

Chief economist's comment

What do bubbles mean?

Chief Investment Office WM | 10 November 2017

Paul Donovan, Global Chief Economist WM, paul.donovan@ubs.com

- The fourth industrial revolution may make financial markets more prone to bubbles. The novelty and uncertainty of a period of structural change increases bubble risks.
- A bubble requires asset prices to trade above fundamental value. A bubble normally occurs when there is novelty in the asset, or in the financial instruments that support the asset – allowing uncertainty about future fundamentals to build. A bubble normally has a delay before real economic value can be realized. Bubbles are relatively easy to define after the fact, because they burst.
- Bubbles transfer wealth from one group in society to another. Generally there are fewer bubble winners than bubble losers, which concentrates wealth. This has economic consequences. Bubble losers increase savings, suffer loss aversion, and may become risk adverse. All of this has economic consequences. Bubbles divert money from economically "good" investments to economically "bad" investments. This has obvious economic consequences.
- Policy makers can mitigate the negative consequences of a bubble. If a bubble is confined to a limited number of people, the economic consequences may also be limited.

There is no clear economic definition of what makes an asset price a bubble. The term is controversial. In broad terms a bubble has four characteristics.

The most obvious characteristic is that a bubble requires an asset price to be above its fundamental value. This is difficult to define because investors will argue about where the fundamental value lies. Economists still argue passionately about the fundamental value in Dutch tulip bulb prices during the early seventeenth century (economists do not get out very much).

A bubble generally has to involve some kind of novelty. It can be the underlying asset that is new. Dutch tulips were new and exotic. Eighteenth century canals were new, on the scale that they were being built. Nineteenth century railways were new. Twentieth century cars and radios were new. Turn of the century internet stocks were new. Cryptocurrencies today are new. Alternatively it can be the financial innovation that is the novelty. Cash-settled futures contracts on Dutch tulip bulbs were new. Large scale joint stock companies in France and England in the early eighteenth century were new. Large scale leveraged buyouts in the 1980s were new.

Novelty matters to a bubble, because it makes valuing future fundamentals more difficult. Novelty allows the dread phrase "this time it is different" to be spoken. If fundamental value is to be ignored, there has to be a reason investors forget the rational lessons of history. Novelty helps.

A bubble must promise real world returns at some distant date. If real world returns are expected quickly, the failure to realize those returns quickly will be obvious quickly. It took time for tulip bulbs to become tulips. The Mississippi and South Sea bubbles of the early eighteenth century promised non-existent riches from trade. The non-existent riches were supposed to be earned in the future. The internet bubble promised that we would all be buying pet food online – not immediately, but in the new millennium. The gap between selling financial assets and achieving the real world returns lets irrationality build. The asset price continues to rise because "this time it is different" and bubble buyers believe that returns will come pouring in if only they wait long enough.

The final characteristic of a bubble is that a bubble bursts. The sudden drop in the asset price is the defining characteristic of a bubble. It is the bursting of a bubble that is of most interest to the economist. This conclusive signal comes too late for the bubble buyer, of course. The bubble buyer must suffer the result.

Bubbles and the real economy

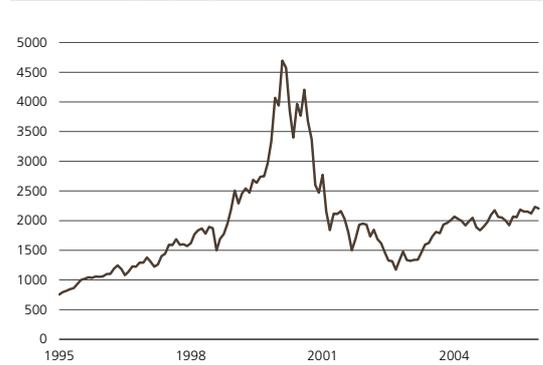
Bubbles in financial assets certainly make for exciting media headlines, but what do they mean for the real economy?

At its simplest, a bubble transfers money from one group in society (asset buyers) to another group in society (asset sellers). Wealth is redistributed, but wealth redistribution of itself need not matter economically.

Bubbles often involve a large numbers of buyers giving wealth to a smaller number of sellers. The South Sea bubble saw a large numbers of middle class shareholders lose their savings. A small number of generally well-connected promoters profited. The 1929 equity market bubble sucked in the general population as buyers. A smaller group sold out in time. Cryptocurrency buyers are larger in number than cryptocurrency miners today. The large number of losers and the small number of winners from a bubble has an economic impact by concentrating wealth in an economy.

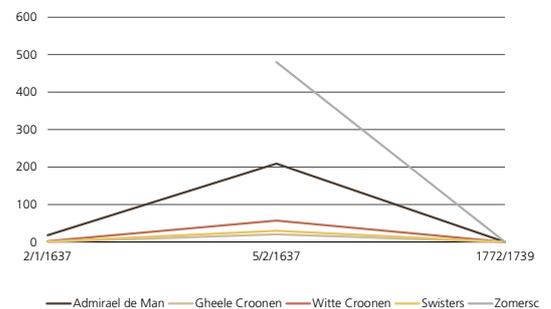
If building and bursting a bubble concentrates wealth ownership, consumption patterns will change. Wealthy people buy different things from less wealthy people. It is also generally true (though not universally true) that wealthy people spend less of their income than less wealthy people. Concentrating wealth makes a small number of people more wealthy, and lots of people less wealthy. Shifting spending power from the losers of a bubble to the winners will probably reduce overall consumer spending. That demand shock will lower economic growth, and potentially trigger a recession.

US Nasdaq Equity Index



Source: Haver

Selected Dutch tulip bulb prices (Guilder per bulb), start of 1637, peak bubble, the following century



Source: Peter Gaber (2000) "Famous First Bubbles, MIT press, table 10.1 pg 66

Bubble buyers will experience a negative wealth effect. As long as a bubble pushes asset prices higher, bubble buyers are likely to feel wealthier. Bubble buyers will have less incentive to save (why save 5% of your paycheck if the bubble is inflating at 5% per month?). In the expansionary phase of the bubble rising asset prices may be matched by rising levels of consumption. This all changes when the bubble bursts. The decline in the value of their assets (often to near zero) will cause bubble buyers to increase their savings. Bubble buyers will cut back on spending to make up for the "savings" that have been lost. This is a negative impact for the economy.

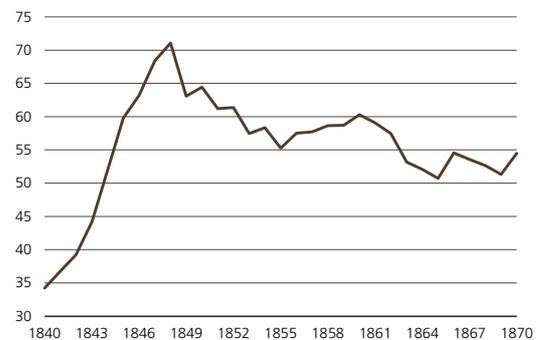
The loss of wealth is made worse by a behavioral economic concept called "loss aversion". People are biased against losing. People dislike the loss of something more than they like gaining something. It is a very ancient survival mechanism, forcing people to run away from danger. Research suggests a loss is twice as important as a gain. We run away from the sabre tooth tiger twice as fast as we run towards a potential meal. Even though the size of bubble losers' losses will equal the size of bubble winners' gains when a bubble bursts, the losses will be more important economically.

Negative wealth effects and loss aversion may change future investment. Direct experience of building and bursting a bubble may make investors more risk adverse in the future. Some studies imply that risk aversion may even be inherited by the children of bubble buyers. A culture of risk aversion can develop as a result of significant losses. Rising risk aversion can change an economy's future investment and innovation. This hurts the trend rate of growth.

While a bubble builds, money is diverted from useful economic activity into less useful economic activity. Because asset prices exceed fundamental value, more money is allocated to the bubble's object than is economically efficient. Investing in a bubble is "bad" investment (economically speaking). That means that parts of the economy that should be getting investment ("good" investment) lose out. This can be negative for longer-term economic growth. Bursting the bubble may help restore the balance of good and bad investment – but risk aversion may lower investment (and growth) overall.

Finally it is worth considering any links between bubbles and banks. Bubbles do not necessarily need banks. On occasion, a bubble will be credit financed. This makes a bigger economic threat than the wealth effects alone. If bank solvency is questioned (e.g. the US Knickerbocker crash of 1907), financial stability may be questioned. That can lead to a classic credit crunch. Areas of the economy not directly involved in the bubble would be hurt.

Market capitalization of UK Railway Shares during the Railway Bubble - £ million



Source: Aecheson, Hickson, Turner and Ye (2009), "Rule Britannia!", Journal of Economic History, 69, 4, pp 1118-1119

US Dow Jones Equity Index



Source: Haver

It does not have to be negative

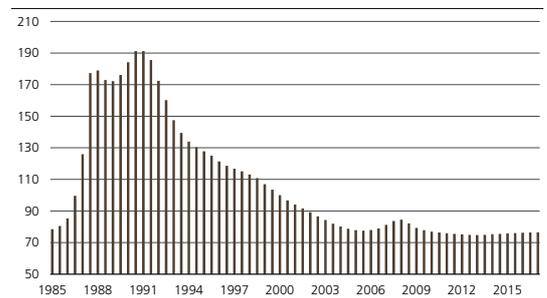
Does a bursting bubble have to have negative economic consequences? It is likely, but not certain. How many people participated in the bubble matters. If a small group of people in a country participate in a bubble, then the economic consequences of the bubble and of the bubble bursting are limited. This is particularly true if the financial sector has remained aloof from the bubble.

Policy makers can attempt to limit the damage. Seventeenth century Dutch officials allowed tulip futures contracts to be terminated by bubble buyers at a fraction of the cost – limiting the worst of the wealth transfers. The economic costs of the South Sea bubble in 1729 were partly offset by the actions of the Bank of England. The US Federal Reserve famously failed to mitigate the effects of the 1929 equity crash, but did offer help after the 1987 equity correction.

Double, double, toil and trouble

Clearly bubbles are unlikely to disappear from financial markets. The changes of the fourth industrial revolution may produce more of the novelty that can fuel bubble creation. Looking for signs that a bubble is building, and understanding the real world consequences, are likely to matter more.

Residential land price index, Tokyo area



Source: Japan Real Estate Research Institute, via Haver

Appendix

Generic financial research – Risk information: UBS Chief Investment Office WM's investment views are prepared and published by Wealth Management and Personal & Corporate Banking or Wealth Management Americas, Business Divisions of UBS AG (regulated by FINMA in Switzerland), its subsidiary or affiliate ("UBS"). In certain countries UBS AG is referred to as UBS SA. This material 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. 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 material 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 prices indicated are current as of the date of this report, and are subject to change without notice. The market prices provided in performance charts and tables are closing prices on the respective principal stock exchange. The analysis contained herein is based on numerous assumptions. Different assumptions could result in materially different results. 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. 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. 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. In developing the Chief Investment Office (CIO) economic forecasts, CIO economists worked in collaboration with economists employed by UBS Investment Research. Forecasts and estimates are current only as of the date of this publication and may change without notice. For information on the ways in which UBS CIO WM 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.

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. **Australia:** This notice is issued by UBS AG ABN 47 088 129 613 (Holder of Australian Financial Services Licence No 231087): This Document is issued and distributed by UBS AG. This is the case despite anything to the contrary in the Document. The Document is intended for use only by "Wholesale Clients" as defined in section 761G ("Wholesale Clients") of the Corporations Act 2001 (Cth) ("Corporations Act"). In no circumstances may the Document be made available by UBS AG to a "Retail Client" as defined in section 761G of the Corporations Act. UBS AG's research services are only available to Wholesale Clients. The Document is general information only and does not take into account any person's investment objectives, financial and taxation situation or particular needs. **Austria:** This publication is not intended to constitute a public offer under Austrian law, but might be made available 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 a branch of UBS Europe SE, a credit institution constituted under German Law in the form of a Societas Europaea, duly authorized by the German Federal Financial Services Supervisory Authority (Bundesanstalt für Finanzdienstleistungsaufsicht, BaFin), and is subject to the joint supervision of BaFin, the central bank of Germany (Deutsche Bundesbank), as well as of the Austrian supervisory authority (Finanzmarktaufsicht, FMA), to which this publication has not been submitted for approval. **Bahamas:** This publication is distributed to private clients of UBS (Bahamas) Ltd and is not intended for distribution to persons designated as a Bahamian citizen or resident under the Bahamas Exchange Control Regulations. **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:** Prepared by UBS Brasil Administradora de Valores Mobiliários Ltda, entity regulated by Comissão de Valores Mobiliários ("CVM"). **Canada:** In Canada, this publication is distributed to clients of UBS Wealth Management Canada by UBS Investment Management Canada Inc.. **Czech Republic:** UBS is not a licensed bank in Czech Republic and thus is not allowed to provide regulated banking or investment services in Czech Republic. This material is distributed for marketing purposes. **Denmark:** This publication is not intended to constitute a public offer under Danish law, but might be distributed by UBS Europe SE, Denmark Branch, filial af UBS Europe SE, with place of business at Sankt Annæ Plads 13, 1250 Copenhagen, Denmark, registered with the Danish Commerce and Companies Agency, under the No. 38 17 24 33. UBS Europe SE, Denmark Branch, filial af UBS Europe SE 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 German Federal Financial Services Supervisory Authority (Bundesanstalt für Finanzdienstleistungsaufsicht, BaFin). UBS Europe SE, Denmark Branch, filial af UBS Europe SE is subject to the joint supervision of the BaFin, the central bank of Germany (Deutsche Bundesbank) and the Danish Financial Supervisory Authority (DFSA) (Finanstilsynet), to which this document has not been submitted for approval. **France:** This publication is distributed by UBS (France) S.A., French "société anonyme" with share capital of € 125.726.944, 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:** The issuer under German Law is UBS Europe SE, Bockenheimer Landstrasse 2-4, 60306 Frankfurt am Main. UBS Europe SE is authorized and regulated by the "Bundesanstalt für Finanzdienstleistungsaufsicht". **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. **India:** Distributed by UBS Securities India Private Ltd. 2/F, 2 North Avenue, Maker Maxity, Bandra Kurla Complex, Bandra (East), Mumbai (India) 400051. Phone: +912261556000. SEBI Registration Numbers: NSE (Capital Market Segment): INB230951431, NSE (F&O Segment) INF230951431, BSE (Capital Market Segment) INB010951437. **Israel:** UBS Switzerland AG is registered as a Foreign Dealer in cooperation with UBS Wealth Management Israel Ltd, a wholly owned UBS subsidiary. UBS Wealth Management Israel Ltd is a licensed Portfolio Manager which engages also in Investment Marketing and is regulated by the Israel Securities Authority. This publication shall not replace any investment advice and/or investment marketing provided by a relevant licensee which is adjusted to your personal needs. **Italy:** This publication is distributed to the clients of UBS Europe SE, Succursale Italia, Via del Vecchio Politecnico, 3 - 20121 Milano, the branch of a German bank duly authorized by the "Bundesanstalt für Finanzdienstleistungsaufsicht" to the provision of financial services and supervised by "Consob". **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, but might be made available 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 a branch of UBS Europe SE, a credit institution constituted under German Law in the form of a Societas Europaea, duly authorized by the German Federal Financial Services Supervisory Authority (Bundesanstalt für Finanzdienstleistungsaufsicht, BaFin), and is subject to the joint supervision of BaFin, the central bank of Germany (Deutsche Bundesbank), as well as of the Luxembourg supervisory authority, the Commission de Surveillance du Secteur Financier (the "CSSF"), to which this publication has not been submitted for approval. **Mexico:** This document has been distributed by UBS Asesores México, S.A. de C.V., a company which is not part of UBS Grupo Financiero, S.A. de C.V. or of any other Mexican financial group and whose obligations are not guaranteed by any third party. UBS Asesores México, S.A. de C.V. does not guarantee any yield whatsoever. **Netherlands:** This publication is not intended to constitute a public offering or a comparable solicitation under Dutch law, but might be made available for information purposes to clients of UBS Europe SE, Netherlands branch, a branch of a German bank duly authorized by the "Bundesanstalt für Finanzdienstleistungsaufsicht" for the provision of financial services and supervised by "Autoriteit Financiële Markten" (AFM) in the Netherlands, to which this publication has not been submitted for approval. **New Zealand:** This notice is distributed to clients of UBS Wealth Management Australia Limited ABN 50 005 311 937 (Holder of Australian Financial Services Licence No. 231127), Chifley Tower, 2 Chifley Square, Sydney, New South Wales, NSW 2000, by UBS Wealth Management Australia Ltd. You are being provided with this UBS publication or material because you have indicated to UBS that you are a client certified as a wholesale investor and/or an eligible investor ("Certified Client") located in New Zealand. This publication or material is not intended for clients who are not Certified Clients ("Non-Certified Clients"), and if you are a Non-Certified Client you must not rely on this publication or material. If despite this warning you nevertheless rely on this publication or material, you hereby (i) acknowledge that you may not rely on the content of this publication or material and that any recommendations or opinions in this publication or material are not made or provided to you, and (ii) to the maximum extent permitted by law (a) indemnify UBS and its associates or related entities (and their respective directors, officers, agents and advisers (each a "Relevant Person") for any loss, damage, liability or claim any of them may incur or suffer as a result of, or in connection with, your unauthorised reliance on this publication or material and (b) waive any rights or remedies you may have against any Relevant Person for (or in respect of) any loss, damage, liability or claim you may incur or suffer as a result of, or in connection with, your unauthorised reliance on this publication or material. **Saudi Arabia:** This publication has been approved by UBS Saudi Arabia (a subsidiary of UBS AG), a Saudi Arabian closed joint stock company incorporated in the Kingdom of Saudi Arabia under commercial register number 1010257812 having its registered office at Tawteer Towers, P.O. Box 75724, Riyadh 11588, Kingdom of Saudi Arabia. UBS Saudi Arabia is authorized and regulated by the Capital Market Authority of Saudi Arabia. **Singapore:** 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 distributed to its clients by UBS Europe SE, Sucursal en España, with registered office

Appendix

at Calle María de Molina 4, C.P. 28006, Madrid, entity supervised by Banco de España and the Bundesanstalt für Finanzdienstleistungsaufsicht. UBS Europe SE, Sucursal en España is a branch of UBS Europe SE, a credit institution constituted in the form of a Societas Europaea authorized and regulated by the Bundesanstalt für Finanzdienstleistungsaufsicht.

Sweden: This publication is not intended to constitute a public offer under Swedish law, but might be distributed by UBS Europe SE, Sweden Bankfilial with place of business at Regeringsgatan 38, 11153 Stockholm, Sweden, registered with the Swedish Companies Registration Office under the Reg. No 516406-1011. UBS Europe SE, Sweden Bankfilial 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 German Federal Financial Supervisory Authority (Bundesanstalt für Finanzdienstleistungsaufsicht, BaFin). UBS Europe SE, Sweden Bankfilial is subject to the joint supervision of the BaFin, the central bank of Germany (Deutsche Bundesbank) and the Swedish financial supervisory authority (Finansinspektionen), to which this document has not been submitted for approval. **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. **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 delete the e-mail and inform UBS immediately. 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. **UAE:** This research report is not intended to constitute an offer, sale or delivery of shares or other securities under the laws of the United Arab Emirates (UAE). The contents of this report have not been and will not be approved by any authority in the United Arab Emirates including the UAE Central Bank or Dubai Financial Authorities, the Emirates Securities and Commodities Authority, the Dubai Financial Market, the Abu Dhabi Securities market or any other UAE exchange. This material is intended for professional clients only. UBS AG Dubai Branch is regulated by the DFSA in the DIFC. UBS AG/UBS Switzerland AG is not licensed to provide banking services in the UAE by the Central Bank of the UAE nor is it licensed by the UAE Securities and Commodities Authority. The UBS AG Representative Office in Abu Dhabi is licensed by the Central Bank of the UAE to operate a representative office. **UK:** Approved by UBS AG, 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 subject to regulation by the Financial Conduct Authority and limited regulation by the Prudential Regulation Authority. Details about the extent of our regulation by the Prudential Regulation Authority are available from us on request. A member of the London Stock Exchange. This publication is distributed to private clients of UBS London in the UK. Where products or services are provided from outside the UK, they will not be covered by the UK regulatory regime or the Financial Services Compensation Scheme. **USA:** This document is not intended for distribution into the US, to US persons, or by US-based UBS personnel. UBS Securities LLC is a subsidiary of UBS AG and an affiliate of UBS Financial Services Inc., UBS Financial Services Inc. is a subsidiary of UBS AG.

Version 07/2017.

©UBS 2017. The key symbol and UBS are among the registered and unregistered trademarks of UBS. All rights reserved.