Asia Quantitative Research: Relationship between market breadth and value factor

Tsumugi Akiba
+852-2978-1383 | tsumugi.akiba@gs.com
Goldman Sachs (Asia) L.L.C.

Crystal Lu
+65-6654-5269 | crystal.lu@gs.com
Goldman Sachs (Singapore) Pte

In recent meetings with investors, many voiced concerns about the general perception that Asian equity markets are narrow and that this is causing the underperformance of Value factors. While our newly constructed Market Breadth Index (MBI) indicates a relatively narrow breadth in Japan, the MBI registers above average in Asia excluding Japan (MXAPJ).

- The Japan MBI is currently trending downward (narrow breadth) while the MXAPJ MBI is trending upward (wide breadth).
- The MBI is an index that consists of three concepts to measure market breadth: Dispersion, Correlation and Concentration.
- The MBI shows a high correlation with Value factors especially forward P/E (Exhibits 1 and 2).
- Monitoring the trend of the MBIs may help investors identify when to diversify factors and when to concentrate.

Portfolio managers' summary on market breadth

Investors often refer to market breadth when talking about alpha opportunities in the equity market. One of the most frequently discussed topics in our recent meetings with both quantitative and fundamental investors, is how market breadth and the narrowing/widening of it, affect their performance. We define market breadth as the degree to which a broad base of securities participate in overall market movements. Investors loosely use three concepts to measure market breadth: Dispersion, Correlation and Concentration. To that end, we construct the Market Breadth Index (MBI) for Japan and Asia excluding Japan (MXAPJ), using the three concepts. While the MBI for Japan is currently at the low end of its range, indicating a tough market condition for single style investment strategy for alpha generation, the case is opposite for AeJ.

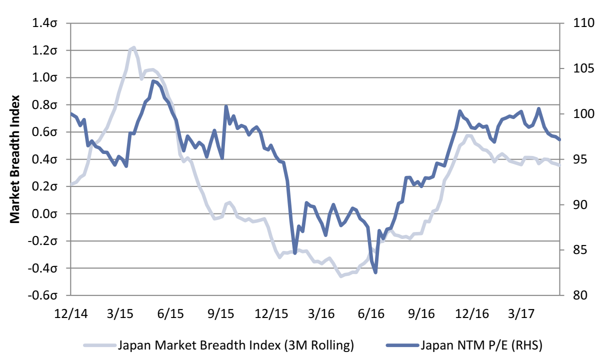
Assessing alpha opportunities of the investing universe is an important aspect of the investment process as it can have a potentially large influence on allocation. Our main goal behind developing the MBI is to provide a quantitative measure of alpha opportunities in Japanese and AeJ equity markets. In addition, our aim of the MBI is to identify significant changes in market conditions to better capture alpha opportunities systematically. Each of the three components of the MBI has slightly different implications. However, by constructing a composite of the three, we believe it provides meaningful insights with regards to the equity market.

In this report, we discuss the MBI's construction and implication.

Market breadth affects quantitative factors differently, the wider the better for Value

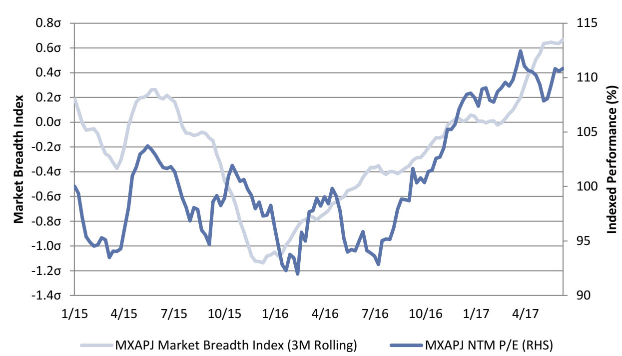
Market breadth affects quantitative factors' performance, but not all are equally affected. Quantitative factors such as Value benefit from the mean-reversion effect, such that the strategy makes profit by the conversion of the spread between richly valued stocks and less expensive stocks. The wider the breadth, the more room to converge, and therefore the more profitable the factor gets. Consequently, the strategy is less effective if the breadth does not exist.

Exhibit 1: Forward P/E factor performance shows a strong correlation with the MBI
Japan Market Breadth Index and NTM P/E Factor Performance



Source: FactSet, IBES, Bloomberg, Goldman Sachs Global Investment Research

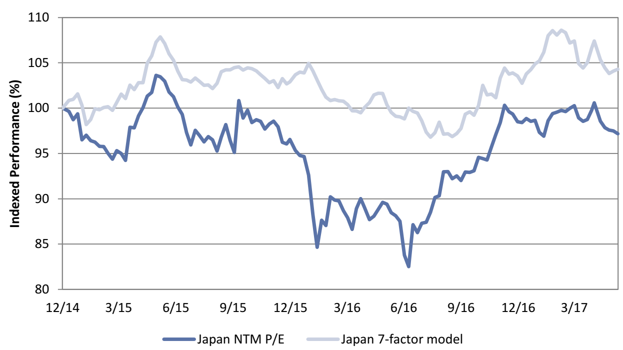
Exhibit 2: Upward trend of MXAPJ MBI supports performance of forward P/E
MXAPJ Market Breadth Index and NTM P/E Factor Performance



Source: FactSet, IBES, Bloomberg, Goldman Sachs Global Investment Research

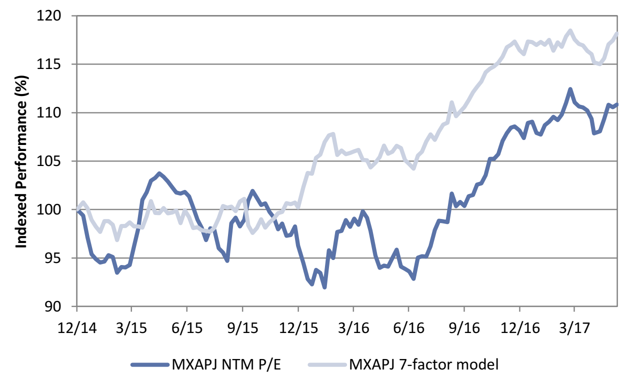
Backtesting results of our simple equal-weighted 7-factor model indicate that factor diversification is effective especially when breadth measures show narrow breadth. Exhibits 3 and 4 show the performance of single factor strategy (forward P/E) vis-a-vis a simple equal-weighted 7-factor based strategy. In both Japan and AeJ, factor diversification produces a more stable and consistent performance despite the changes in market breadth. Our equal-weighted 7 factors include value and momentum factors such as next 12M P/E, P/B, dividend yield, EV/EBITDA, 6M and (12M – 1M) price momentum, and 1M consensus EPS revision.

Exhibit 3: Simple factor diversification produces more stable and better performance
Single factor (NTM P/E) and 7-factor performance in Japan



Source: FactSet, IBES, Bloomberg, Goldman Sachs Global Investment Research

Exhibit 4: Simple factor diversification works significantly better than single Value (P/E) strategy in MXAPJ
Single factor (NTM P/E) and 7-factor performance in MXAPJ



Source: FactSet, IBES, Bloomberg, Goldman Sachs Global Investment Research

Market Breadth Index: Construction

As mentioned earlier in the note, our Market Breadth Index utilizes three concepts - Dispersion, Correlation and Concentration.

First component: Dispersion

Dispersion, adjusted by market volatility, is a cross-sectional concept. Wider dispersion represents more alpha opportunities as the gap between outperformers and underperformers widens, hence making rewards higher. In contrast, periods when the market experiences narrow return dispersion is likely to offer less alpha opportunities and therefore disappointing performance results. We adjust dispersion by market volatility as dispersion heavily depends on market volatility (i.e., periods of high dispersion are also characterized by high market volatility). Three measures for dispersion include:

1. **Cross-sectional stock level return dispersion adjusted by market volatility**: We calculate this by taking a cross-sectional standard deviation of stock level returns of index constituents, and then adjust it by index volatility. If the return dispersion is low, the breadth is said to be narrow. We use the historical time-series data for TOPIX 500 and MXAPJ.
2. **Quantitative factor return dispersion adjusted by market volatility**: We calculate this by taking a cross-sectional standard deviation of sector neutral long/short factor basket returns, and then adjust it by index volatility. If the factor return dispersion is low, the breadth is said to be narrow. We use the historical time-series data.
3. **Cross-sectional return dispersion of actively managed mutual funds[1.]**: We calculate this by taking a cross-sectional standard deviation of actively managed mutual funds' return, and then adjust it by index volatility (for details on mutual funds

1. Huij, Joop and Lansdorp, Simon, Mutual Fund Performance Persistence, Market Efficiency, and Breadth (October 25, 2012). Available at SSRN: https://ssrn.com/abstract=2166824 or http://dx.doi.org/10.2139/ssrn.2166824

selection, please see the Appendix section). If the mutual funds' return dispersion is low, the breadth is said to be narrow.

However, there is a caveat to this. Dispersion, even adjusted by market volatility, can show a much wider measure and a misleading reading when a small group of stocks outperformed/underperformed significantly and the rest of the stocks had very similar returns, in the case of positively/negatively skewed distribution. Nonetheless, we see the above mentioned as three useful dispersion measures that reflect the market condition in general.

Second component: Correlation/Synchronicity

Correlation or synchronicity is a measure of how closely stocks in an index move together. It is a time-series concept. The higher the correlation/synchronicity, the lower the alpha opportunities as more stocks move in a similar direction. Hence, rewards between picking outperformers and underperformers are lower. Within each of the three concepts, we have included measures described below:

1. **Co-movement of stocks**: We calculate this by counting the number of stocks that move in the same direction in a given period of time. This measure therefore lies between 50 and 100 percent. The higher the value, the closer the stocks move, and therefore the breadth is said to be narrow. We use the historical time-series data for TOPIX 500 and MXAPJ.
2. **Regression based average R-squared**: This looks at the portion of stock returns explained by the market by a stock-level simple regression of returns. The idea is similar to our earlier work on return disaggregation (see here for more details[2.]). The regression model is built for each stock with the following formula…

$$r_{i,c,t} = \alpha + \beta r_{m,t} + \varepsilon_{i,c,t}$$

…where $r_{i,c,t}$ represents the individual stock return and $r_{m,t}$ represents the market return. The R-squared is a measure of how fit the data are to the regression line. A high cross-sectional average R-squared with all the stocks in the index suggests a high degree of price synchronicity, meaning the breadth is narrow. We use the historical time-series data.

3. **Average pair-wise correlation**: We calculate this by taking the average of all possible stock-to-stock pairs in the index. If many move in the same way, the average correlation becomes high, and the breadth is said to be narrow.

Third component: Concentration

Concentration is a quantitative measure of how concentrated stock returns are. High concentration happens when a small number of stocks drive the overall index, indicating lower alpha opportunities in general. On the other hand, low concentration means more alpha opportunities.

2. Asian Quantamentals: Factors vs. Fundamentals: Disaggregating stock returns in Asia (February 21, 2017)

1. **Market density**: This is a measure of the impact by the largest 10 stocks in an index. It is the time-series share of index such as TOPIX and MXAPJ market cap accounted for by the 10 largest stocks. The market is said to be narrow if the index relies heavily on a small number of stocks, i.e., high density. We use the historical time-series data for TOPIX 500 and MXAPJ.

2. **Return concentration**[3]: This is a measure of how concentrated returns are on a weighted basis. An index return is a weighted sum of constituents return. The actual return concentration (RC) formula is as follows…

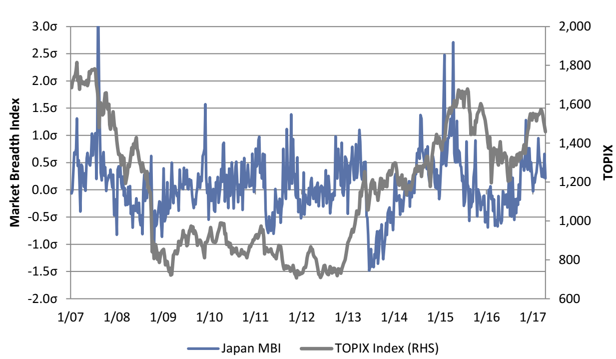
$$Return\ Concentration = \frac{R^2 * \sum w^2}{\sum w^2 * r^2}$$

…where R represents the Index return, w is individual constituents weights, and r is individual constituents 3M return. The value takes 0% to 100%. There can be two extreme cases, 0 or 100. The first extreme case happens when all stocks contribute equally on a weighted basis to the overall index return. The reading indicates 100 in such cases, and alpha opportunity is at its highest. The other extreme case happens when one stock accounts for the entire index return. The reading indicates 0 in this case and alpha opportunity is at its lowest.

We construct the MBI by taking the average of the each component in standardized Z-score terms. Exhibits 5 and 6 below show the historical MBIs along with TOPIX index (left hand chart) and MXAPJ index (right hand chart). The MBIs vary over time and generally track the benchmark indices.

Exhibit 5: Market Breadth Index tracks TOPIX and shows cyclicality

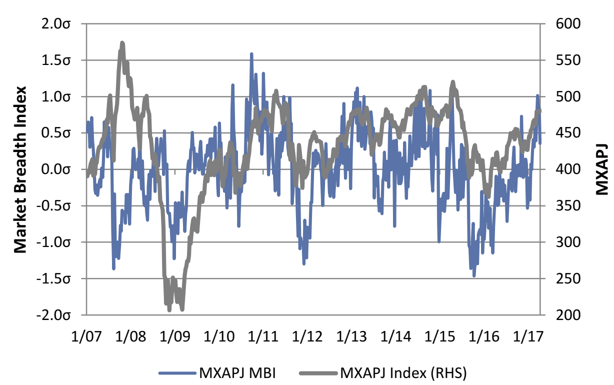
Japan Market Breadth Index (MBI) and TOPIX Index



Source: FactSet, IBES, Bloomberg, Goldman Sachs Global Investment Research

Exhibit 6: Market Breadth Index and MXAPJ performance is highly correlated, but MBI is not a good predictor of future return

MXAPJ Market Breadth Index (MBI) and MSCI AC Asia Pacific ex-Japan Index



Source: FactSet, IBES, Bloomberg, Goldman Sachs Global Investment Research

3. US Weekly Kickstart: Introducing the Goldman Sachs Breadth Index: Ride mega-cap and momentum into 2016 (November 13, 2015)

Appendix

Actively managed Japan and Asia ex-Japan equity mutual funds

We screen mutual funds based on following criteria:

- Fund Type: Mutual Fund
- Fund Asset Class Focus: Equity
- Fund Geographical Focus

- Japan: Japan Country Focus
- AEJ: Asian Pacific Region or Asian Pacific Region ex Japan or any regional focus with more than 1 country.

- Exclude funds with objective in certain region/sector
- Total Assets > US$100 million

There are 113 funds for Japan (total AUM: US$60.5 billion) and 93 funds for AeJ (total AUM: US$57.3 billion) from our screen. Performances are gross returns.

Disclosure Appendix

Reg AC

We, Tsumugi Akiba and Crystal Lu, hereby certify that all of the views expressed in this report accurately reflect our personal views about the subject company or companies and its or their securities. We also certify that no part of our compensation was, is or will be, directly or indirectly, related to the specific recommendations or views expressed in this report.

Unless otherwise stated, the individuals listed on the cover page of this report are analysts in Goldman Sachs' Global Investment Research division.

GS Factor Profile

The Goldman Sachs Factor Profile provides investment context for a security by comparing key attributes of that security to its conviction sector and the market. The four key attributes depicted are: growth, returns, multiple and an integrated IP score. Growth returns and multiple are indexed based on composites of several methodologies to determine the stocks percentile ranking within the region's coverage universe. The precise calculation of each metric may vary depending on the fiscal year, industry and region but the standard approach is as follows:

Growth is a composite of next year's estimate over current year's estimate, e.g. EPS, EBITDA, Revenue. **Return** is a year one prospective aggregate of various return on capital measures, e.g. CROCI, ROACE, and ROE. **Multiple** Multiple is a composite of one-year forward valuation ratios, e.g. P/E, dividend yield, EV/FCF, EV/EBITDA, EV/DACF, Price/Book. **Integrated IP score** is a composite of Growth, Return and Multiple scores.

Quantum

Quantum is Goldman Sachs' proprietary database providing access to detailed financial statement histories, forecasts and ratios. It can be used for in-depth analysis of a single company, or to make comparisons between companies in different sectors and markets.

GS SUSTAIN

GS SUSTAIN is a global investment strategy aimed at long-term, long-only performance with a low turnover of ideas. The GS SUSTAIN focus list includes leaders our analysis shows to be well positioned to deliver long term outperformance through sustained competitive advantage and superior returns on capital relative to their global industry peers. Leaders are identified based on quantifiable analysis of three aspects of corporate performance: cash return on cash invested, industry positioning and management quality (the effectiveness of companies' management of the environmental, social and governance issues facing their industry).

Disclosures

Distribution of ratings/investment banking relationships

Goldman Sachs Investment Research global Equity coverage universe

	Rating Distribution			Investment Banking Relationships		
	Buy	Hold	Sell	Buy	Hold	Sell
Global	33%	53%	14%	63%	57%	50%

As of April 1, 2017, Goldman Sachs Global Investment Research had investment ratings on 2,857 equity securities. Goldman Sachs assigns stocks as Buys and Sells on various regional Investment Lists; stocks not so assigned are deemed Neutral. Such assignments equate to Buy, Hold and Sell for the purposes of the above disclosure required by the FINRA Rules. See 'Ratings, Coverage groups and views and related definitions' below. The Investment Banking Relationships chart reflects the percentage of subject companies within each rating category for whom Goldman Sachs has provided investment banking services within the previous twelve months.

Regulatory disclosures

Disclosures required by United States laws and regulations

See company-specific regulatory disclosures above for any of the following disclosures required as to companies referred to in this report: manager or co-manager in a pending transaction; 1% or other ownership; compensation for certain services; types of client relationships; managed/co-managed public offerings in prior periods; directorships; for equity securities, market making and/or specialist role. Goldman Sachs trades or may trade as a principal in debt securities (or in related derivatives) of issuers discussed in this report.

The following are additional required disclosures: **Ownership and material conflicts of interest:** Goldman Sachs policy prohibits its analysts, professionals reporting to analysts and members of their households from owning securities of any company in the analyst's area of coverage. **Analyst compensation:** Analysts are paid in part based on the profitability of Goldman Sachs, which includes investment banking revenues. **Analyst as officer or director:** Goldman Sachs policy prohibits its analysts, persons reporting to analysts or members of their households from serving as an officer, director, advisory board member or employee of any company in the analyst's area of coverage. **Non-U.S. Analysts:** Non-U.S. analysts may not be associated persons of Goldman, Sachs & Co. and therefore may not be subject to FINRA Rule 2241 or FINRA Rule 2242 restrictions on communications with subject company, public appearances and trading securities held by the analysts.

Distribution of ratings: See the distribution of ratings disclosure above. **Price chart:** See the price chart, with changes of ratings and price targets in prior periods, above, or, if electronic format or if with respect to multiple companies which are the subject of this report, on the Goldman Sachs website at http://www.gs.com/research/hedge.html.

Additional disclosures required under the laws and regulations of jurisdictions other than the United States

The following disclosures are those required by the jurisdiction indicated, except to the extent already made above pursuant to United States laws and regulations. **Australia:** Goldman Sachs Australia Pty Ltd and its affiliates are not authorised deposit-taking institutions (as that term is defined in the Banking Act 1959 (Cth)) in Australia and do not provide banking services, nor carry on a banking business, in Australia. This research, and any access to it, is intended only for "wholesale clients" within the meaning of the Australian Corporations Act, unless otherwise agreed by Goldman Sachs. In producing research reports, members of the Global Investment Research Division of Goldman Sachs Australia may attend site visits and other meetings hosted by the issuers the subject of its research reports. In some instances the costs of such site visits or meetings may be met in part or in whole by the issuers concerned if Goldman Sachs Australia considers it is appropriate and reasonable in the specific circumstances relating to the site visit or meeting. **Brazil:** Disclosure information in relation to CVM Instruction 483 is available at http://www.gs.com/worldwide/brazil/area/gir/index.html. Where applicable, the Brazil-registered analyst primarily responsible for the content of this research report, as defined in Article 16 of CVM Instruction 483, is the first author named at the beginning of this report, unless indicated otherwise at the end of the text. **Canada:** Goldman Sachs Canada Inc. is an affiliate of The Goldman Sachs Group Inc. and therefore is included in the company specific disclosures relating to Goldman Sachs (as defined above). Goldman Sachs Canada Inc. has approved of, and agreed to take responsibility for, this research report in Canada if and to the extent that Goldman Sachs Canada Inc. disseminates this research report to its clients. **Hong Kong:** Further information on the securities of covered companies referred to in this research may be obtained on request from Goldman Sachs (Asia) L.L.C. **India:** Further information on the subject company or companies referred to in this research may be obtained from Goldman Sachs (India) Securities Private Limited, Research Analyst - SEBI Registration Number INH000001493, 951-A, Rational House, Appasaheb Marathe Marg, Prabhadevi, Mumbai 400 025, India, Corporate Identity Number U74140MH2006FTC160634, Phone +91 22 6616 9000, Fax +91 22 6616 9001. Goldman Sachs may beneficially own 1% or more of the securities (as such term is defined in clause 2 (h) the Indian Securities Contracts (Regulation) Act, 1956) of the subject company or companies referred to in this research report. **Japan:** See below. **Korea:** Further information on the subject company or companies referred to in this research may be obtained from Goldman Sachs (Asia) L.L.C., Seoul Branch. **New Zealand:** Goldman Sachs New Zealand Limited and its affiliates are neither "registered banks" nor "deposit takers" (as defined in the Reserve Bank of New Zealand Act 1989) in New Zealand. This research, and any access to it, is intended for "wholesale clients" (as defined in the Financial Advisers Act 2008) unless otherwise agreed by Goldman Sachs. **Russia:** Research reports distributed in the Russian Federation are not advertising as defined in the Russian legislation, but are information and analysis not having product promotion as their main purpose and do not provide appraisal within the meaning of the Russian legislation on appraisal activity. **Singapore:** Further information on the covered companies referred to in this research may be obtained from Goldman Sachs (Singapore) Pte. (Company Number: 198602165W). **Taiwan:** This material is for reference only and must not be reprinted without permission. Investors should carefully consider their own investment risk. Investment results are the responsibility of the individual investor. **United Kingdom:** Persons who would be categorized as retail clients in the United Kingdom, as such term is defined in the rules of the Financial Conduct Authority, should read this research in conjunction with prior Goldman Sachs research on the covered companies referred to herein and should refer to the risk warnings that have been sent to them by Goldman Sachs International. A copy of these risks warnings, and a glossary of certain financial terms used in this report, are available from Goldman Sachs International on request.

European Union: Disclosure information in relation to Article 4 (1) (d) and Article 6 (2) of the European Commission Directive 2003/125/EC is available at http://www.gs.com/disclosures/europeanpolicy.html which states the European Policy for Managing Conflicts of Interest in Connection with Investment Research.

Japan: Goldman Sachs Japan Co., Ltd. is a Financial Instrument Dealer registered with the Kanto Financial Bureau under registration number Kinsho 69, and a member of Japan Securities Dealers Association, Financial Futures Association of Japan and Type II Financial Instruments Firms Association. Sales and purchase of equities are subject to commission pre-determined with clients plus consumption tax. See company-specific disclosures as to any applicable disclosures required by Japanese stock exchanges, the Japanese Securities Dealers Association or the Japanese Securities Finance Company.

Ratings, coverage groups and views and related definitions

Buy (B), Neutral (N), Sell (S) -Analysts recommend stocks as Buys or Sells for inclusion on various regional Investment Lists. Being assigned a Buy or Sell on an Investment List is determined by a stock's return potential relative to its coverage group as described below. Any stock not assigned as a Buy or a Sell on an Investment List is deemed Neutral. Each regional Investment Review Committee manages various regional Investment Lists to a global guideline of 25%-35% of stocks as Buy and 10%-15% of stocks as Sell; however, the distribution of Buys and Sells in any particular coverage group may vary as determined by the regional Investment Review Committee. Additionally, the regional Investment Review Committees each manage regional Conviction lists which represent investment recommendations focused on either the size of the potential return or the likelihood of the realization of the return. Addition or removal of stocks from such Conviction lists do not represent a change in the analysts' investment rating for such stocks.

Total return potential represents the upside or downside differential between the current share price and the price target, including all paid or anticipated dividends, expected during the time horizon associated with the price target. Price targets are required for all covered stocks. The total return potential, price target and associated time horizon are stated in each report adding or reiterating an Investment List membership.

Coverage groups and views: A list of all stocks in each coverage group is available by primary analyst, stock and coverage group at http://www.gs.com/research/hedge.html. The analyst assigns one of the following coverage views which represents the analyst's investment outlook on the coverage group relative to the group's historical fundamentals and/or valuation. **Attractive (A).** The investment outlook over the following 12 months is favorable relative to the coverage group's historical fundamentals and/or valuation. **Neutral (N).** The investment outlook over the following 12 months is neutral relative to the coverage group's historical fundamentals and/or valuation. **Cautious (C).** The investment outlook over the following 12 months is unfavorable relative to the coverage group's historical fundamentals and/or valuation.

Not Rated (NR). The investment rating and target price have been removed pursuant to Goldman Sachs policy when Goldman Sachs is acting in an advisory capacity in a merger or strategic transaction involving this company and in certain other circumstances. **Rating Suspended (RS).** Goldman Sachs Research has suspended the investment rating and price target for this stock, because there is not a sufficient fundamental basis for determining, or there are legal, regulatory or policy constraints around publishing, an investment rating or target. The previous investment rating and price target, if any, are no longer in effect for this stock and should not be relied upon. **Coverage Suspended (CS).** Goldman Sachs has suspended coverage of this company. **Not Covered (NC).** Goldman Sachs does not cover this company. **Not Available or Not Applicable (NA).** The information is not available for display or is not applicable. **Not Meaningful (NM).** The information is not meaningful and is therefore excluded.

Global product; distributing entities

The Global Investment Research Division of Goldman Sachs produces and distributes research products for clients of Goldman Sachs on a global basis. Analysts based in Goldman Sachs offices around the world produce equity research on industries and companies, and research on macroeconomics, currencies, commodities and portfolio strategy. This research is disseminated in Australia by Goldman Sachs Australia Pty Ltd (ABN 21 006 797 897); in Brazil by Goldman Sachs do Brasil Corretora de Títulos e Valores Mobiliários S.A.; in Canada by either Goldman Sachs Canada Inc. or Goldman, Sachs & Co.; in Hong Kong by Goldman Sachs (Asia) L.L.C.; in India by Goldman Sachs (India) Securities Private Ltd.; in Japan by Goldman Sachs Japan Co., Ltd.; in the Republic of Korea by Goldman Sachs (Asia) L.L.C., Seoul Branch; in New Zealand by Goldman Sachs New Zealand Limited; in Russia by OOO Goldman Sachs; in Singapore by Goldman Sachs (Singapore) Pte. (Company Number: 198602165W); and in the United States of America by Goldman, Sachs & Co. Goldman Sachs International has approved this research in connection with its distribution in the United Kingdom and European Union.

European Union: Goldman Sachs International authorised by the Prudential Regulation Authority and regulated by the Financial Conduct Authority and the Prudential Regulation Authority, has approved this research in connection with its distribution in the European Union and United Kingdom; Goldman Sachs AG and Goldman Sachs International Zweigniederlassung Frankfurt, regulated by the Bundesanstalt für Finanzdienstleistungsaufsicht, may also distribute research in Germany.

General disclosures

This research is for our clients only. Other than disclosures relating to Goldman Sachs, this research is based on current public information that we consider reliable, but we do not represent it is accurate or complete, and it should not be relied on as such. The information, opinions, estimates and forecasts contained herein are as of the date hereof and are subject to change without prior notification. We seek to update our research as appropriate, but various regulations may prevent us from doing so. Other than certain industry reports published on a periodic basis, the large majority of reports are published at irregular intervals as appropriate in the analyst's judgment.

Goldman Sachs conducts a global full-service, integrated investment banking, investment management, and brokerage business. We have investment banking and other business relationships with a substantial percentage of the companies covered by our Global Investment Research Division. Goldman, Sachs & Co., the United States broker dealer, is a member of SIPC (http://www.sipc.org).

Our salespeople, traders, and other professionals may provide oral or written market commentary or trading strategies to our clients and principal trading desks that reflect opinions that are contrary to the opinions expressed in this research. Our asset management area, principal trading desks and investing businesses may make investment decisions that are inconsistent with the recommendations or views expressed in this research.

The analysts named in this report may have from time to time discussed with our clients, including Goldman Sachs salespersons and traders, or may discuss in this report, trading strategies that reference catalysts or events that may have a near-term impact on the market price of the equity securities discussed in this report, which impact may be directionally counter to the analyst's published price target expectations for such stocks. Any such trading strategies are distinct from and do not affect the analyst's fundamental equity rating for such stocks, which rating reflects a stock's return potential relative to its coverage group as described herein.

We and our affiliates, officers, directors, and employees, excluding equity and credit analysts, will from time to time have long or short positions in, act as principal in, and buy or sell, the securities or derivatives, if any, referred to in this research.

The views attributed to third party presenters at Goldman Sachs arranged conferences, including individuals from other parts of Goldman Sachs, do not necessarily reflect those of Global Investment Research and are not an official view of Goldman Sachs.

Any third party referenced herein, including any salespeople, traders and other professionals or members of their household, may have positions in the products mentioned that are inconsistent with the views expressed by analysts named in this report.

This research is not an offer to sell or the solicitation of an offer to buy any security in any jurisdiction where such an offer or solicitation would be illegal. It does not constitute a personal recommendation or take into account the particular investment objectives, financial situations, or needs of individual clients. Clients should consider whether any advice or recommendation in this research is suitable for their particular circumstances and, if appropriate, seek professional advice, including tax advice. The price and value of investments referred to in this research and the income from them may fluctuate. Past performance is not a guide to future performance, future returns are not guaranteed, and a loss of original capital may occur. Fluctuations in exchange rates could have adverse effects on the value or price of, or income derived from, certain investments.

Certain transactions, including those involving futures, options, and other derivatives, give rise to substantial risk and are not suitable for all investors. Investors should review current options disclosure documents which are available from Goldman Sachs sales representatives or at http://www.theocc.com/about/publications/character-risks.jsp. Transaction costs may be significant in option strategies calling for multiple purchase and sales of options such as spreads. Supporting documentation will be supplied upon request.

All research reports are disseminated and available to all clients simultaneously through electronic publication to our internal client websites. Not all research content is redistributed to our clients or available to third-party aggregators, nor is Goldman Sachs responsible for the redistribution of our research by third party aggregators. For research, models or other data available on a particular security, please contact your sales representative or go to http://360.gs.com.

Disclosure information is also available at http://www.gs.com/research/hedge.html or from Research Compliance, 200 West Street, New York, NY 10282.