bluebird bio

Notes from the Road

Overweight

BLUE, BLUE US

Price: $36.47

▲ **Price Target: $53.00**
Previous: $44.00

Following bluebird's rather striking data at EHA over the weekend (see our note here), we had the opportunity to host management for two days of investor meetings and wanted to pass along some of the key takeaways. Not surprisingly, discussion focused largely on the new beta-thalassemia data. Management reiterated their (and KOL) surprise and enthusiasm for the results (especially the speed and quantity of the hemoglobin increases), describing it as a "best case" scenario. Investors across the board viewed this as a highly de-risking event. Other points of discussion were around the read-through from the B-Thal data to sickle-cell anemia (it's positive) and progress with the CCALD trial (which is on track). Overall, we continue to view BLUE – with its gene therapy platform – as a potentially transformative and disruptive company that appears to be much more than just a "big idea". Thus, we are reiterating our Overweight rating and increasing our YE14 target to $53 (from $44) on a higher probability of success assigned to the LentiGlobin program in B-Thal.

- **One of the main reasons for releasing the data early was to give doctors/patients more information as they consider trial enrollment.** BLUE noted that prior to this data release, doctors may have reserved the clinical trial option as an option of last resort for the sickest patients. However, the availability of these results at EHA – and of course the degree of benefit observed in the initial 2 patients – may alter the decision matrix now as docs/patients consider their options. To date, across both the HGB-205 and Northstar Ph1/2 trials, BLUE has enrolled 10/22 pts and 3 pts have been transplanted (2 of which were from the HGB-205 trial that we saw data for last wknd). The next data update is likely to be at ASH in December for both the HGB-205 and Northstar Ph1/2 trials. BLUE also plans on announcing when the 1st sickle cell disease patient is treated.

- **Approximately 80-90% of the improvements that produced the new LentiGlobin vector were process related, which strengthens exclusivity.** When asked whether academic labs could reproduce similar vectors, BLUE noted that the potency of their vector is highly process dependent, with industrialization being a key factor. The currently produced lentiviral products coming out of academic labs have a VCN ≤1 (vs. the 1.5 and 2.1 seen with the first 2 pts receiving BLUE's new product). Thus, in addition to specific IP, BLUE believes expertise/knowhow and scale are two key additional factors that will prevent duplication. BLUE does not believe any further optimization of LentiGlobin is going to be required and is targeting vector copy numbers of >1.

Biotechnology

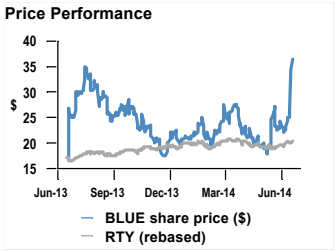
Cory Kasimov AC
(1-212) 622-5266
cory.w.kasimov@jpmorgan.com
Bloomberg JPMA KASIMOV <GO>

Matthew J. Lowe, Ph.D.
(1-212) 622-0848
matthew.j.lowe@jpmorgan.com

Whitney G Ijem
(1-212) 622-4668
whitney.g.ijem@jpmorgan.com

Brittany Terner
(1-212) 622-8527
brittany.terner@jpmorgan.com

J.P. Morgan Securities LLC



	YTD	1m	3m	12m
Abs	74.7%	36.4%	34.1%	114.5 %
Rel	73.6%	30.8%	35.1%	95.4%

bluebird bio, Inc. (BLUE;BLUE US)

FYE Dec	2013A	2014E
EPS reported ($)		
Q1 (Mar)	-	(0.44)A
Q2 (Jun)	(2.13)	(0.46)
Q3 (Sep)	(0.26)	(0.46)
Q4 (Dec)	(0.33)	(0.45)
FY	(2.02)	(1.80)
Bloomberg EPS FY ($)	-1.66	-1.78

Source: Company data, Bloomberg, J.P. Morgan estimates.

Company Data	
Price ($)	36.47
Date Of Price	17 Jun 14
52-week Range ($)	41.75-17.00
Market Cap ($ mn)	882.57
Fiscal Year End	Dec
Shares O/S (mn)	24
Price Target ($)	53.00
Price Target End Date	31-Dec-14

See page 5 for analyst certification and important disclosures.

- **While many beta-thalassemia pts are located ex-US, BLUE believes the pharmacoeconomics of a cure will make sense to cash strapped governments.** Given the higher prevalence of B-Thal in tropical and sub-tropical countries (e.g. the Middle East, Southeast Asia), there were some questions on the actual market opportunity for a highly transformative (i.e. high tech and expensive) therapy. BLUE noted that the economic burden of constant (~1x/month) blood transfusions for these pts is large. They pointed to Thailand as an example of an ex-US government's willingness to pay for a curative treatment. In Thailand, the government has started paying for allogenic transplants in children as they recognize it is more cost effective.

- **The amount of corrected βAT87Q-globin seen with the new vector has positive read-through to sickle-cell disease.** In the most recent data, up to ~70% of the total amount of a patient's hemoglobin was βAT87Q-globin (vs. ~33% with the best performing pt – #1003 – from LG001), which BLUE believes could be sufficient to eliminate the sickle-cell phenotype. BLUE highlighted an example from nature, wherein pts with abnormally high fetal hemoglobin levels – which is functional/non-sickling – can have dramatic attenuation (and in some cases complete obliteration) of their sickle-cell disease. Data from these rare pts have shown that if just 15-30% of the total hemoglobin is fetal that can rescue the phenotype (clearly the 70% level seen in the most recent B-Thal data far exceeds that threshold).

- **No news is good news for CCALD as the Ph2/3 trial progresses as planned, and the push for newborn screening grows.** BLUE noted that they remain on track to finish Phase 2/3 enrollment for Lenti-D in CCALD sometime in 2015. BLUE indicated there is tremendous enthusiasm for this study worldwide, and noted that newborn screening has been implemented faster than they thought. Newborn screening has already been implemented in the state of NY (where 7 cases have been identified since the start of the program in Dec 2013), and CA and CT will hopefully follow suit shortly.

- **BLUE's cash position is strong with $193M as of the end of 1Q, which should last into 2016 using conservative assumptions.** Management believes their current cash position is sufficient to run operations into 2016, even when assuming that OpEx ramps up to support continued Lenti-D and LentiGlobin development. They noted that this runway does not assume a raise or that the CAR-T collaboration with CELG produces any more milestones/fees.

- **Increasing price target to $53 (from $44) on higher probability of success for LentiGlobin in beta-thalassemia; significant dry powder still left in our model.** On the back of highly positive Ph1/2 data, we have bumped up our probability of success for LentiGlobin (in B-Thal only) to 50% (from 25%). We still don't include sickle cell disease in our valuation even though we are materially more optimistic about the program. Overall, we think our assumptions remain quite conservative, and if the data continue to trend in this direction, there is a substantial amount of upside still left in our model.

Cory Kasimov
(1-212) 622-5266
cory.w.kasimov@jpmorgan.com

Investment Thesis, Valuation and Risks

bluebird bio *(Overweight; Price Target: $53.00)*

Investment Thesis

We have an OW rating on BLUE. In our view, BLUE, with its gene therapy platform, is one of the more potentially transformative and disruptive companies we've come across in some time. Importantly, BLUE has already established promising proof of concept for its two lead products, Lenti-D and LentiGlobin, and it is going after orphan indications (such as CCALD and beta-thalassemia) with a very high unmet medical need that could bolster the ultimate probability of success.

Valuation

We have a Dec 2014 price target of $53 for BLUE. Our valuation methodology is based on a blended average of our risk-adjusted NPV model (33%), our proprietary scenario analysis (33%), and a DCF analysis (33%) and reflects a 50% probability of success for Lenti-D (~$250M in peak sales) and 50% for LentiGlobin (~$1B peak). We assign each valuation method a 15% discount rate, which we believe is appropriate given the probability-adjustments made to each development program.

BLUE Valuation Summary

BlueBird Bio : Valuation Summary

Discount rate	15%		
Main value driver	**Prob of approval**	**Peak sales est (avg. scenario)**	**Avg peak yr**
CCALD	50%	$ 260	2022
B-Thalassemia	50%	$ 1,204	2023
Sickle Cell Disease	0%	$ -	-
Valuation methodology	Value	Weighting	Adj. value/ share
P/E 2015	$ -	0%	$ -
Real options scenario analysis	$ 58.60	33%	19.5
Risk adjusted NPV analysis	$ 45.14	33%	15.0
DCF analysis	$ 53.87	33%	18.0
Total			$ 52.53
Catalyst/liquidity discount			0%
YE14 Valuation			**$ 53**

Source: J.P. Morgan estimates.

Risks to Rating and Price Target

Downside risks to our OW recommendation include the standard issues that apply to the entire biotechnology industry, including development, regulatory, commercial, manufacturing, financing, and IP pitfalls. Other risks specific to BLUE include clinical trial risk with ongoing studies involving Lenti-D or LentiGlobin, regulatory uncertainty surrounding gene therapy, the company's ability to deliver gene therapies on a commercially viable scale, and competition within the gene therapy field.

Cory Kasimov
(1-212) 622-5266
cory.w.kasimov@jpmorgan.com

bluebird bio: Summary of Financials

Income Statement - Annual	FY13A	FY14E	FY15E	FY16E
Revenues	20	25	25	-
Cost of products sold	0	0	0	-
Gross profit	-	-	-	-
SG&A	(14)	(23)	(26)	-
R&D	(31)	(48)	(51)	-
Operating income	(25)	(45)	(51)	-
EBITDA	(25)	(45)	(51)	-
Net interest (income) / expense	0	0	2	-
Other income / (expense)	(0)	0	0	-
Income taxes	0	0	0	-
Net income - GAAP	(25)	(45)	(49)	-
Net income - recurring	(25)	(45)	(49)	-
Diluted shares outstanding	13	25	26	-
EPS - excluding non-recurring	(2.02)	(1.80)	(1.88)	-
EPS - recurring	(2.02)	(1.80)	(1.88)	-

Balance Sheet and Cash Flow Data	FY13A	FY14E	FY15E	FY16E
Cash and cash equivalents	238	207	170	-
Accounts receivable	0	0	0	-
Inventories	-	-	-	-
Other current assets	0	0	0	-
Current assets	238	207	170	-
PP&E	0	0	0	-
Total assets	238	232	233	-
Total debt	0	0	0	-
Total liabilities	77	62	54	-
Shareholders' equity	161	170	178	-
Net income (including charges)	(25)	(45)	(49)	-
D&A	6	8	8	-
Change in working capital	69	0	0	-
Other	7	0	0	-
Cash flow from operations	63	(31)	(36)	-
Capex	0	0	0	-
Free cash flow	63	(31)	(36)	-
Cash flow from investing activities	0	0	0	-
Cash flow from financing activities	108	0	0	-
Dividends	-	-	-	-
Dividend yield	-	-	-	-

Income Statement - Quarterly	1Q14A	2Q14E	3Q14E	4Q14E
Revenues	6A	6	6	6
Cost of products sold	0A	0	0	0
Gross profit	-	-	-	-
SG&A	(6)A	(6)	(6)	(6)
R&D	(11)A	(12)	(12)	(12)
Operating income	(11)A	(11)	(11)	(12)
EBITDA	(11)A	(11)	(11)	(12)
Net interest (income) / expense	0A	0	0	0
Other income / (expense)	0A	0	0	0
Income taxes	0A	0	0	0
Net income - GAAP	(11)A	(11)	(11)	(11)
Net income - recurring	(11)A	(11)	(11)	(11)
Diluted shares outstanding	24A	25	25	25
EPS - excluding non-recurring	(0.44)A	(0.46)	(0.46)	(0.45)
EPS - recurring	(0.44)A	(0.46)	(0.46)	(0.45)

Ratio Analysis	FY13A	FY14E	FY15E	FY16E
Sales growth	5835.6%	25.6%	0.0%	-
EBIT growth	5.2%	80.2%	14.4%	-
EPS growth - recurring	-	(10.6%)	4.1%	-
Gross margin	-	-	-	-
EBIT margin	(123.6%)	(177.4%)	(203.0%)	-
EBITDA margin	(123.6%)	(177.4%)	(203.0%)	-
Tax rate	0.0%	0.0%	0.0%	-
Net margin	(125.5%)	(176.2%)	(195.2%)	-
Net Debt / EBITDA	953.6%	459.7%	331.4%	-
Net Debt / Capital (book)	307.8%	561.2%	(2128.9%)	-
Return on assets (ROA)	(16.5%)	(19.0%)	(21.3%)	-
Return on equity (ROE)	(22.5%)	(27.0%)	(28.4%)	-
Enterprise value / sales	29.5	24.8	26.2	-
Enterprise value / EBITDA	NM	NM	NM	-
Free cash flow yield	13.7%	(3.5%)	(3.8%)	-

Source: Company reports and J.P. Morgan estimates.
Note: $ in millions (except per-share data).Fiscal year ends Dec

Analyst Certification: The research analyst(s) denoted by an "AC" on the cover of this report certifies (or, where multiple research analysts are primarily responsible for this report, the research analyst denoted by an "AC" on the cover or within the document individually certifies, with respect to each security or issuer that the research analyst covers in this research) that: (1) all of the views expressed in this report accurately reflect his or her personal views about any and all of the subject securities or issuers; and (2) no part of any of the research analyst's compensation was, is, or will be directly or indirectly related to the specific recommendations or views expressed by the research analyst(s) in this report. For all Korea-based research analysts listed on the front cover, they also certify, as per KOFIA requirements, that their analysis was made in good faith and that the views reflect their own opinion, without undue influence or intervention.

Important Disclosures

- **Market Maker:** JPMS makes a market in the stock of bluebird bio.
- **Lead or Co-manager:** J.P. Morgan acted as lead or co-manager in a public offering of equity and/or debt securities for bluebird bio within the past 12 months.
- **Client:** J.P. Morgan currently has, or had within the past 12 months, the following company(ies) as clients: bluebird bio.
- **Client/Investment Banking:** J.P. Morgan currently has, or had within the past 12 months, the following company(ies) as investment banking clients: bluebird bio.
- **Investment Banking (past 12 months):** J.P. Morgan received in the past 12 months compensation from investment banking bluebird bio.
- **Investment Banking (next 3 months):** J.P. Morgan expects to receive, or intends to seek, compensation for investment banking services in the next three months from bluebird bio.

Company-Specific Disclosures: Important disclosures, including price charts, are available for compendium reports and all J.P. Morgan–covered companies by visiting https://jpmm.com/research/disclosures, calling 1-800-477-0406, or e-mailing research.disclosure.inquiries@jpmorgan.com with your request. J.P. Morgan's Strategy, Technical, and Quantitative Research teams may screen companies not covered by J.P. Morgan. For important disclosures for these companies, please call 1-800-477-0406 or e-mail research.disclosure.inquiries@jpmorgan.com.

bluebird bio (BLUE, BLUE US) Price Chart

Date	Rating	Share Price ($)	Price Target ($)
15-Jul-13	OW	30.65	44.00

Source: Bloomberg and J.P. Morgan; price data adjusted for stock splits and dividends.
Initiated coverage Jul 15, 2013.

The chart(s) show J.P. Morgan's continuing coverage of the stocks; the current analysts may or may not have covered it over the entire period.
J.P. Morgan ratings or designations: OW = Overweight, N= Neutral, UW = Underweight, NR = Not Rated

Explanation of Equity Research Ratings, Designations and Analyst(s) Coverage Universe:
J.P. Morgan uses the following rating system: Overweight [Over the next six to twelve months, we expect this stock will outperform the average total return of the stocks in the analyst's (or the analyst's team's) coverage universe.] Neutral [Over the next six to twelve months, we expect this stock will perform in line with the average total return of the stocks in the analyst's (or the analyst's team's)

coverage universe.] Underweight [Over the next six to twelve months, we expect this stock will underperform the average total return of the stocks in the analyst's (or the analyst's team's) coverage universe.] Not Rated (NR): J.P. Morgan has removed the rating and, if applicable, the price target, for this stock because of either a lack of a sufficient fundamental basis or for legal, regulatory or policy reasons. The previous rating and, if applicable, the price target, no longer should be relied upon. An NR designation is not a recommendation or a rating. In our Asia (ex-Australia) and U.K. small- and mid-cap equity research, each stock's expected total return is compared to the expected total return of a benchmark country market index, not to those analysts' coverage universe. If it does not appear in the Important Disclosures section of this report, the certifying analyst's coverage universe can be found on J.P. Morgan's research website, www.jpmorganmarkets.com.

Coverage Universe: Kasimov, Cory W: ACADIA Pharmaceuticals (ACAD), Aegerion Pharmaceuticals (AEGR), Alkermes, Inc. (ALKS), Arena Pharmaceuticals, Inc. (ARNA), Ariad Pharmaceuticals (ARIA), Array BioPharma (ARRY), BioMarin Pharmaceuticals (BMRN), Clovis Oncology (CLVS), Dendreon (DNDN), Emergent BioSolutions (EBS), Exelixis, Inc (EXEL), Geron Corp (GERN), ImmunoGen (IMGN), Incyte Corporation (INCY), Infinity Pharmaceuticals (INFI), Isis Pharmaceuticals (ISIS), Keryx Biopharmaceuticals (KERX), Lexicon Pharmaceuticals (LXRX), MannKind Corporation (MNKD), Nektar Therapeutics (NKTR), Orexigen Therapeutics (OREX), Pharmacyclics, Inc. (PCYC), Rigel Pharmaceuticals (RIGL), Seattle Genetics (SGEN), The Medicines Company (MDCO), Ultragenyx (RARE), VIVUS, Inc (VVUS), ZIOPHARM Oncology (ZIOP), bluebird bio (BLUE)

J.P. Morgan Equity Research Ratings Distribution, as of March 31, 2014

	Overweight (buy)	Neutral (hold)	Underweight (sell)
J.P. Morgan Global Equity Research Coverage	44%	44%	11%
IB clients*	58%	49%	40%
JPMS Equity Research Coverage	45%	48%	7%
IB clients*	78%	67%	60%

*Percentage of investment banking clients in each rating category.
For purposes only of FINRA/NYSE ratings distribution rules, our Overweight rating falls into a buy rating category; our Neutral rating falls into a hold rating category; and our Underweight rating falls into a sell rating category. Please note that stocks with an NR designation are not included in the table above.

Equity Valuation and Risks: For valuation methodology and risks associated with covered companies or price targets for covered companies, please see the most recent company-specific research report at http://www.jpmorganmarkets.com, contact the primary analyst or your J.P. Morgan representative, or email research.disclosure.inquiries@jpmorgan.com.

Equity Analysts' Compensation: The equity research analysts responsible for the preparation of this report receive compensation based upon various factors, including the quality and accuracy of research, client feedback, competitive factors, and overall firm revenues.

Other Disclosures

J.P. Morgan ("JPM") is the global brand name for J.P. Morgan Securities LLC ("JPMS") and its affiliates worldwide. J.P. Morgan Cazenove is a marketing name for the U.K. investment banking businesses and EMEA cash equities and equity research businesses of JPMorgan Chase & Co. and its subsidiaries.

All research reports made available to clients are simultaneously available on our client website, J.P. Morgan Markets. Not all research content is redistributed, e-mailed or made available to third-party aggregators. For all research reports available on a particular stock, please contact your sales representative.

Options related research: If the information contained herein regards options related research, such information is available only to persons who have received the proper option risk disclosure documents. For a copy of the Option Clearing Corporation's Characteristics and Risks of Standardized Options, please contact your J.P. Morgan Representative or visit the OCC's website at http://www.optionsclearing.com/publications/risks/riskstoc.pdf

Legal Entities Disclosures
U.S.: JPMS is a member of NYSE, FINRA, SIPC and the NFA. JPMorgan Chase Bank, N.A. is a member of FDIC. **U.K**.: JPMorgan Chase N.A., London Branch, is authorised by the Prudential Regulation Authority and is subject to regulation by the Financial Conduct Authority and to limited regulation by the Prudential Regulation Authority. Details about the extent of our regulation by the Prudential Regulation Authority are available from J.P. Morgan on request. J.P. Morgan Securities plc (JPMS plc) is a member of the London Stock Exchange and is authorised by the Prudential Regulation Authority and regulated by the Financial Conduct Authority and the Prudential Regulation Authority. Registered in England & Wales No. 2711006. Registered Office 25 Bank Street, London, E14 5JP. **South Africa**: J.P. Morgan Equities South Africa Proprietary Limited is a member of the Johannesburg Securities Exchange and is regulated by the Financial Services Board. **Hong Kong**: J.P. Morgan Securities (Asia Pacific) Limited (CE number AAJ321) is regulated by the Hong Kong Monetary Authority and the Securities and Futures Commission in Hong Kong and/or J.P. Morgan Broking (Hong Kong) Limited (CE number AAB027) is regulated by the Securities and Futures Commission in Hong Kong. **Korea**: J.P. Morgan Securities (Far East) Ltd, Seoul Branch, is regulated by the Korea Financial Supervisory Service. **Australia**: J.P. Morgan Australia Limited (JPMAL) (ABN 52 002 888 011/AFS Licence No: 238188) is regulated by ASIC and J.P. Morgan Securities Australia Limited (JPMSAL) (ABN 61 003 245 234/AFS Licence No: 238066) is regulated by ASIC and is a Market, Clearing and Settlement Participant of ASX Limited and CHI-X. **Taiwan**: J.P.Morgan Securities (Taiwan) Limited is a participant of the Taiwan Stock Exchange (company-type) and regulated by the Taiwan Securities and Futures Bureau. **India**: J.P. Morgan India Private Limited, having its registered office at J.P. Morgan Tower, Off. C.S.T. Road, Kalina, Santacruz East, Mumbai - 400098, is a member of the National Stock

Exchange of India Limited (SEBI Registration Number - INB 230675231/INF 230675231/INE 230675231) and Bombay Stock Exchange Limited (SEBI Registration Number - INB 010675237/INF 010675237) and is regulated by Securities and Exchange Board of India. For non local research reports, this material is not distributed in India by J.P. Morgan India Private Limited. **Thailand**: This material is issued and distributed in Thailand by JPMorgan Securities (Thailand) Ltd., which is a member of the Stock Exchange of Thailand and is regulated by the Ministry of Finance and the Securities and Exchange Commission and its registered address is 3rd Floor, 20 North Sathorn Road, Silom, Bangrak, Bangkok 10500. **Indonesia**: PT J.P. Morgan Securities Indonesia is a member of the Indonesia Stock Exchange and is regulated by the OJK a.k.a. BAPEPAM LK. **Philippines**: J.P. Morgan Securities Philippines Inc. is a Trading Participant of the Philippine Stock Exchange and a member of the Securities Clearing Corporation of the Philippines and the Securities Investor Protection Fund. It is regulated by the Securities and Exchange Commission. **Brazil**: Banco J.P. Morgan S.A. is regulated by the Comissao de Valores Mobiliarios (CVM) and by the Central Bank of Brazil. **Mexico**: J.P. Morgan Casa de Bolsa, S.A. de C.V., J.P. Morgan Grupo Financiero is a member of the Mexican Stock Exchange and authorized to act as a broker dealer by the National Banking and Securities Exchange Commission. **Singapore**: This material is issued and distributed in Singapore by or through J.P. Morgan Securities Singapore Private Limited (JPMSS) [MCI (P) 199/03/2014 and Co. Reg. No.: 199405335R] which is a member of the Singapore Exchange Securities Trading Limited and is regulated by the Monetary Authority of Singapore (MAS) and/or JPMorgan Chase Bank, N.A., Singapore branch (JPMCB Singapore) which is regulated by the MAS. This material is provided in Singapore only to accredited investors, expert investors and institutional investors, as defined in Section 4A of the Securities and Futures Act, Cap. 289. Recipients of this document are to contact JPMSS or JPMCB Singapore in respect of any matters arising from, or in connection with, the document. **Japan**: JPMorgan Securities Japan Co., Ltd. is regulated by the Financial Services Agency in Japan. **Malaysia**: This material is issued and distributed in Malaysia by JPMorgan Securities (Malaysia) Sdn Bhd (18146-X) which is a Participating Organization of Bursa Malaysia Berhad and a holder of Capital Markets Services License issued by the Securities Commission in Malaysia. **Pakistan**: J. P. Morgan Pakistan Broking (Pvt.) Ltd is a member of the Karachi Stock Exchange and regulated by the Securities and Exchange Commission of Pakistan. **Saudi Arabia**: J.P. Morgan Saudi Arabia Ltd. is authorized by the Capital Market Authority of the Kingdom of Saudi Arabia (CMA) to carry out dealing as an agent, arranging, advising and custody, with respect to securities business under licence number 35-07079 and its registered address is at 8th Floor, Al-Faisaliyah Tower, King Fahad Road, P.O. Box 51907, Riyadh 11553, Kingdom of Saudi Arabia. **Dubai**: JPMorgan Chase Bank, N.A., Dubai Branch is regulated by the Dubai Financial Services Authority (DFSA) and its registered address is Dubai International Financial Centre - Building 3, Level 7, PO Box 506551, Dubai, UAE.

Country and Region Specific Disclosures
U.K. and European Economic Area (EEA): Unless specified to the contrary, issued and approved for distribution in the U.K. and the EEA by JPMS plc. Investment research issued by JPMS plc has been prepared in accordance with JPMS plc's policies for managing conflicts of interest arising as a result of publication and distribution of investment research. Many European regulators require a firm to establish, implement and maintain such a policy. This report has been issued in the U.K. only to persons of a kind described in Article 19 (5), 38, 47 and 49 of the Financial Services and Markets Act 2000 (Financial Promotion) Order 2005 (all such persons being referred to as "relevant persons"). This document must not be acted on or relied on by persons who are not relevant persons. Any investment or investment activity to which this document relates is only available to relevant persons and will be engaged in only with relevant persons. In other EEA countries, the report has been issued to persons regarded as professional investors (or equivalent) in their home jurisdiction. **Australia:** This material is issued and distributed by JPMSAL in Australia to "wholesale clients" only. This material does not take into account the specific investment objectives, financial situation or particular needs of the recipient. The recipient of this material must not distribute it to any third party or outside Australia without the prior written consent of JPMSAL. For the purposes of this paragraph the term "wholesale client" has the meaning given in section 761G of the Corporations Act 2001. **Germany:** This material is distributed in Germany by J.P. Morgan Securities plc, Frankfurt Branch and J.P.Morgan Chase Bank, N.A., Frankfurt Branch which are regulated by the Bundesanstalt für Finanzdienstleistungsaufsicht. **Hong Kong:** The 1% ownership disclosure as of the previous month end satisfies the requirements under Paragraph 16.5(a) of the Hong Kong Code of Conduct for Persons Licensed by or Registered with the Securities and Futures Commission. (For research published within the first ten days of the month, the disclosure may be based on the month end data from two months prior.) J.P. Morgan Broking (Hong Kong) Limited is the liquidity provider/market maker for derivative warrants, callable bull bear contracts and stock options listed on the Stock Exchange of Hong Kong Limited. An updated list can be found on HKEx website: http://www.hkex.com.hk. **Japan:** There is a risk that a loss may occur due to a change in the price of the shares in the case of share trading, and that a loss may occur due to the exchange rate in the case of foreign share trading. In the case of share trading, JPMorgan Securities Japan Co., Ltd., will be receiving a brokerage fee and consumption tax (shouhizei) calculated by multiplying the executed price by the commission rate which was individually agreed between JPMorgan Securities Japan Co., Ltd., and the customer in advance. Financial Instruments Firms: JPMorgan Securities Japan Co., Ltd., Kanto Local Finance Bureau (kinsho) No. 82 Participating Association / Japan Securities Dealers Association, The Financial Futures Association of Japan, Type II Financial Instruments Firms Association and Japan Investment Advisers Association. **Korea:** This report may have been edited or contributed to from time to time by affiliates of J.P. Morgan Securities (Far East) Ltd, Seoul Branch. **Singapore:** JPMSS and/or its affiliates may have a holding in any of the securities discussed in this report; for securities where the holding is 1% or greater, the specific holding is disclosed in the Important Disclosures section above. **India:** For private circulation only, not for sale. **Pakistan:** For private circulation only, not for sale. **New Zealand:** This material is issued and distributed by JPMSAL in New Zealand only to persons whose principal business is the investment of money or who, in the course of and for the purposes of their business, habitually invest money. JPMSAL does not issue or distribute this material to members of "the public" as determined in accordance with section 3 of the Securities Act 1978. The recipient of this material must not distribute it to any third party or outside New Zealand without the prior written consent of JPMSAL. **Canada:** The information contained herein is not, and under no circumstances is to be construed as, a prospectus, an advertisement, a public offering, an offer to sell securities described herein, or solicitation of an offer to buy securities described herein, in Canada or any province or territory thereof. Any offer or sale of the securities described herein in Canada will be made only under an exemption from the requirements to file a prospectus with the relevant Canadian securities regulators and only by a dealer properly registered under applicable securities laws or, alternatively, pursuant to an exemption from the dealer registration requirement in the relevant province or territory of Canada in which such offer or sale is made. The information contained herein is under no circumstances to be construed as investment advice in any province or territory of Canada and is not tailored to the needs of the recipient. To the extent that the information contained herein references securities of an issuer incorporated, formed or created under the laws of Canada or a province or territory of Canada, any trades in such securities must be conducted through a dealer registered in Canada. No securities commission or similar regulatory authority in Canada has reviewed or in any way passed judgment upon these materials, the information contained herein or the merits of the securities described herein, and any representation to the contrary is an offence. **Dubai:** This report has been issued to persons regarded as professional clients as defined under the DFSA rules. **Brazil**: Ombudsman J.P. Morgan: 0800-7700847 / ouvidoria.jp.morgan@jpmorgan.com.

General: Additional information is available upon request. Information has been obtained from sources believed to be reliable but JPMorgan Chase & Co. or its affiliates and/or subsidiaries (collectively J.P. Morgan) do not warrant its completeness or accuracy except with respect to any disclosures relative to JPMS and/or its affiliates and the analyst's involvement with the issuer that is the subject of the research. All pricing is as of the close of market for the

securities discussed, unless otherwise stated. Opinions and estimates constitute our judgment as of the date of this material and are subject to change without notice. Past performance is not indicative of future results. This material is not intended as an offer or solicitation for the purchase or sale of any financial instrument. The opinions and recommendations herein do not take into account individual client circumstances, objectives, or needs and are not intended as recommendations of particular securities, financial instruments or strategies to particular clients. The recipient of this report must make its own independent decisions regarding any securities or financial instruments mentioned herein. JPMS distributes in the U.S. research published by non-U.S. affiliates and accepts responsibility for its contents. Periodic updates may be provided on companies/industries based on company specific developments or announcements, market conditions or any other publicly available information. Clients should contact analysts and execute transactions through a J.P. Morgan subsidiary or affiliate in their home jurisdiction unless governing law permits otherwise.

"Other Disclosures" last revised April 5, 2014.