.

Fig. 7: Investment strategy of pension funds shifts

Annual average 2006 to 2018, average January to October 2019, according to UBS Pension Fund Performance



Source: UBS

Policy

According to our calculations, the fair conversion rate, given today's appropriate technical interest rate of one to two percent, should be between four and five percent. This is well below the minimum conversion rate of 6.8 percent set by current legislation. If, in today's investment environment, pension funds are certain that they will be able to pay pensions without risk of breaching the funded mechanism of the second pillar, the current interest rate promises would have to be matched with the safe returns that are effectively expected on the capital market. Technical interest to calculate the conversion rate would have to follow the key interest rates to negative levels – the conversion rate would in this case fall below four percent.

It can now be argued that the state should ensure that pension funds need to have safe investments with a positive return if they are obliged by the legal framework to set a conversion rate based on the based on a positive technical interest rate. For example, the federal government could issue "pension provision bonds", Eidgenossen with a non-negative return in which only pension funds are allowed to invest. In such a case, however, political debate is inevitable. Is this simply state

subsidization of a group of savers or do negative interest rates in conjunction with a positive technical interest rate implicitly represent a new form of taxation of pension funds or their active-insured persons?

Insured
The employee can compensate for the expected lower benefits of the second pillar by saving privately (through the tax-privileged pillar 3a, but also with other savings). Purchasing into the second pillar can also directly improve occupational pension benefits. However, this must be carefully considered. On the one hand, there are tax advantages, but on the other hand, it is precisely the concern about the future benefits from pension funds that is forcing higher savings.

Those who do not have confidence in their own pension fund can withdraw this capital early to use for residential property while benefitting from tax savings. However, the direct consequences for subsequent pension payments should be budgeted and the tax savings should be consistently used for voluntary pension provision. In addition, the insured person must be aware that rising interest rates may not only put pension funds in short-term trouble, but can also lead to falling house prices.

A long-term, holistic plan for personal financial is essential. A long retirement is becoming increasingly difficult to finance with rising costs in old age and the current negative interest rate environment. Ultimately, this means that a longer period of employment will be needed to maintain living standards. These considerations must be taken into account at an early stage, especially for women, for example when deciding to reduce or extend their workload, to seek early retirement or to continue working after retirement. Various flexible working models, such as rainbow careers, part-time work and counselling activities, offer opportunities to stay in the labor market for longer while gradually exiting.

Employer
The more flexible job opportunities for older workers are also becoming increasingly important for companies, as the Swiss economy is expected to be short of between 300,000 and 500,000 people in the next ten years. Employers benefit twice: they reduce the shortage of skilled workers and contribute to the sustainable development of their pension fund. If employees pay longer into the pension fund and receive fewer benefits, this is also advantageous for the employer, who has to support the pension fund in the case of restructuring.

Appendix

UBS Chief Investment Office's ("CIO") investment views are prepared and published by the Global Wealth Management business of UBS Switzerland AG (regulated by FINMA in Switzerland) or its affiliates ("UBS"). The investment views have been prepared in accordance with legal requirements designed to promote **the independence of investment research.**

Generic investment research – Risk information: This publication is **for your information only** and is not intended as an offer, or a solicitation of an offer, to buy or sell any investment or other specific product. The analysis contained herein does not constitute a personal recommendation or take into account the particular investment objectives, investment strategies, financial situation and needs of any specific recipient. It is based on numerous assumptions. Different assumptions could result in materially different results. Certain services and products are subject to legal restrictions and cannot be offered worldwide on an unrestricted basis and/or may not be eligible for sale to all investors. All information and opinions expressed in this document were obtained from sources believed to be reliable and in good faith, but no representation or warranty, express or implied, is made as to its accuracy or completeness (other than disclosures relating to UBS). All information and opinions as well as any forecasts, estimates and market prices indicated are current as of the date of this report, and are subject to change without notice. Opinions expressed herein may differ or be contrary to those expressed by other business areas or divisions of UBS as a result of using different assumptions and/or criteria.

In no circumstances may this document or any of the information (including any forecast, value, index or other calculated amount ("Values")) be used for any of the following purposes (i) valuation or accounting purposes; (ii) to determine the amounts due or payable, the price or the value of any financial instrument or financial contract; or (iii) to measure the performance of any financial instrument including, without limitation, for the purpose of tracking the return or performance of any Value or of defining the asset allocation of portfolio or of computing performance fees. By receiving this document and the information you will be deemed to represent and warrant to UBS that you will not use this document or otherwise rely on any of the information for any of the above purposes. UBS and any of its directors or employees may be entitled at any time to hold long or short positions in investment instruments referred to herein, carry out transactions involving relevant investment instruments in the capacity of principal or agent, or provide any other services or have officers, who serve as directors, either to/for the issuer, the investment instrument itself or to/for any company commercially or financially affiliated to such issuers. At any time, investment decisions (including whether to buy, sell or hold securities) made by UBS and its employees may differ from or be contrary to the opinions expressed in UBS research publications. Some investments may not be readily realizable since the market in the securities is illiquid and therefore valuing the investment and identifying the risk to which you are exposed may be difficult to quantify. UBS relies on information barriers to control the flow of information contained in one or more areas within UBS, into other areas, units, divisions or affiliates of UBS. Futures and options trading is not suitable for every investor as there is a substantial risk of loss, and losses in excess of an initial investment may occur. Past performance of an investment is no guarantee for its future performance. Additional information will be made available upon request. Some investments may be subject to sudden and large falls in value and on realization you may receive back less than you invested or may be required to pay more. Changes in foreign exchange rates may have an adverse effect on the price, value or income of an investment. The analyst(s) responsible for the preparation of this report may interact with trading desk personnel, sales personnel and other constituencies for the purpose of gathering, synthesizing and interpreting market information.

Tax treatment depends on the individual circumstances and may be subject to change in the future. UBS does not provide legal or tax advice and makes no representations as to the tax treatment of assets or the investment returns thereon both in general or with reference to specific client's circumstances and needs. We are of necessity unable to take into account the particular investment objectives, financial situation and needs of our individual clients and we would recommend that you take financial and/or tax advice as to the implications (including tax) of investing in any of the products mentioned herein.

This material may not be reproduced or copies circulated without prior authority of UBS. Unless otherwise agreed in writing UBS expressly prohibits the distribution and transfer of this material to third parties for any reason. UBS accepts no liability whatsoever for any claims or lawsuits from any third parties arising from the use or distribution of this material. This report is for distribution only under such circumstances as may be permitted by applicable law. For information on the ways in which CIO manages conflicts and maintains independence of its investment views and publication offering, and research and rating methodologies, please visit www.ubs.com/research. Additional information on the relevant authors of this publication and other CIO publication(s) referenced in this report; and copies of any past reports on this topic; are available upon request from your client advisor.

Important Information About Sustainable Investing Strategies: Sustainable investing strategies aim to consider and incorporate environmental, social and governance (ESG) factors into investment process and portfolio construction. Strategies across geographies and styles approach ESG analysis and incorporate the findings in a variety of ways. Incorporating ESG factors or Sustainable Investing considerations may inhibit the portfolio manager's ability to participate in certain investment opportunities that otherwise would be consistent with its investment objective and other principal investment strategies. The returns on a portfolio consisting primarily of sustainable investments may be lower or higher than portfolios where ESG factors, exclusions, or other sustainability issues are not considered by the portfolio manager, and the investment opportunities available to such portfolios may differ. Companies may not necessarily meet high performance standards on all aspects of ESG or sustainable investing issues; there is also no guarantee that any company will meet expectations in connection with corporate responsibility, sustainability, and/or impact performance.

Distributed to US persons by UBS Financial Services Inc. or UBS Securities LLC, subsidiaries of UBS AG. UBS Switzerland AG, UBS Europe SE, UBS Bank, S.A., UBS Brasil Administradora de Valores Mobiliarios Ltda, UBS Asesores Mexico, S.A. de C.V., UBS Securities Japan Co., Ltd, UBS Wealth Management Israel Ltd and UBS Menkul Degerler AS are affiliates of UBS AG. UBS Financial Services Incorporated of Puerto Rico is a subsidiary of UBS Financial Services Inc. **UBS Financial Services Inc. accepts responsibility for the content of a report prepared by a non-US affiliate when it distributes reports to US persons. All transactions by a US person in the securities mentioned in this report should be effected through a US-registered broker dealer affiliated with UBS, and not through a non-US affiliate. The contents of this report have not been and will not be approved by any securities or investment authority in the United States or elsewhere. UBS Financial Services Inc. is not acting as a municipal advisor to any municipal entity or obligated person within the meaning of Section 15B of**

the Securities Exchange Act (the "Municipal Advisor Rule") and the opinions or views contained herein are not intended to be, and do not constitute, advice within the meaning of the Municipal Advisor Rule.

External Asset Managers / External Financial Consultants: In case this research or publication is provided to an External Asset Manager or an External Financial Consultant, UBS expressly prohibits that it is redistributed by the External Asset Manager or the External Financial Consultant and is made available to their clients and/or third parties.

Austria: This publication is not intended to constitute a public offer under Austrian law. It is distributed only for information purposes to clients of UBS Europe SE, Niederlassung Österreich, with place of business at Wächtergasse 1, A-1010 Wien. UBS Europe SE, Niederlassung Österreich is subject to the joint supervision of the European Central Bank ("ECB"), the German Central Bank (Deutsche Bundesbank), the German Federal Financial Services Supervisory Authority (Bundesanstalt für Finanzdienstleistungsaufsicht), as well as of the Austrian Financial Market Authority (Finanzmarktaufsicht), to which this publication has not been submitted for approval. UBS Europe SE is a credit institution constituted under German law in the form of a Societas Europaea, duly authorized by the ECB. **Bahrain:** UBS is a Swiss bank not licensed, supervised or regulated in Bahrain by the Central Bank of Bahrain and does not undertake banking or investment business activities in Bahrain. Therefore, clients have no protection under local banking and investment services laws and regulations. **Brazil:** This publication is not intended to constitute a public offer under Brazilian law or a research analysis report as per the definition contained under the Comissão de Valores Mobiliários ("CVM") Instruction 598/2018. It is distributed only for information purposes to clients of UBS Brasil Administradora de Valores Mobiliários Ltda. and/or of UBS Consenso Investimentos Ltda., entities regulated by CVM. **Canada:** In Canada, this publication is distributed to clients of UBS Wealth Management Canada by UBS Investment Management Canada Inc.. **China:** This report is prepared by UBS Switzerland AG or its offshore subsidiary or affiliate (collectively as "UBS Offshore"). UBS Offshore is an entity incorporated out of China and is not licensed, supervised or regulated in China to carry out banking or securities business. The recipient should not contact the analysts or UBS Offshore which produced this report for advice as they are not licensed to provide securities investment advice in China. UBS Investment Bank (including Research) has its own wholly independent research and views which at times may vary from the views of UBS Global Wealth Management. This report shall not be regarded as providing specific securities related analysis. The recipient should not use this document or otherwise rely on any of the information contained in this report in making investment decisions and UBS takes no responsibility in this regard. **Czech Republic:** UBS is not a licensed bank in the Czech Republic and thus is not allowed to provide regulated banking or investment services in the Czech Republic. Please notify UBS if you do not wish to receive any further correspondence. **Denmark:** This publication is not intended to constitute a public offer under Danish law. It is distributed only for information purposes to clients of UBS Europe SE, Denmark Branch, filial af UBS Europe SE, with place of business at Sankt Annae Plads 13, 1250 Copenhagen, Denmark, registered with the Danish Commerce and Companies Agency, under No. 38 17 24 33. UBS Europe SE, Denmark Branch, filial af UBS Europe SE is subject to the joint supervision of the European Central Bank ("ECB"), the German Central Bank (Deutsche Bundesbank), the German Federal Financial Services Supervisory Authority (Bundesanstalt für Finanzdienstleistungsaufsicht), as well as of the Danish Financial Supervisory Authority (Finanstilsynet), to which this publication has not been submitted for approval. UBS Europe SE is a credit institution constituted under German law in the form of a Societas Europaea, duly authorized by the ECB. **France:** This publication is distributed by UBS (France) S.A., French "société anonyme" with share capital of € 132.975.556, 69, boulevard Haussmann F-75008 Paris, R.C.S. Paris B 421 255 670, to its clients and prospects. UBS (France) S.A. is a provider of investment services duly authorized according to the terms of the "Code Monétaire et Financier", regulated by French banking and financial authorities as the "Autorité de Contrôle Prudentiel et de Résolution". **Germany:** This publication is not intended to constitute a public offer under German law. It is distributed only for information purposes to clients of UBS Europe SE, Germany, with place of business at Bockenheimer Landstrasse 2-4, 60306 Frankfurt am Main. UBS Europe SE is a credit institution constituted under German law in the form of a Societas Europaea, duly authorized by the European Central Bank ("ECB"), and supervised by the ECB, the German Central Bank (Deutsche Bundesbank) and the German Federal Financial Services Supervisory Authority (Bundesanstalt für Finanzdienstleistungsaufsicht), to which this publication has not been submitted for approval. **Greece:** UBS Switzerland AG and its affiliates (UBS) are not licensed as a bank or financial institution under Greek legislation and do not provide banking and financial services in Greece. Consequently, UBS provides such services from branches outside of Greece, only. This document may not be considered as a public offering made or to be made to residents of Greece. **Hong Kong:** This publication is distributed to clients of UBS AG Hong Kong Branch by UBS AG Hong Kong Branch, a licensed bank under the Hong Kong Banking Ordinance and a registered institution under the Securities and Futures Ordinance. UBS AG Hong Kong Branch is incorporated in Switzerland with limited liability. **India:** UBS Securities India Private Ltd. (Corporate Identity Number U67120MH1996PTC097299) 2/F, 2 North Avenue, Maker Maxity, Bandra Kurla Complex, Bandra (East), Mumbai (India) 400051. Phone: +912261556000. It provides brokerage services bearing SEBI Registration Number INZ000259830; merchant banking services bearing SEBI Registration Number: INM000010809 and Research Analyst services bearing SEBI Registration Number: INH000001204. UBS AG, its affiliates or subsidiaries may have debt holdings or positions in the subject Indian company/companies. Within the past 12 months, UBS AG, its affiliates or subsidiaries may have received compensation for non-investment banking securities-related services and/or non-securities services from the subject Indian company/companies. The subject company/companies may have been a client/clients of UBS AG, its affiliates or subsidiaries during the 12 months preceding the date of distribution of the research report with respect to investment banking and/or non-investment banking securities-related services and/or non-securities services. With regard to information on associates, please refer to the Annual Report at: http://www.ubs.com/global/en/about_ubs/investor_relations/annualreporting.html **Indonesia, Malaysia, Philippines, Thailand:** This material was provided to you as a result of a request received by UBS from you and/or persons entitled to make the request on your behalf. Should you have received the material erroneously, UBS asks that you kindly destroy/delete it and inform UBS immediately. Any and all advice provided and/or trades executed by UBS pursuant to the material will only have been provided upon your specific request or executed upon your specific instructions, as the case may be, and may be deemed as such by UBS and you. The material may not have been reviewed, approved, disapproved or endorsed by any financial or regulatory authority in your jurisdiction. The relevant investments will be subject to restrictions and obligations on transfer as set forth in the material, and by receiving the material you undertake to comply fully with such restrictions and obligations. You should carefully study and ensure that you understand and exercise due care and discretion in considering your investment objective, risk appetite and personal circumstances against the risk of the investment. You are advised to seek independent professional advice in case of doubt. **Israel:** UBS is a premier global financial firm offering wealth management, asset management and investment banking services from its headquarters in Switzerland and its operations in over 50 countries worldwide to individual, corporate and institutional investors. In Israel, UBS Switzerland AG is registered as Foreign Dealer

in cooperation with UBS Wealth Management Israel Ltd., a wholly owned UBS subsidiary. UBS Wealth Management Israel Ltd. is a Portfolio Manager licensee which engages also in Investment Marketing and is regulated by the Israel Securities Authority. This publication is intended for information only and is not intended as an offer to buy or solicitation of an offer. Furthermore, this publication is not intended as an investment advice and/or investment marketing and is not replacing any investment advice and/or investment marketing provided by the relevant licensee which is adjusted to each person needs. The word "advice" and/or any of its derivatives shall be read and construed in conjunction with the definition of the term "investment marketing" as defined under the Israeli Regulation of Investment Advice, Investment Marketing and Portfolio Management Law, 1995.**Italy:** This publication is not intended to constitute a public offer under Italian law. It is distributed only for information purposes to clients of UBS Europe SE, Succursale Italia, with place of business at Via del Vecchio Politecnico, 3-20121 Milano. UBS Europe SE, Succursale Italia is subject to the joint supervision of the European Central Bank ("ECB"), the German Central Bank (Deutsche Bundesbank), the German Federal Financial Services Supervisory Authority (Bundesanstalt für Finanzdienstleistungsaufsicht), as well as of the Bank of Italy (Banca d'Italia) and the Italian Financial Markets Supervisory Authority (CONSOB - Commissione Nazionale per le Società e la Borsa), to which this publication has not been submitted for approval. UBS Europe SE is a credit institution constituted under German law in the form of a Societas Europaea, duly authorized by the ECB. **Jersey:** UBS AG, Jersey Branch, is regulated and authorized by the Jersey Financial Services Commission for the conduct of banking, funds and investment business. Where services are provided from outside Jersey, they will not be covered by the Jersey regulatory regime. UBS AG, Jersey Branch is a branch of UBS AG a public company limited by shares, incorporated in Switzerland whose registered offices are at Aeschenvorstadt 1, CH-4051 Basel and Bahnhofstrasse 45, CH 8001 Zurich. UBS AG, Jersey Branch's principal place business is 1, IFC Jersey, St Helier, Jersey, JE2 3BX. **Luxembourg:** This publication is not intended to constitute a public offer under Luxembourg law. It is distributed only for information purposes to clients of UBS Europe SE, Luxembourg Branch, with place of business at 33A, Avenue J. F. Kennedy, L-1855 Luxembourg. UBS Europe SE, Luxembourg Branch is subject to the joint supervision of the European Central Bank ("ECB"), the German Central bank (Deutsche Bundesbank), the German Federal Financial Services Supervisory Authority (Bundesanstalt für Finanzdienstleistungsaufsicht), as well as of the Luxembourg supervisory authority (Commission de Surveillance du Secteur Financier), to which this publication has not been submitted for approval. UBS Europe SE is a credit institution constituted under German law in the form of a Societas Europaea, duly authorized by the ECB. **Mexico:** This information is distributed by UBS Asesores México, S.A. de C.V. ("UBS Asesores"), an affiliate of UBS Switzerland AG, incorporated as a non-independent investment advisor under the Securities Market Law due to the relation with a Foreign Bank. UBS Asesores is a regulated entity and it is subject to the supervision of the Mexican Banking and Securities Commission ("CNBV"), which exclusively regulates UBS Asesores regarding the rendering of portfolio management, as well as on securities investment advisory services, analysis and issuance of individual investment recommendations, so that the CNBV has no surveillance faculties nor may have over any other service provided by UBS Asesores. UBS Asesores is registered before CNBV under Registry number 30060. You are being provided with this UBS publication or material because you have indicated to UBS Asesores that you are a Sophisticated Qualified Investor located in Mexico. The compensation of the analyst(s) who prepared this report is determined exclusively by research management and senior management of any entity of UBS Group to which such analyst(s) render services. **Nigeria:** UBS Switzerland AG and its affiliates (UBS) are not licensed, supervised or regulated in Nigeria by the Central Bank of Nigeria or the Nigerian Securities and Exchange Commission and do not undertake banking or investment business activities in Nigeria. **Portugal:** UBS Switzerland AG is not licensed to conduct banking and financial activities in Portugal nor is UBS Switzerland AG supervised by the portuguese regulators (Bank of Portugal "Banco de Portugal" and Portuguese Securities Exchange Commission "Comissão do Mercado de Valores Mobiliários"). **Singapore:** This material was provided to you as a result of a request received by UBS from you and/or persons entitled to make the request on your behalf. Should you have received the material erroneously, UBS asks that you kindly destroy/delete it and inform UBS immediately. Clients of UBS AG Singapore branch are asked to please contact UBS AG Singapore branch, an exempt financial adviser under the Singapore Financial Advisers Act (Cap. 110) and a wholesale bank licensed under the Singapore Banking Act (Cap. 19) regulated by the Monetary Authority of Singapore, in respect of any matters arising from, or in connection with, the analysis or report. **Spain:** This publication is not intended to constitute a public offer under Spanish law. It is distributed only for information purposes to clients of UBS Europe SE, Sucursal en España, with place of business at Calle María de Molina 4, C.P. 28006, Madrid. UBS Europe SE, Sucursal en España is subject to the joint supervision of the European Central Bank ("ECB"), the German Central bank (Deutsche Bundesbank), the German Federal Financial Services Supervisory Authority (Bundesanstalt für Finanzdienstleistungsaufsicht), as well as of the Spanish supervisory authority (Banco de España), to which this publication has not been submitted for approval. Additionally it is authorized to provide investment services on securities and financial instruments, regarding which it is supervised by the Comisión Nacional del Mercado de Valores as well. UBS Europe SE, Sucursal en España is a branch of UBS Europe SE, a credit institution constituted under German law in the form of a Societas Europaea, duly authorized by the ECB. **Sweden:** This publication is not intended to constitute a public offer under Swedish law. It is distributed only for information purposes to clients of UBS Europe SE, Sweden Bankfilial, with place of business at Regeringsgatan 38, 11153 Stockholm, Sweden, registered with the Swedish Companies Registration Office under Reg. No 516406-1011. UBS Europe SE, Sweden Bankfilial is subject to the joint supervision of the European Central Bank ("ECB"), the German Central bank (Deutsche Bundesbank), the German Federal Financial Services Supervisory Authority (Bundesanstalt für Finanzdienstleistungsaufsicht), as well as of the Swedish supervisory authority (Finansinspektionen), to which this publication has not been submitted for approval. UBS Europe SE is a credit institution constituted under German law in the form of a Societas Europaea, duly authorized by the ECB. **Taiwan:** This material is provided by UBS AG, Taipei Branch in accordance with laws of Taiwan, in agreement with or at the request of clients/prospects. **UAE:** UBS is not licensed in the UAE by the Central Bank of UAE or by the Securities & Commodities Authority. The UBS AG Dubai Branch is licensed in the DIFC by the Dubai Financial Services Authority as an authorised firm. **UK:** This document is issued by UBS Wealth Management, a division of UBS AG which is authorised and regulated by the Financial Market Supervisory Authority in Switzerland. In the United Kingdom, UBS AG is authorised by the Prudential Regulation Authority and is subject to regulation by the Financial Conduct Authority and limited regulation by the Prudential Regulation Authority. Details about the extent of regulation by the Prudential Regulation Authority are available from us on request. A member of the London Stock Exchange. This publication is distributed to retail clients of UBS Wealth Management.
Version 06/2019. CIO82652744

© UBS 2019.The key symbol and UBS are among the registered and unregistered trademarks of UBS. All rights reserved.