BARCLAYS

Index, Portfolio & Risk Solutions
Research
21 November 2014

# Barclays Portfolio Optimizer
# Asset Allocation User Guide

The Portfolio Optimizer available in POINT delivers advanced portfolio construction, re-balancing, and hedging functionality to clients. The Portfolio Optimizer is based on mean-variance optimization techniques and is primarily geared toward security selection. With the POINT 3.14.9 release, we expand these portfolio construction capabilities to include risk-based asset allocation techniques, such as risk parity and risk budgeting. We describe how to use these techniques in POINT and different alternatives available to clients.

Abhinav Verma
+1 212 526 8351
abhinav.xa.verma@barclays.com

www.barclays.com

# Introduction

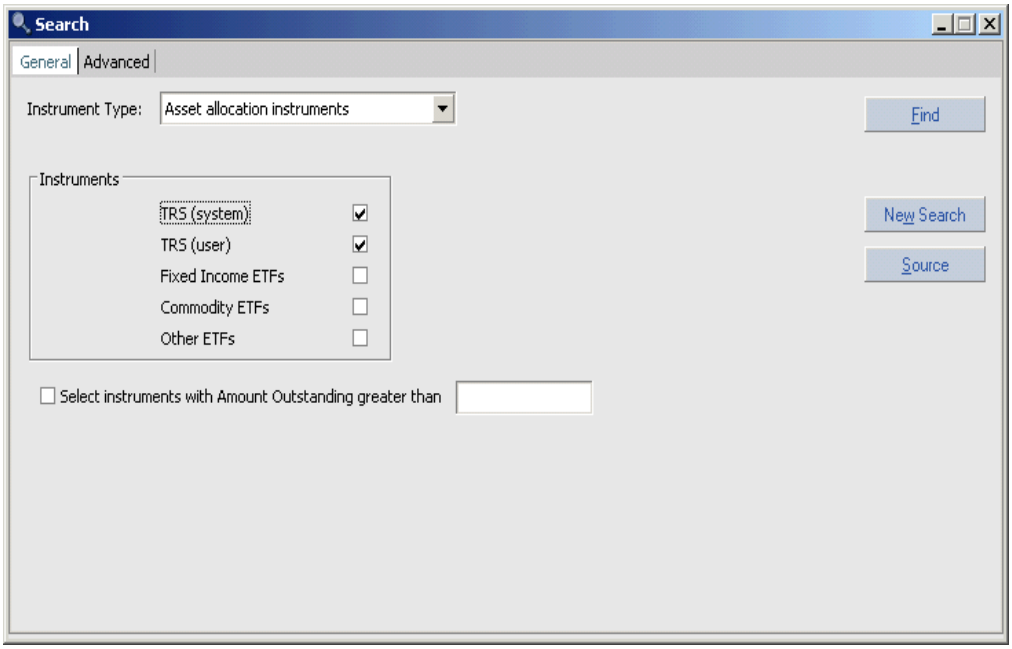
POINT is expanding its portfolio construction capabilities to include risk-based, asset allocation techniques in the Portfolio Optimizer. The techniques being offered are risk budgeting, risk parity, systematic risk budgeting, equal volatility, volatility budgeting, minimum variance, and most diversified. These are offered as choices under a new 'Asset allocation benchmark' dropdown in the optimizer. Clients can represent asset classes by ETFs, custom funds, and derivatives such as equity index, bond, and commodity futures, CDX-indices, FX-forwards, as well as total return swaps (TRS) on any portfolio, index, and custom index. These techniques will supplement the current portfolio construction capabilities, which are based on mean-variance optimization and primarily work at the security level.

# Creating Asset Allocation Instruments

Clients can use a variety of instruments to represent asset classes within POINT. These include derivatives which represent asset classes – equity index, bond and commodity futures, FX-forwards, CDX indices – as well as cash instruments such as ETFs and funds available within POINT. Clients can also create total return swaps (TRS) on any portfolio, index or custom index available within POINT.

In this release, we have made it easier to search for asset allocation instruments in POINT. We have added a new option in the search window, specifically under the "instrument type" dropdown menu: "Asset allocation instrument". Figure 1 lists the instrument types accessible from this new search category.

FIGURE 1
**Asset Allocation Instruments in Search Wizard**



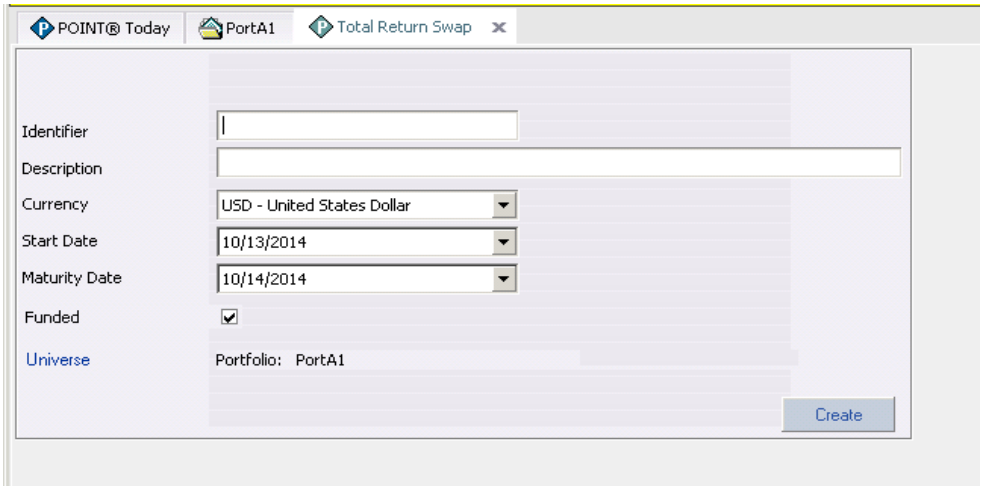

Source: Barclays Research

## Quick Creation of Total Return Swaps

There are two types of TRS available within POINT: system-created and user-created. A system-created TRS is linked to an underlying index and tends to track the total return of such index. We plan to expand the list of system-created TRS within POINT to reflect popular indices from all asset classes. Clients can use user-created TRS to a construct a basket representation for their portfolio, custom index or any index for which system-created TRS is not available.

Clients can now quickly create TRS via File > New > Instruments > Total Return Swaps. Once a minimal set of fields is populated that user can click "Create" to define a TRS (Figure 2).

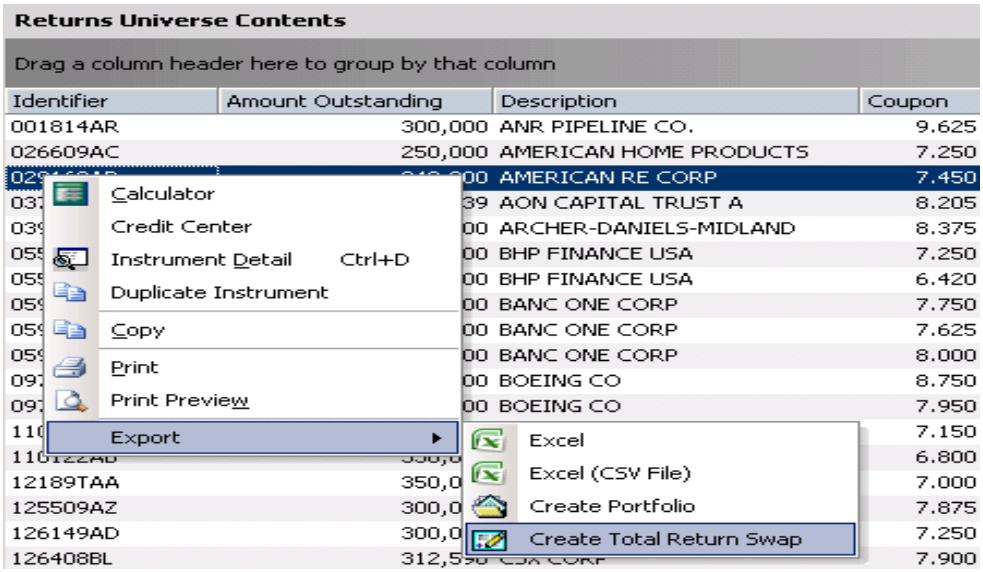
FIGURE 2
**Quick Creation of TRS**




Source: Barclays Research

Alternatively, they can open any portfolio or index, right click on screen and click Export > Create Total Return Swap (Figure 3), which will take them to the options dialog box for creating TRS (Figure 2).

FIGURE 3
**Creating TRS from Portfolio or Index View**




Source: Barclays Research

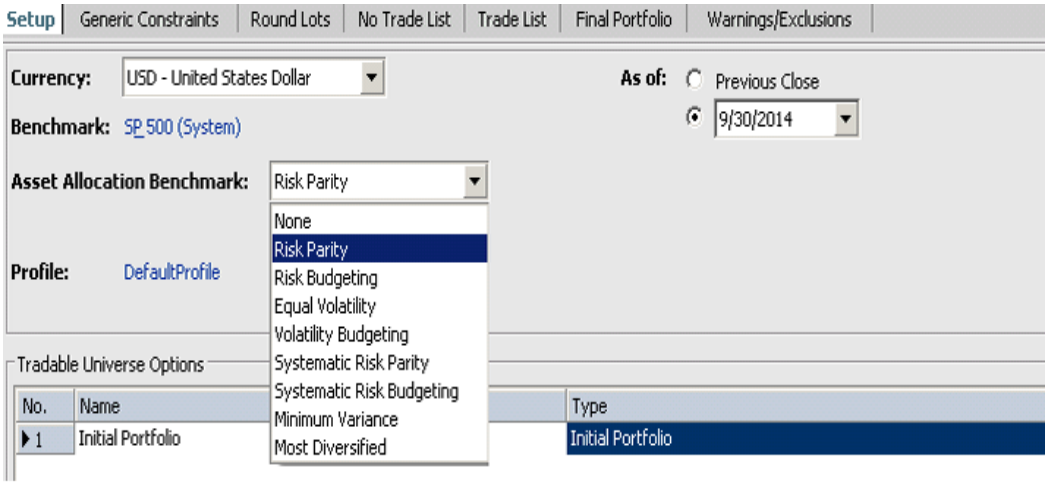
# Asset Allocation Techniques

Until now, mean-variance optimization was the primary portfolio construction technique within POINT and was primarily geared toward 'security-selection'. POINT will now also support popular asset allocation techniques for portfolio construction. Asset allocation techniques allocate weights to broad asset classes as opposed to securities. The techniques that will be supported are:

- Risk budgeting
- Risk parity
- Systematic risk budgeting
- Equal volatility
- Volatility budgeting
- Minimum variance
- Most diversified

Figure 4 displays these choices in the optimizer tab, which will have a new dropdown menu called 'Asset Allocation Benchmark'. The default choice in the dropdown list is 'None', which corresponds to the current mean-variance optimization framework.

FIGURE 4
**Asset Allocation Techniques Dropdown in the Optimizer Module**




Source: Barclays Research

Among the asset allocation techniques we plan to support, minimum variance and most diversified portfolios can be considered as special cases of mean-variance optimization. Clients should refer to the optimizer user guide for details on setting up objectives and constraints for these two cases. For rest of this document, we will focus on the remaining asset allocation techniques – namely, risk parity, risk budgeting, equal volatility, systematic risk parity, and systematic risk budgeting.

## Objective Function

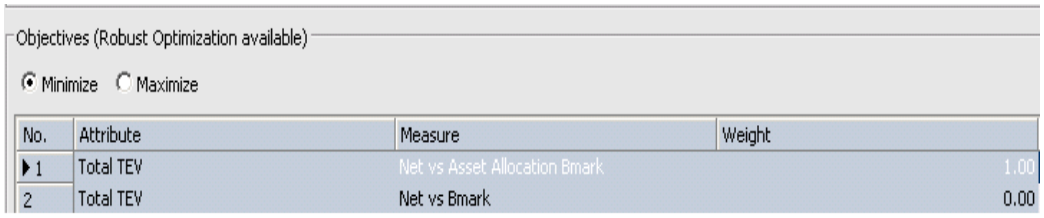
For asset allocation techniques, POINT still supports the objectives and constraints which are typically available in mean variance optimization. For example, clients can create a risk parity portfolio with additional constraints on position limits, leverage and/or tracking error volatility (TEV) from a benchmark. Similarly, clients can specify more than one objective such as minimizing a combination of the portfolio's TEV to a risk parity portfolio and to a pre-specified benchmark. As with mean variance optimization, clients can assign different

weights to each objective functions to reflect relative priorities. Figure 5 shows multiple objective functions for asset allocation techniques.

We incorporate the additional constraints and objectives in the asset allocation optimization techniques by solving two optimization problems: in the first stage, we find the optimal portfolio that corresponds to the unconstrained asset allocation technique specified. Then, in the second step, we minimize TEV with respect to this unconstrained optimal portfolio, taking into account additional objectives and constraints specified by the user.

The default objective function for asset allocation techniques is to minimize TEV to the asset allocation benchmark. Clients can also choose to minimize systematic TEV with respect to asset allocation benchmark as an objective. An asset allocation optimization with no other objectives or constraints other than budget constraint (or target volatility, which will be discussed later) will have an optimal objective value of 0.0. This implies that the optimal portfolio corresponds to the asset allocation technique specified and, hence, has zero tracking error volatility. When users specify additional constraints or objectives, the optimal value of the objective Total TEV (to asset allocation benchmark) will differ from zero, reflecting the trade-off made by the optimizer to satisfy additional constraints and incorporate additional objectives.

FIGURE 5
**Objective Functions for Asset Allocation Techniques**




Source: Barclays Research

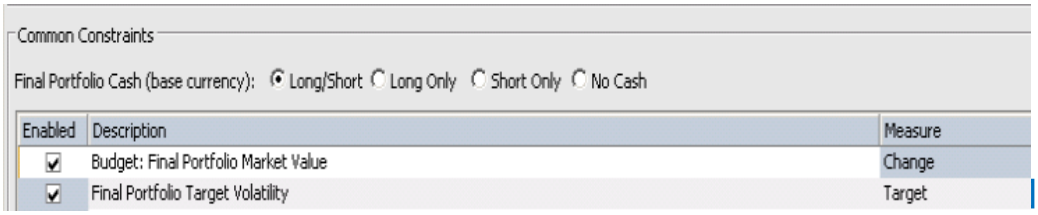
## Volatility Target in Common Constraints

A volatility-targeting strategy uses dynamic allocation to target a pre-specified level of volatility by leveraging or deleveraging in cash. In other words, a volatility-targeting strategy aims to achieve a stable level of volatility over time and is different from a static strategy where the weights stay constant but the overall portfolio risk varies with time.

There are several reasons why volatility targeting may be useful. Volatility tends to be negatively correlated to market (equity) risk. As such, employing volatility targeting may reduce drawdown, improve the tail-risk profile of the portfolio, and increase the overall Sharpe-ratio of strategy. Moreover, volatility tends to persist over time, which makes volatility targeting an implementable strategy. Volatility target constraints are also useful when asset classes are represented by derivatives (futures, CDX-indices, FX-forwards etc) since market values of these instruments can be very different from fully funded instruments.

For asset allocation techniques, we will support volatility targeting, which we have added to the common constraints section (Figure 6). When target volatility constraint is enabled, the final portfolio cash option is changed to long/short to allow leverage/deleverage in base currency.

FIGURE 6
**Target Volatility Constraint in Common Constraints Tab**




Source: Barclays Research

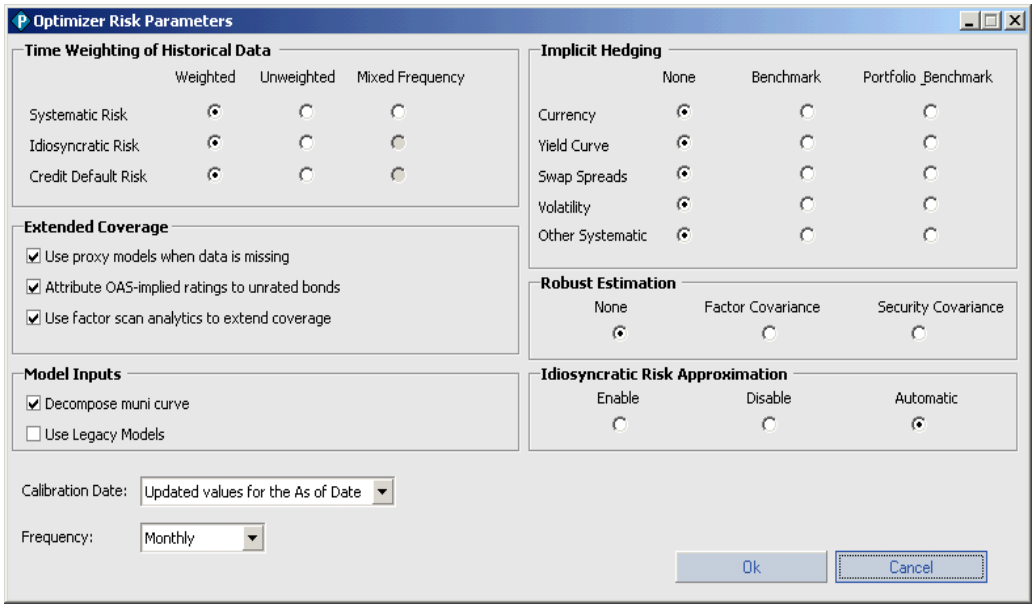
## Generic Constraints

For Asset Allocation optimizations, we support all generic constraints including soft constraints at portfolio, partition, as well as at Issue/Issuer/Ticker level. We have also added a new constraint called Total TEV with respect to Asset Allocation Benchmark. This allows for an explicit upper-bound on TEV to the asset allocation Benchmark - from the unconstrained (first stage) asset allocation portfolio - when second stage optimization is solved in the presence of additional objectives and constraints.

## Idiosyncratic Risk Approximation

Almost all asset classes will be represented by basket instruments such as exchange traded funds (ETFs), total return swaps on portfolio or index and derivatives such equity index, bond, and commodity futures. A simple portfolio consisting of just a few basket instruments might have thousands of underlying instruments. The presence of basket instruments in the investable universe requires special handling by the optimizer. The optimizer should represent such instruments as single instruments for trading purposes but at the same time recognize the contribution of every security in the basket instrument for calculating systematic risk exposures, idiosyncratic risk of the basket instrument, as well as idiosyncratic covariance with other instruments in the portfolio. Aggregating idiosyncratic variance-covariance over several thousand instruments can be very expensive in terms of time and computational resources.

FIGURE 7
**Idiosyncratic Approximation in Risk Model Parameters**




Source: Barclays Research

To overcome this issue, we have added an option to approximate the idiosyncratic return variance-covariance matrix. We approximate the idiosyncratic risk matrix by only taking the diagonal (variance) contribution of constituents for each basket instrument and ignoring any cross-contribution from different constituents. In other words, the idiosyncratic variance of a basket instrument is approximated by a weighted sum of idiosyncratic variance of constituents and idiosyncratic covariance terms among basket constituents are ignored. The approximation tends to be fairly accurate since systematic risk tends to explain majority of the risk for diversified portfolios (such as asset classes), and, as such, the effect of the approximation of the idiosyncratic component tends to be small.

Figure 7 shows the option of idiosyncratic risk approximation which we have added to 'Optimizer Risk Parameters' tab. For asset allocation techniques, the default option is 'Automatic' in which the approximation is enabled when the sum of expanded securities in the portfolio, tradable universe, and benchmark is greater than 5000. Clients also have the option of computing the full idiosyncratic covariance matrix by selecting the 'Disable' option.

## Specifying Risk Budgets

Clients have to specify risk budgets for asset classes when one of risk budgeting, systematic risk budgeting or volatility budgeting is selected. We use a default value of zero for risk budget of an asset class when it is not provided by the client. In this case, the optimization will result in a zero market value weight for the asset class. Clients can specify risk budgets for each asset class in the user-defined data field 'Custom User Field N15' via File > Import > User-Defined Data Fields.

**Analyst Certification**
I, Abhinav Verma, hereby certify (1) that the views expressed in this research report accurately reflect my personal views about any or all of the subject securities or issuers referred to in this research report and (2) no part of my compensation was, is or will be directly or indirectly related to the specific recommendations or views expressed in this research report.

To the extent that any of the conclusions are based on a quantitative model, Barclays hereby certifies (1) that the views expressed in this research report accurately reflect the firm's quantitative research model and (2) no part of the firm's compensation was, is or will be directly or indirectly related to the specific recommendations or views expressed in this research report.

**Important Disclosures:**
The Index Portfolio and Risk Solutions Group ("IPRS") is a part of the Research Department within the Investment Bank of Barclays Bank PLC and its affiliates (collectively and each individually, "Barclays"). IPRS is a leading provider of benchmark and strategy indices, portfolio analytics, risk and attribution models, and portfolio construction tools. IPRS operates independently from other businesses within the Investment Bank, including Sales, Trading, Structuring and Investment Banking. Notwithstanding the foregoing, potential conflicts of interest may exist where: (i) IPRS acts in multiple capacities with respect to a particular Barclays index, including but not limited to functioning as index sponsor, calculation agent, licensing agent, and/or publisher; (ii) IPRS uses price contributions from Barclays' trading desks as a primary pricing source for a Barclays index; and (iii) Barclays' Sales, Trading or Structuring desks launch tradable products linked to the performance of a Barclays index. Barclays has in place policies, information barriers and governance procedures that are designed to avoid or otherwise appropriately manage such conflicts of interest and ensure the independence and integrity of its indices. Where permitted and subject to appropriate information barrier restrictions, Barclays IPRS personnel regularly interact with internal trading desk personnel regarding current market conditions and prices. Additional information about Barclays indices is available at: https://indices.barcap.com/index.dxml.

Any systematic investment strategies described herein may involve a high degree of risk, including without limitation market risk and other risks inherent in investing in securities, commodities, currencies, derivatives and other financial instruments. The value of and income from investments linked to such strategies may decline in value and loss of the original amount invested can occur.

Barclays regularly trades, generally deals as principal and generally provides liquidity (as market maker or otherwise) in the securities, commodities, currencies, derivatives and other financial instruments included in Barclays indices, as well as other financial products linked to such indices. Barclays trading desks may have either a long and/or short position in such securities, commodities, currencies, derivatives and index-linked products, which may pose a conflict with the interests of investing customers and/or index users. All levels, prices and spreads are historical and do not represent current market levels, prices or spreads, some or all of which may have changed since the publication of this document. To the extent that any historical pricing information was obtained from Barclays trading desks, the firm makes no representation that it is accurate or complete.

Barclays does and seeks to do business with issuers covered in its research reports. As a result, investors should be aware that Barclays may have a conflict of interest that could affect the objectivity of this report. Barclays has investment banking and other business relationships with many of the issuers of securities included in Barclays indices, which may result in potential conflicts of interest. Barclays may from time to time perform commercial, investment banking or other advisory services for the issuers of securities included in Barclays indices, including acting as manager, co-manager or underwriter of such securities.

Barclays produces various types of research including, but not limited to, fundamental analysis, equity-linked analysis, quantitative analysis, index strategies research, and trade ideas. Recommendations contained in one type of research may differ from recommendations contained in other types of research, whether as a result of differing time horizons, methodologies, or otherwise.

In order to access Barclays Statement regarding Research Dissemination Policies and Procedures, please refer to https://live.barcap.com/publiccp/RSR/nyfipubs/disclaimer/disclaimer-research-dissemination.html. In order to access Barclays Research Conflict Management Policy Statement, please refer to: https://live.barcap.com/publiccp/RSR/nyfipubs/disclaimer/disclaimer-conflict-management.html.

For current important disclosures regarding companies that are the subject of this research report, please send a written request to: Barclays Research Compliance, 745 Seventh Avenue, 14th Floor, New York, NY 10019 or refer to http://publicresearch.barclays.com or call 212-526-1072.

**Disclaimer:**
This publication has been prepared by the Corporate and Investment Banking division of Barclays Bank PLC and/or one or more of its affiliates (collectively and each individually, "Barclays").It has been issued by one or more Barclays legal entities within its Corporate and Investment Banking division as provided below.
Indices are unmanaged and cannot be invested in directly. The development or creation of any product that uses, is based on, or is developed in connection with any Barclays index (each a "Product") is prohibited without the prior written consent of Barclays. IPRS does not sponsor, endorse, sell or promote such Products and makes no representation regarding the advisability of investing in any such Product.
Barclays is not acting as an investment adviser or fiduciary. This publication does not constitute personal investment advice or take into account the individual financial circumstances or objectives of any investor. The indices, securities, commodities, currencies, derivatives and other financial products discussed herein may not be suitable for all purposes or for all investors. Accordingly, recipients must independently determine, in consultation with their own advisors, whether any index or investment discussed herein is appropriate for their purposes.
The index data, quantitative models, analytic tools and other information ("Content") referenced in this publication are considered reliable, but Barclays does not represent that the Content (including information obtained from third party sources) is accurate, complete or error free, and it should not be relied upon as such. The Content is provided for informational purposes only and is made available "as is". Barclays does not guarantee the accuracy, timeliness, reliability, performance, continued availability, completeness or currency of any Content and Barclays shall have no liability for any errors, omissions or interruptions therein. Any data on past performance, modelling or back-testing contained in the Content is no indication as to future performance. No representation is made as to the reasonableness of the assumptions made within or the accuracy or completeness of any modelling or

back-testing. Because of the possibility of human and mechanical errors as well as other factors, Barclays accepts no responsibility for any errors or omissions in the Content (including but not limited to the calculation or performance of any index and/or the output of any quantitative model or analytic tool). Barclays accepts no liability whatsoever for the accuracy, timeliness, reliability, performance, continued availability, completeness or currency of the Content, or for delays or omissions therein, or for interruptions in the delivery of any Content, or for any special, punitive, indirect, incidental or consequential losses arising from the use of or reliance on any content, even if advised of the possibility of such losses.

Index returns represent past performance and are not indicative of any specific investment. The Content (including any of the output derived from any analytic tools or models) is not intended to predict actual results, which may differ substantially from those reflected. Past performance is not necessarily indicative of future results.

Not all products or services mentioned are available in all jurisdictions. No offers, sales, resales, or delivery of any products or services described herein or any offering materials relating to any such products or services may be made in or from any jurisdiction except in circumstances which will result with compliance with any applicable laws and regulations and which will not impose any obligations on Barclays.

This material has been issued and approved for distribution in the UK and European Economic Area ("EEA") by Barclays Bank PLC. It is being made available primarily to persons who are investment professionals as that term is defined in Article 19 of the Financial Services and Markets Act 2000 (Financial Promotion) Order 2005. It is directed at, and therefore should only be relied upon by, persons who have professional experience in matters relating to investments. The investments to which it relates are available only to such persons and will be entered into only with such persons. Barclays Bank PLC is authorised by the Prudential Regulation Authority and regulated by the Financial Conduct Authority and the Prudential Regulation Authority and is a member of the London Stock Exchange.

The Corporate and Investment Banking division of Barclays undertakes U.S. securities business in the name of its wholly owned subsidiary Barclays Capital Inc., a FINRA and SIPC member. Barclays Capital Inc., a U.S. registered broker/dealer, is distributing this material in the United States and, in connection therewith accepts responsibility for its contents. Any U.S. person wishing to effect a transaction in any security discussed herein should do so only by contacting a representative of Barclays Capital Inc. in the U.S. at 745 Seventh Avenue, New York, New York 10019.

Non-U.S. persons should contact and execute transactions through a Barclays Bank PLC branch or affiliate in their home jurisdiction unless local regulations permit otherwise.

Barclays Bank PLC, Paris Branch (registered in France under Paris RCS number 381 066 281) is regulated by the Autorité des marchés financiers and the Autorité de contrôle prudentiel. Registered office 34/36 Avenue de Friedland 75008 Paris.

This material is distributed in Canada by Barclays Capital Canada Inc., a registered investment dealer and member of IIROC (www.iiroc.ca).

Subject to the conditions of this publication as set out above, the Corporate & Investment Banking Division of Absa Bank Limited, an authorised financial services provider (Registration No.: 1986/004794/06. Registered Credit Provider Reg No NCRCP7), is distributing this material in South Africa. Absa Bank Limited is regulated by the South African Reserve Bank. This publication is not, nor is it intended to be, advice as defined and/or contemplated in the (South African) Financial Advisory and Intermediary Services Act, 37 of 2002, or any other financial, investment, trading, tax, legal, accounting, retirement, actuarial or other professional advice or service whatsoever. Any South African person or entity wishing to effect a transaction in any security discussed herein should do so only by contacting a representative of the Corporate & Investment Banking Division of Absa Bank Limited in South Africa, 15 Alice Lane, Sandton, Johannesburg, Gauteng 2196. Absa Bank Limited is a member of the Barclays group.

In Japan, foreign exchange research reports are prepared and distributed by Barclays Bank PLC Tokyo Branch. Other research reports are distributed to institutional investors in Japan by Barclays Securities Japan Limited. Barclays Securities Japan Limited is a joint-stock company incorporated in Japan with registered office of 6-10-1 Roppongi, Minato-ku, Tokyo 106-6131, Japan. It is a subsidiary of Barclays Bank PLC and a registered financial instruments firm regulated by the Financial Services Agency of Japan. Registered Number: Kanto Zaimukyokucho (kinsho) No. 143.

Barclays Bank PLC, Hong Kong Branch is distributing this material in Hong Kong as an authorised institution regulated by the Hong Kong Monetary Authority. Registered Office: 41/F, Cheung Kong Center, 2 Queen's Road Central, Hong Kong.

Information on securities/instruments that trade in Taiwan or written by a Taiwan-based research analyst is distributed by Barclays Capital Securities Taiwan Limited to its clients. The material on securities/instruments not traded in Taiwan is not to be construed as 'recommendation' in Taiwan.Barclays Capital Securities Taiwan Limited does not accept orders from clients to trade in such securities. This material may not be distributed to the public media or used by the public media without prior written consent of Barclays.

This material is distributed in South Korea by Barclays Capital Securities Limited, Seoul Branch.

All equity research material is distributed in India by Barclays Securities (India) Private Limited (SEBI Registration No: INB/INF 231292732 (NSE), INB/INF 011292738 (BSE) | Corporate Identification Number: U67120MH2006PTC161063 | Registered Office: 208 | Ceejay House | Dr. Annie Besant Road | Shivsagar Estate | Worli | Mumbai - 400 018 | India, Phone: + 91 22 67196363). Other research reports are distributed in India by Barclays Bank PLC, India Branch.

Barclays Bank PLC Frankfurt Branch distributes this material in Germany under the supervision of Bundesanstalt für Finanzdienstleistungsaufsicht (BaFin).

This material is distributed in Malaysia by Barclays Capital Markets Malaysia Sdn Bhd.

This material is distributed in Brazil by Banco Barclays S.A.

This material is distributed in Mexico by Barclays Bank Mexico, S.A.

Barclays Bank PLC in the Dubai International Financial Centre (Registered No. 0060) is regulated by the Dubai Financial Services Authority (DFSA). Principal place of business in the Dubai International Financial Centre: The Gate Village, Building 4, Level 4, PO Box 506504, Dubai, United Arab Emirates. Barclays Bank PLC-DIFC Branch, may only undertake the financial services activities that fall within the scope of its existing DFSA licence. Related financial products or services are only available to Professional Clients, as defined by the Dubai Financial Services Authority.

Barclays Bank PLC in the UAE is regulated by the Central Bank of the UAE and is licensed to conduct business activities as a branch of a commercial bank incorporated outside the UAE in Dubai (Licence No.: 13/1844/2008, Registered Office: Building No. 6, Burj Dubai Business Hub, Sheikh Zayed Road, Dubai City) and Abu Dhabi (Licence No.: 13/952/2008, Registered Office: Al Jazira Towers, Hamdan Street, PO Box 2734, Abu Dhabi).

Barclays Bank PLC in the Qatar Financial Centre (Registered No. 00018) is authorised by the Qatar Financial Centre Regulatory Authority (QFCRA). Barclays Bank PLC-QFC Branch may only undertake the regulated activities that fall within the scope of its existing QFCRA licence. Principal place of business in Qatar: Qatar Financial Centre, Office 1002, 10th Floor, QFC Tower, Diplomatic Area, West Bay, PO Box 15891, Doha, Qatar. Related financial products or services are only available to Business Customers as defined by the Qatar Financial Centre Regulatory Authority.

This material is distributed in the UAE (including the Dubai International Financial Centre) and Qatar by Barclays Bank PLC.

This material is distributed in Saudi Arabia by Barclays Saudi Arabia ('BSA'). It is not the intention of the publication to be used or deemed as recommendation, option or advice for any action(s) that may take place in future. Barclays Saudi Arabia is a Closed Joint Stock Company, (CMA License No. 09141-37). Registered office Al Faisaliah Tower, Level 18, Riyadh 11311, Kingdom of Saudi Arabia. Authorised and regulated by the Capital Market Authority, Commercial Registration Number: 1010283024.

This material is distributed in Russia by OOO Barclays Capital, affiliated company of Barclays Bank PLC, registered and regulated in Russia by the FSFM.