

# Are you already timing styles successfully?

## *The implicit style rotation in technical styles*

**David Jessop**

Analyst

Tel: +44 20 7567 9882

david.jessop@ubs.com

**Josie Gerken**

Analyst

Tel: +44 20 7568 3560

josephine.gerken@ubs.com

**Nick Baltas**

Analyst

Tel: +44 20 7568 3072

nick.baltas@ubs.com

**Desi Ivanova**

Associate Analyst

Tel: +44 20 7568 1754

desi-r.ivanova@ubs.com

**Claire Jones**

Analyst

Tel: +44 20 7568 1873

claire-c.jones@ubs.com

**Paul Winter**

Analyst

Tel: +61 2 93 242 080

paul-j.winter@ubs.com



This document has been prepared by UBS Limited

**ANALYST CERTIFICATION AND REQUIRED DISCLOSURES BEGIN ON SLIDE 16**

UBS does and seeks to do business with companies covered in its research reports. As a result, investors should be aware that the firm may have a conflict of interest that could affect the objectivity of this report. Investors should consider this report as only a single factor in making their investment decision.

# Style Timing<sup>1</sup>

---

*'Researchers have tried to improve on (style) strategies by incorporating various macroeconomic (conditioning) measures, including earnings yield on the S&P 500, the slope of the yield curve, corporate credit spreads and corporate profits. These "style timing" models have produced mixed results.', Asness (2000)*

- Divide investment styles into two categories: Fundamental and Technical
- Explore the correlation structure between styles:
  - Remarkably stable between fundamental styles
  - Correlations of technical with other technical or fundamental style scores vary over the economic cycle
- This leads to the following question: How far can the implicit style-timing within technical styles explain their performance? We show that it is possible to closely replicate the returns to technical styles using fundamental ones by employing the implicit style rotation strategy embedded within the technical style:
  - Regress technical style scores on the fundamental style scores at each rebalance date (month end)
  - Use the fitted values as the replication scores
- Adding volatility targeting has proved effective, especially with momentum

1. The authors would like to thank Professor James Sefton of Imperial College, London for the significant contribution he provided to this material.

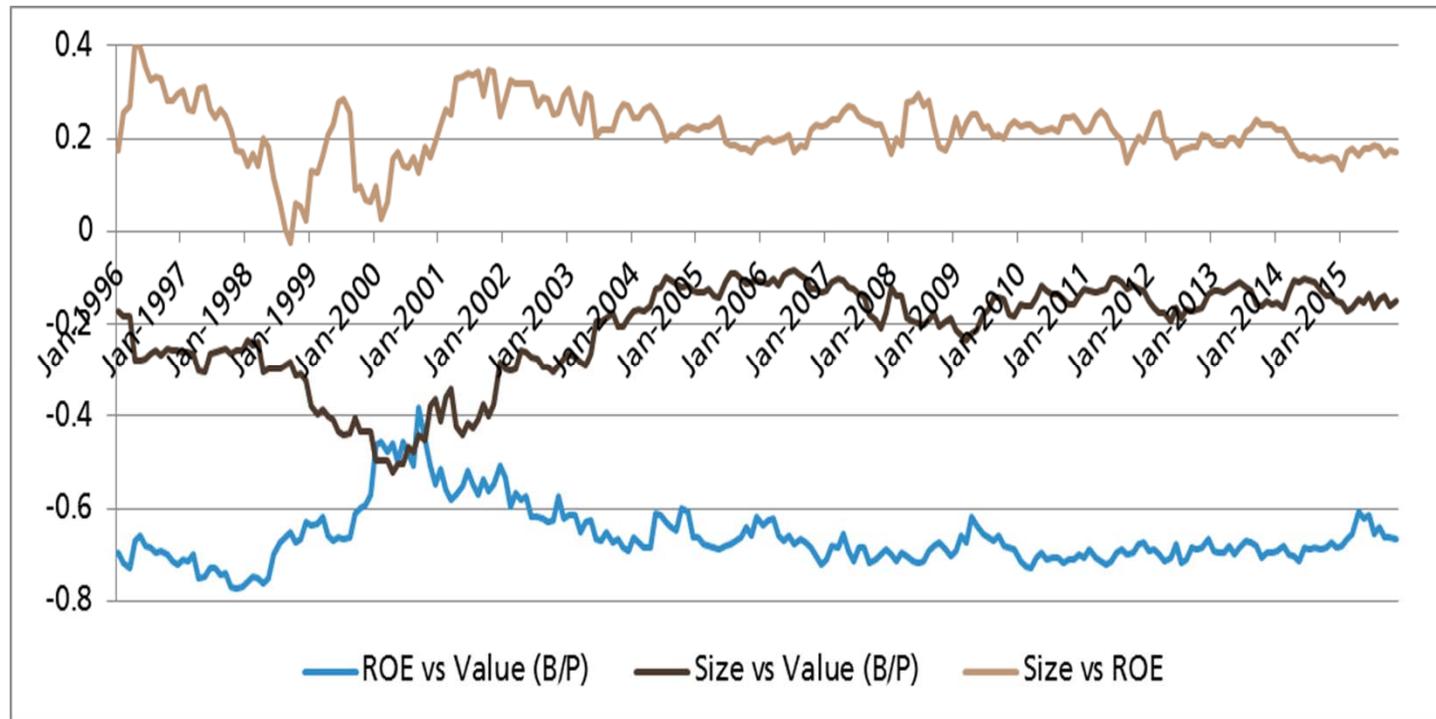
# Fundamental and Technical Styles

---

- Fundamental Styles are styles constructed using fundamental data:
  1. Value: constructed from the firm's book to price ratio
  2. Quality: based on the firm's return on equity (ROE)
  3. Size: using the firm's total market value of equity
  4. Cash Flow Volatility (CFV): constructed using minus the standard deviation of the quarterly cash flow from operations to sales ratio over the previous 4 years
  5. Earnings Momentum (EM): a weighted average of the percentage changes in the 12 months forward EPS forecast relative to 1, 2 and 3 months ago.
- Technical Styles are constructed using past stock return data:
  1. Low volatility (LV): constructed using minus the standard deviation of daily returns over the past 12 months
  2. Price momentum (PM): constructed from the percentage return to the equity of the past 12 months.
- The style portfolios are constructed by ranking monthly and taking either the top quintile or the top minus the bottom quintile, all equally weighted. The market is the MSCI US.

# Cross-Sectional Correlations of Scores

- Cross-sectional correlations between fundamental styles are very stable over time
  - Quality is negatively correlated with Value and positively with Size
  - Value and Size are negatively correlated

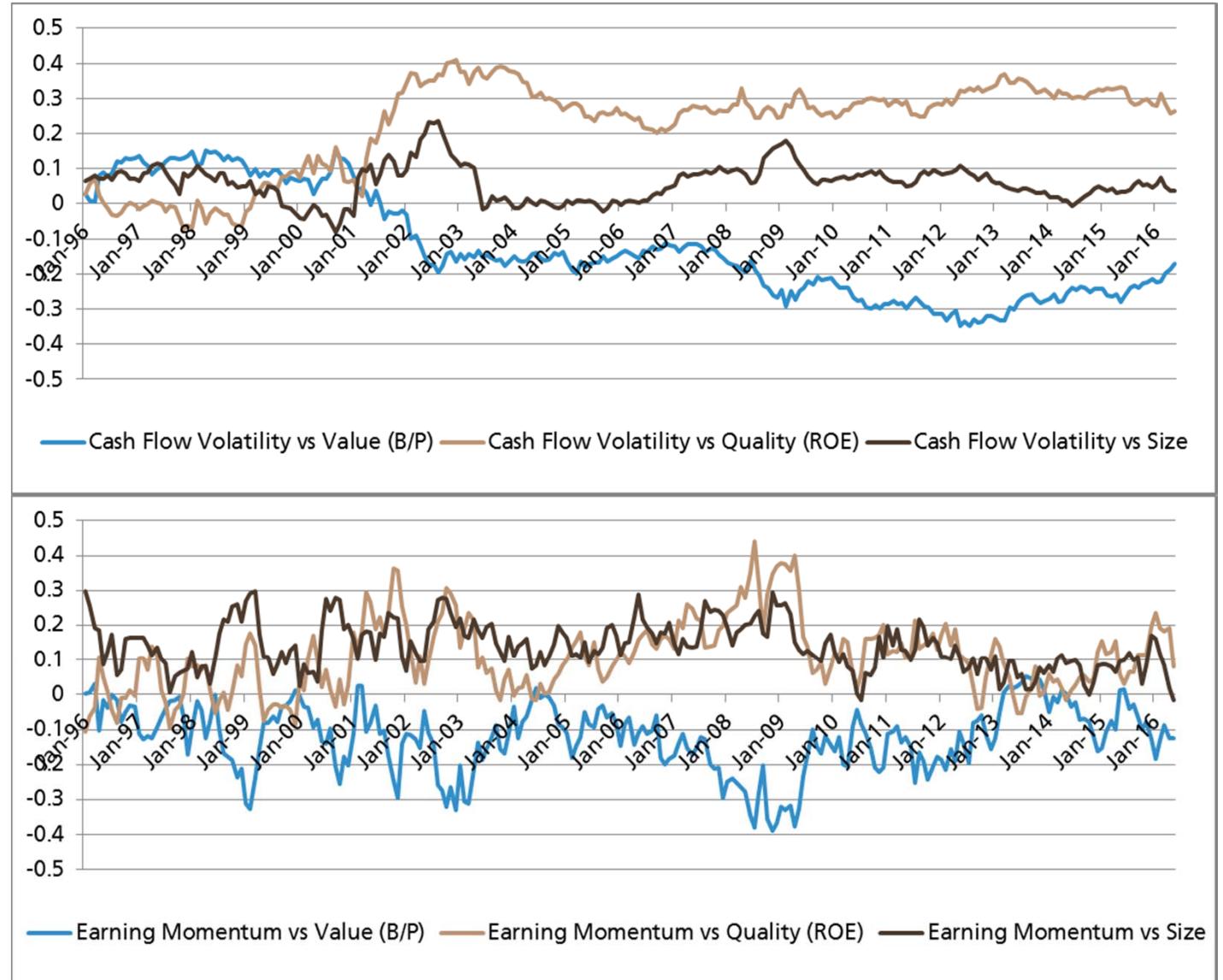


Source: UBS Quantitative Research. The cross-sectional correlation between two styles at the end of every month is the Spearman rank correlation of the two styles scores. The figure plots the value of these correlations over time

# Cross-Sectional Correlations of Scores (2)

## Fundamental Styles

- Quality and Size are positively associated with CFV and EM
- Value is negatively related with CFV and EM
- The correlations with CFV are weaker prior to 2000.

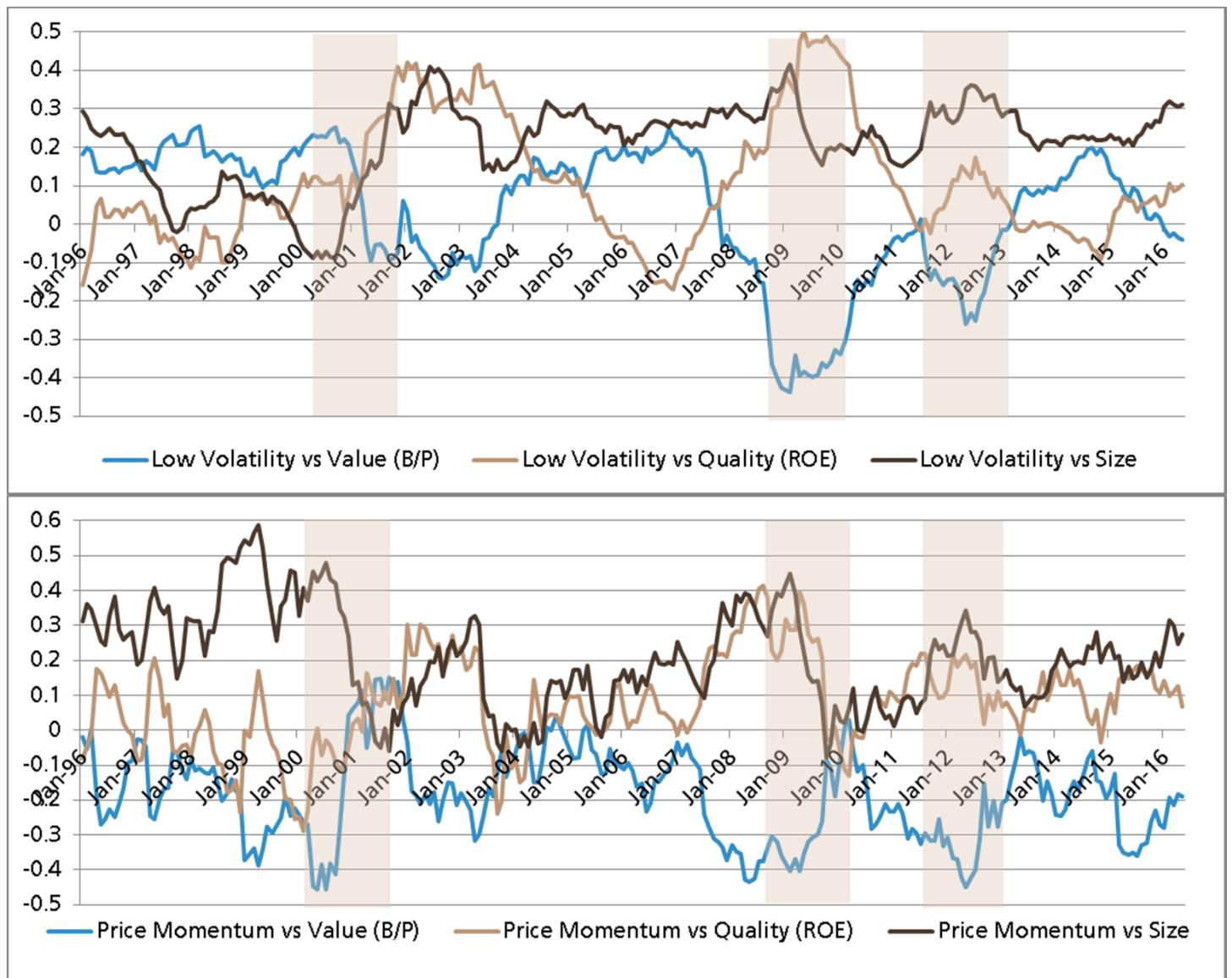


Source: UBS Quantitative Research. The cross-sectional correlation between two styles at the end of every month is the Spearman rank correlation of the two styles scores. The figure plots the variation in these correlations over time.

# Cross-Sectional Correlations of Scores (3)

## Technical Styles

- Cross-sectional correlations are unstable over time.
- Correlations appear cyclical:
  - ROE positive during downturns
  - B/P positive during recovery



Source: UBS Quantitative Research. The top panel plots the cross-sectional correlation of our 3 core fundamental style scores with the low volatility score at each month end. The bottom panel plots the 6 month rolling correlation of the daily returns to the 3 core fundamental style portfolios with the returns to the low volatility portfolio

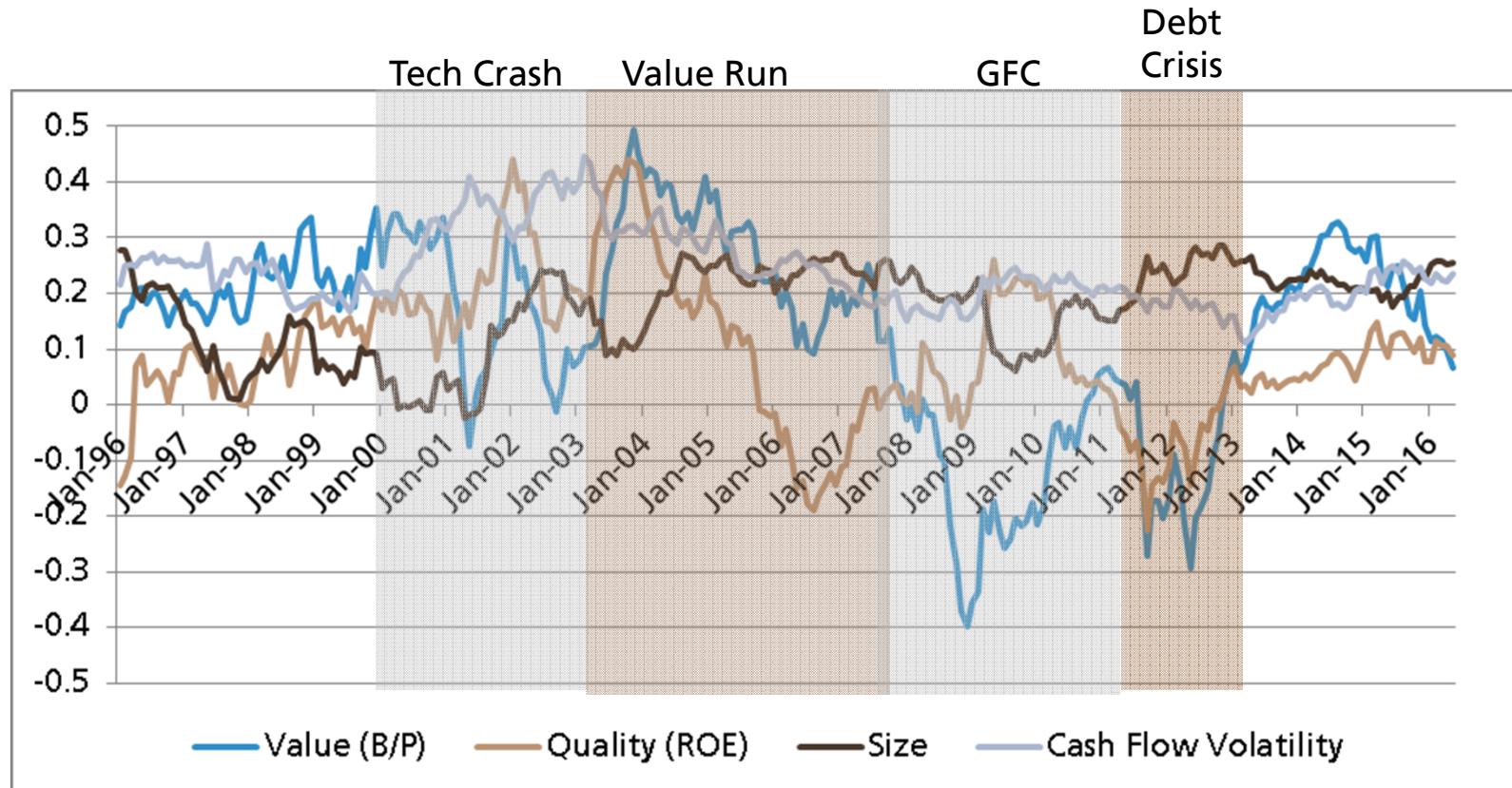
# Replication Strategy – Low Volatility

- Regress Low Volatility scores on the fundamental scores – Book/Price, ROE, Size and CFV:

$$LV_t = \gamma_{1,t}(B/P)_t + \gamma_{2,t}ROE_t + \gamma_{3,t}Size_t + \gamma_{4,t}CFV_t + \epsilon_t$$

- Create a replication score from the regression fitted values, i.e.:

$$LV_t^{rep} = \hat{\gamma}_{1,t}(B/P)_t + \hat{\gamma}_{2,t}ROE_t + \hat{\gamma}_{3,t}Size_t + \hat{\gamma}_{4,t}CFV_t$$



Source: UBS Quantitative Research

# Success of Replication

---

- Compare the returns to the Low Volatility Replication Strategy to the Long-Short Low Volatility Portfolio non sector neutral ( $R^2$  of the returns 0.82)

	Estimate	Estimate	t-value	Estimate	t-value	Estimate	t-value
<b>Low Volatility Replication</b>		1.26	115.33				
<b>Embedded Style Rotation</b>				1.17	95.04		
<b>Cash Flow Volatility</b>						1.23	81.57
<b>MSCI US Index</b>	-0.82	-0.36	-41.99	-0.40	-40.42	-0.51	-49.13
<b>Intercept (*252)</b>	0.082	0.026	2.25	0.023	1.75	0.012	0.84
<b>R<sup>2</sup></b>	0.38	<b>0.82</b>		0.77		0.73	

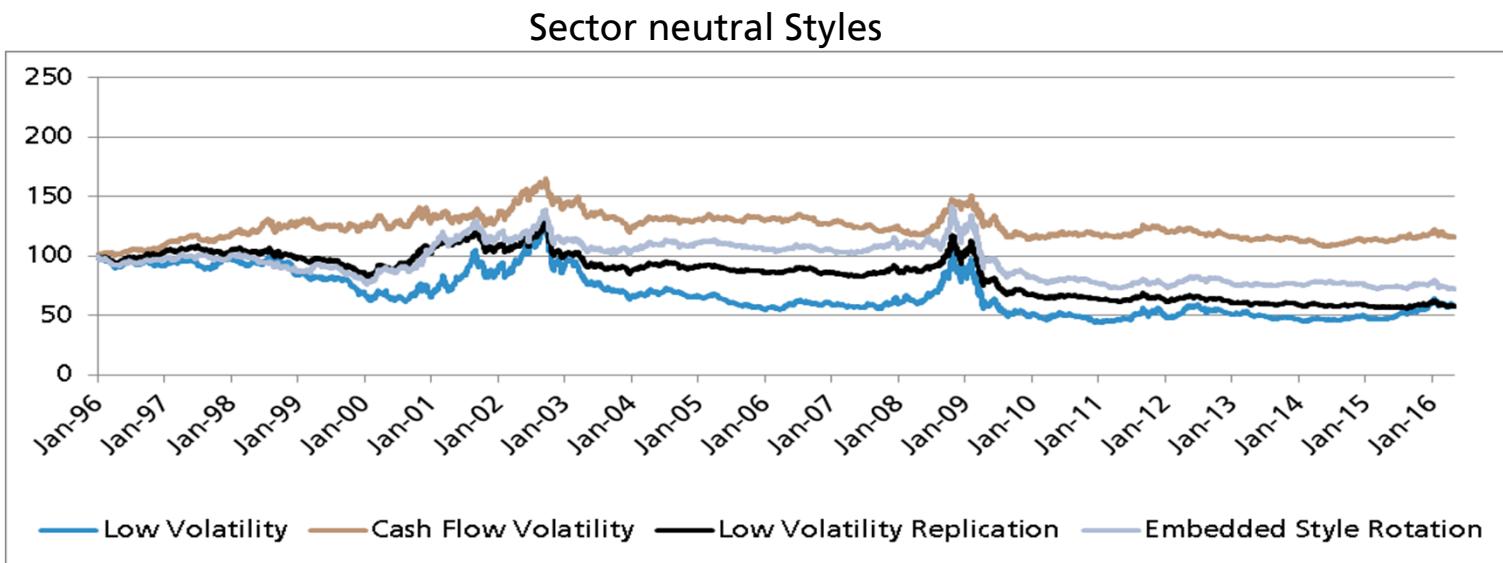
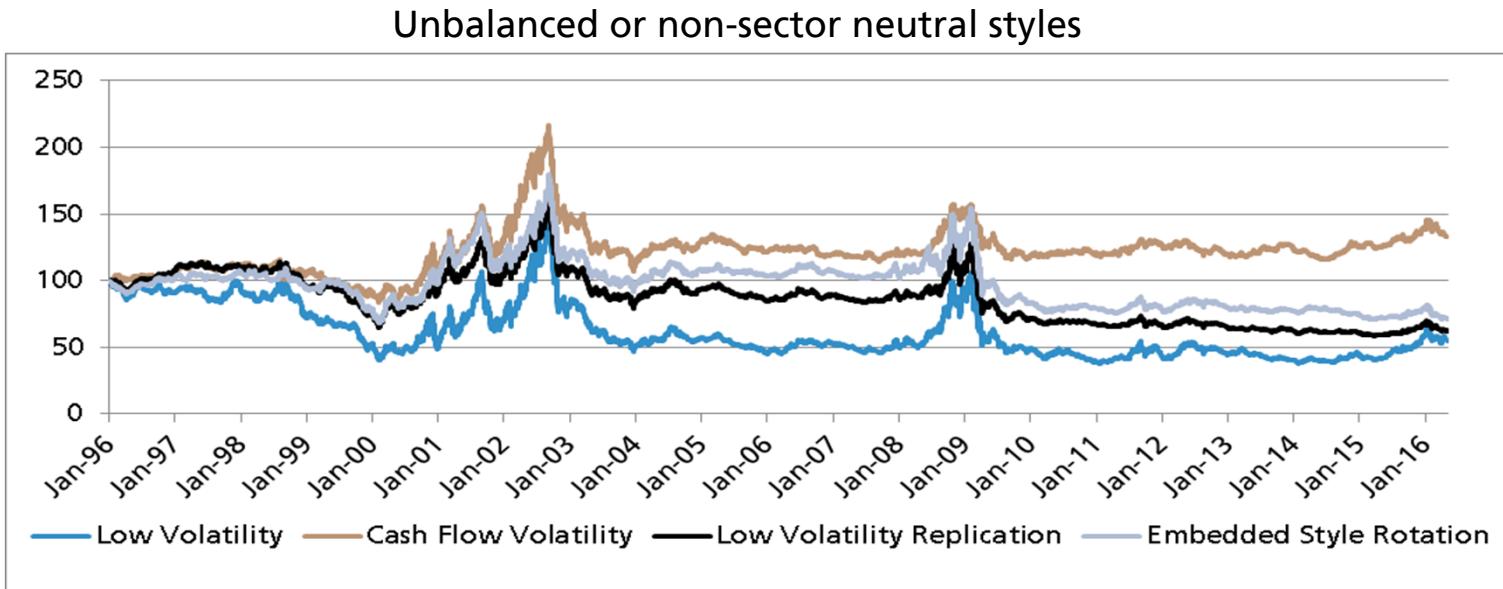
- And sector neutral ( $R^2$  of 0.71)

	Estimate	t-value	Estimate	t-value	Estimate	t-value
<b>Low Volatility Replication</b>	0.98	75.55				
<b>Embedded Style Rotation</b>			0.93	66.17		
<b>Cash Flow Volatility</b>					0.93	49.85
<b>MSCI US Index</b>	-0.35	-54.32	-0.35	-49.57	-0.44	-60.05
<b>Intercept (*252)</b>	0.023	1.75	0.014	1.45	0.009	0.82
<b>R<sup>2</sup></b>	<b>0.71</b>		0.67		0.59	

Source: UBS Quantitative Research. The returns to various replicating portfolios and the MSCI US Index are regressed on the returns to the low volatility strategy. The table records the regression coefficients and their respective t-statistics as well as the  $R^2$ . The intercept term is multiplied by 252 to express it on annualised basis. The first column of the top table records a regression on the market alone; the next 6 columns record the statistics when the portfolios are non-sector neutral. The bottom table records the statistics when the portfolios are sector neutral.

# Success of Replication

- Compare performance of LV replication portfolio with LV portfolio:
  1. High Correlation in returns
  2. But LV portfolio has a lower beta ( $\approx 0.25$ )



Source: UBS Quantitative Research. The figure plots the performance of the low volatility strategy index against the various replicating strategy indices. The upper panel is non-sector neutral strategies; the lower panel is sector neutral ones.

# Success of Replication (Betting against Beta)

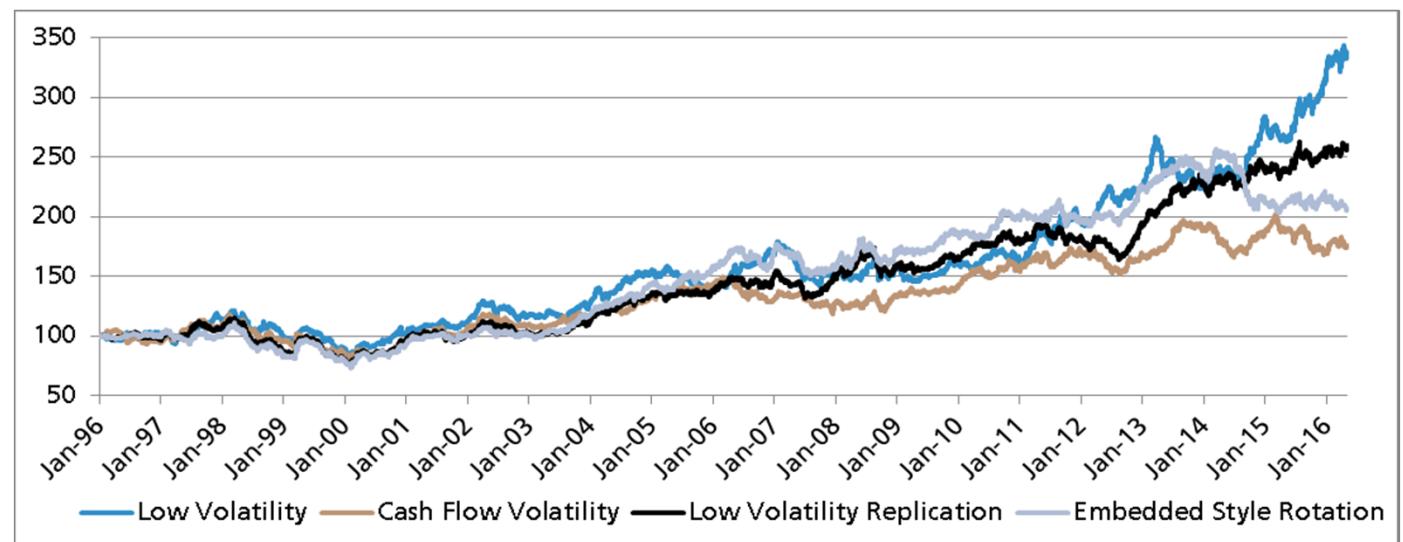
- Alternatively remove Beta exposure (estimate Beta exposure over previous 6M and hedge this exposure over next month)
- Lower Beta exposure of LV portfolio implies slight out-performance over the entire of this portfolio relative to replication portfolio

Performance statistics of the Betting against Beta

	Correlation with Low Volatility	Mean Return (annualised)	Std. Dev. (annualised)	Sharpe Ratio
<b>Low Volatility</b>	1.00	6.2%	9.2%	0.67
<b>Low Volatility Replication</b>	0.88	5.0%	8.9%	0.55
<b>Embedded Style Rotation</b>	0.84	3.1%	8.9%	0.43
<b>Cash Flow Volatility</b>	0.78	3.1%	8.9%	0.35
<b>Quality</b>	0.59	2.0%	9.0%	0.22
<b>Value</b>	-0.15	0.3%	9.2%	0.03
<b>Size</b>	0.57	-0.3%	8.8%	-0.04

Source: UBS Quantitative Research

Index performance of the low volatility Betting against Beta strategies



Source: UBS Quantitative Research

# Price Momentum

---

- Repeat the analysis for 12 month Price Momentum
- Chordia, Shivakumar (2006) – data 1972-1999 – and Leippold and Lohre (2012) – data 1990-2008 – document the relation between Earnings Momentum and Price Momentum
  - CS find that profit to Price Momentum 'is subsumed' by Earnings Momentum in the US
  - LL find a strong relationship too but Price Momentum 'not always' subsumed by Earnings Momentum.
- Daniel, Moskowitz (2013) document the time-varying beta exposure of momentum and its ability to explain its performance
- We explain profits to Price Momentum in terms of:
  1. B/P, ROE, Size and Earnings Momentum
  2. B/P, ROE, Size, Earnings Momentum and Low Volatility

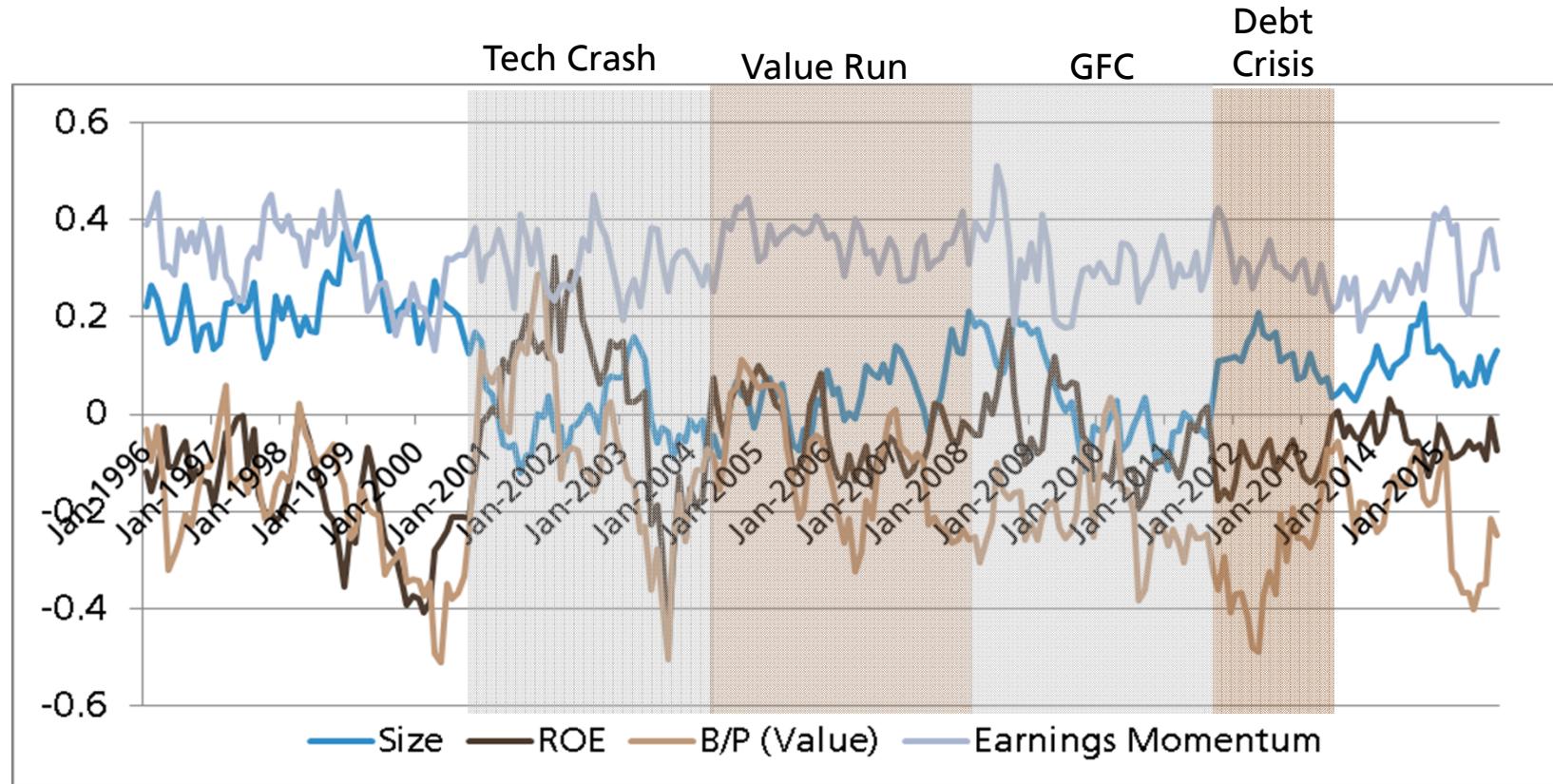
# Replication Strategy – Price Momentum

- Regress Price momentum (PM) scores on the fundamental scores – Book/Price, ROE, Size and Earnings Momentum:

$$PM_t = \gamma_{1,t}(B/P)_t + \gamma_{2,t}ROE_t + \gamma_{3,t}Size_t + \gamma_{4,t}EM_t + \epsilon_t$$

- Create a replication score from the best fit score, that is:

$$PM_t^{rep} = \hat{\gamma}_{1,t}(B/P)_t + \hat{\gamma}_{2,t}ROE_t + \hat{\gamma}_{3,t}Size_t + \hat{\gamma}_{4,t}EM_t$$



Source: UBS Quantitative Research

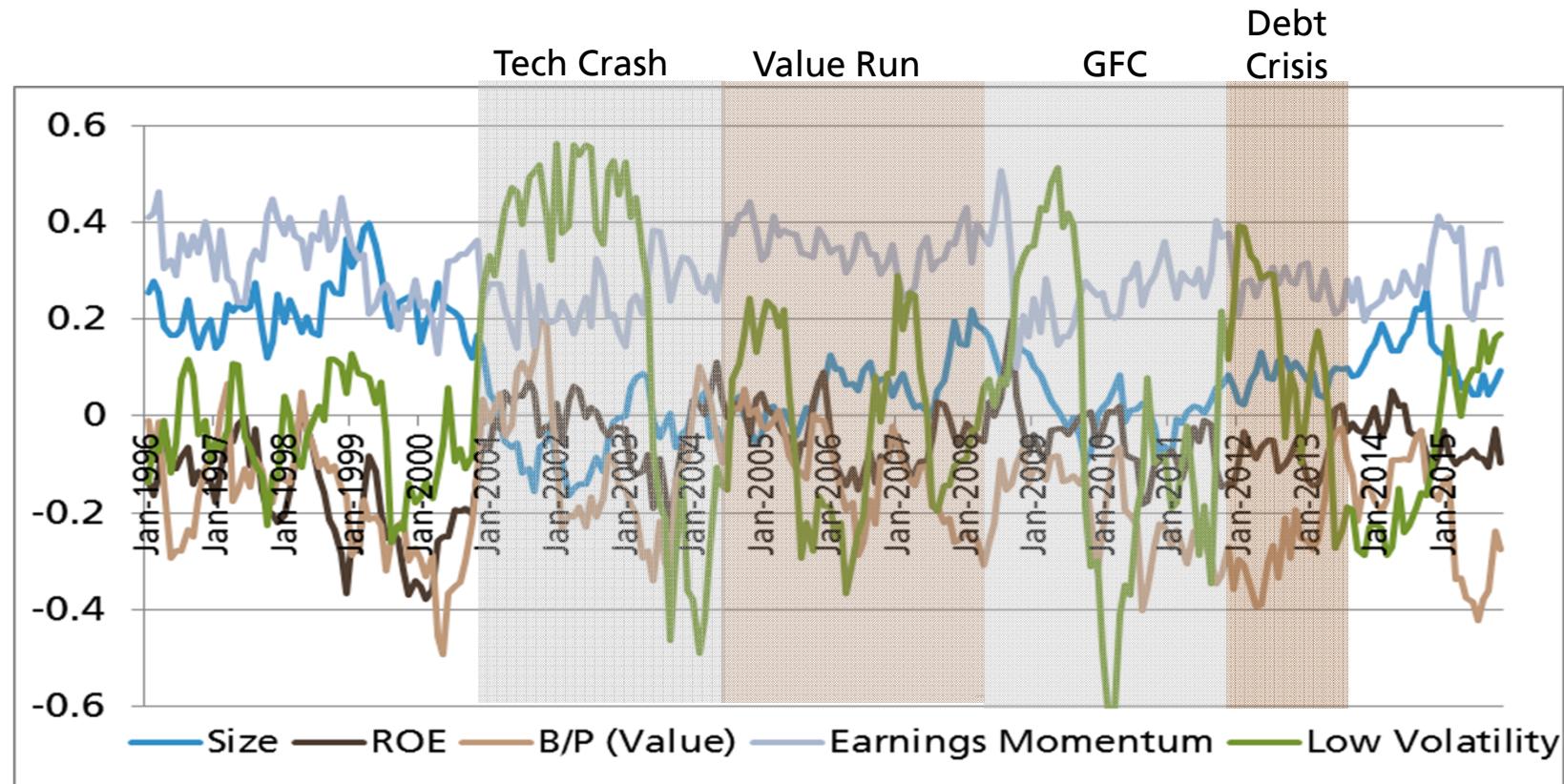
# Replication Strategy – Price Momentum

- Regress Price Momentum on the fundamental scores and Low Volatility:

$$PM_t = \gamma_{1,t}(B/P)_t + \gamma_{2,t}ROE_t + \gamma_{3,t}Size_t + \gamma_{4,t}EM_t + \gamma_{5,t}LV_t + \epsilon_t$$

- Create a replication score from the best fit score:

$$PM_t^{rep} = \hat{\gamma}_{1,t}(B/P)_t + \hat{\gamma}_{2,t}ROE_t + \hat{\gamma}_{3,t}Size_t + \hat{\gamma}_{4,t}EM_t + \hat{\gamma}_{5,t}LV_t$$



# Success of Replication

---

- Compare the returns of the Replication Strategy to the returns of the Unbalanced and Sector Neutral Long-Short Price Momentum Portfolio

Non- Sector Neutral Portfolios									
	Estimate	t-value	Estimate	t-value	Estimate	t-value	Estimate	t-value	
<b>Momentum Replication Basic</b>	1.12	146.35							
<b>Momentum Replication with Low Vol</b>			0.93	191.97			0.84	94.14	
<b>Momentum Earnings</b>					1.16	104.81	0.02	1.13	
<b>Net Earnings Upgrades</b>							0.21	12.55	
<b>MSCI US Index</b>	-0.02	-3.38	0.04	6.92	-0.02	-2.74	0.03	5.83	
<b>Intercept (*252)</b>	0.018	0.86	0.007	0.41	0.018	0.68	0.015	1.06	
<b>R<sup>2</sup></b>	0.81		0.88		0.69		0.89		

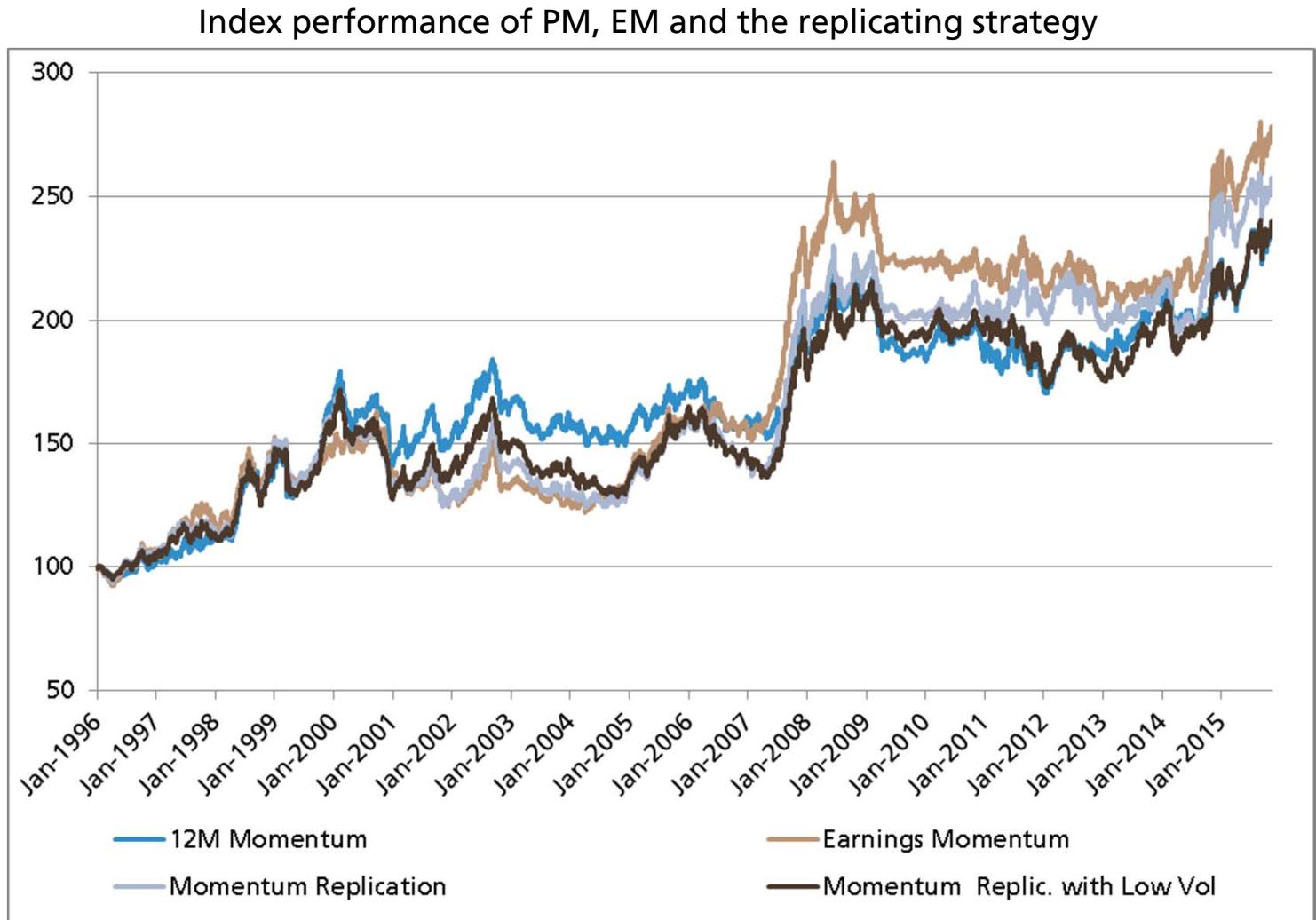
  

Sector Neutral Portfolios									
	Estimate	t-value	Estimate	t-value	Estimate	t-value	Estimate	t-value	
<b>Momentum Replication Basic</b>	1.13	116.64							
<b>Momentum Replication with Low Vol</b>			0.96	138.73			0.78	65.64	
<b>Momentum Earnings</b>					1.17	92.82	0.16	8.84	
<b>Net Earnings Upgrades</b>							0.22	12.63	
<b>MSCI US Index</b>	-0.03	-6.11	0.01	2.17	-0.03	-5.12	0.00	0.66	
<b>Intercept (*252)</b>	0.019	1.12	0.007	1.13	0.013	0.68	0.015	1.06	
<b>R<sup>2</sup></b>	0.73		0.79		0.64		0.81		

Source: UBS Quantitative Research. The replicating portfolio returns are regressed on the returns to a price momentum strategy. The table records the coefficients and the t-statistics in the regressions. The top panel records the results when the portfolios are not constructed to be sector neutral, the bottom panel when they are. The final column also includes a Net Earnings Upgrade strategy within the regressions. The style scores for this strategy are constructed using IBES data and are equal to the number of analyst earnings upgrades minus the number of downgrades in the previous 3 months

# Success of Replication (Volatility Targeting)

- We adjust the returns to the portfolios so as to have same volatility
- The style rotation does little to improve the performance of the strategy.



Source: UBS Quantitative Research.

The graph plots the performance of the three non-sector neutral price momentum strategies. All strategies are leveraged at each month-end rebalance to target 9% annualised volatility. This is affected by dividing the portfolio weights by the daily volatility of the unscaled strategy over the previous 6 months.

# Performance Statistics

---

- Of the three strategies, earnings momentum has the best performance. The style rotation embedded in the momentum replication strategy improves the fit of the strategy but does little for the performance

	Correlation with Momentum	Mean Return (annualised)	Std. Dev. (annualised)	Sharpe Ratio
<b>12 Price Momentum</b>	1.00	4.3%	9.3%	0.47
<b>Earnings Momentum</b>	0.83	5.1%	9.3%	0.54
<b>Momentum Replication</b>	0.90	4.6%	9.3%	0.50
<b>Momentum Replication incl. Low Vol.</b>	0.94	4.3%	9.2%	0.47
<b>Embedded Style Rotation</b>	0.82	1.5%	9.1%	0.16
<b>Embedded Style Rotation incl. Low Vol.</b>	0.89	1.4%	9.1%	0.16
<b>Low Volatility</b>	0.56	0.5%	9.0%	0.06
<b>Value</b>	-0.52	-1.2%	9.0%	-0.13
<b>Quality</b>	0.57	1.6%	9.0%	0.18
<b>Size</b>	0.72	0.0%	9.1%	0.01

Source: UBS Quantitative Research. The table records the performance statistics for price momentum and associated replication strategies. The leverage of all strategies is rebalanced every month to target 9% volatility. The 'Momentum Replication' Strategy weights earnings momentum, value, quality and size scores to replicate price momentum; 'Momentum Replication incl. Low Vol.' includes Low volatility scores as well; 'Embedded Style Rotation' weights Quality, Value and Size scores; 'Embedded Style Rotation incl. Low Vol.' weights Low Volatility as well as Quality, Value and Size scores. The statistics are calculated on daily data over the complete sample of January 1996 to end of June 2016.

# Valuation Method and Risk Statement

---

## **Analyst Certification**

Each research analyst primarily responsible for the content of this research report, in whole or in part, certifies that with respect to each security or issuer that the analyst covered in this report: (1) all of the views expressed accurately reflect his or her personal views about those securities or issuers and were prepared in an independent manner, including with respect to UBS, and (2) no part of his or her compensation was, is, or will be, directly or indirectly, related to the specific recommendations or views expressed by that research analyst in the research report.

# Required Disclosures

This document has been prepared by UBS Limited, an affiliate of UBS AG. UBS AG, its subsidiaries, branches and affiliates are referred to herein as UBS.

For information on the ways in which UBS manages conflicts and maintains independence of its research product; historical performance information; and certain additional disclosures concerning UBS research recommendations, please visit [www.ubs.com/disclosures](http://www.ubs.com/disclosures). The figures contained in performance charts refer to the past; past performance is not a reliable indicator of future results. Additional information will be made available upon request. UBS Securities Co. Limited is licensed to conduct securities investment consultancy businesses by the China Securities Regulatory Commission. UBS acts or may act as principal in the debt securities (or in related derivatives) that may be the subject of this report. This recommendation was finalized on: 13 December 2016 02:25 AM GMT.

## UBS Investment Research: Global Equity Rating Definitions

12-Month Rating	Definition	Coverage <sup>1</sup>	IB Services <sup>2</sup>
<b>Buy</b>	FSR is > 6% above the MRA.	45%	28%
<b>Neutral</b>	FSR is between -6% and 6% of the MRA.	39%	25%
<b>Sell</b>	FSR is > 6% below the MRA.	15%	17%
Short-Term Rating	Definition	Coverage <sup>3</sup>	IB Services <sup>4</sup>
<b>Buy</b>	Stock price expected to rise within three months from the time the rating was assigned because of a specific catalyst or event.	<1%	<1%
<b>Sell</b>	Stock price expected to fall within three months from the time the rating was assigned because of a specific catalyst or event.	<1%	<1%

Source: UBS. Rating allocations are as of 30 September 2016.

1:Percentage of companies under coverage globally within the 12-month rating category.

2:Percentage of companies within the 12-month rating category for which investment banking (IB) services were provided within the past 12 months.

3:Percentage of companies under coverage globally within the Short-Term rating category.

4:Percentage of companies within the Short-Term rating category for which investment banking (IB) services were provided within the past 12 months.

**KEY DEFINITIONS:** **Forecast Stock Return (FSR)** is defined as expected percentage price appreciation plus gross dividend yield over the next 12 months. **Market Return Assumption (MRA)** is defined as the one-year local market interest rate plus 5% (a proxy for, and not a forecast of, the equity risk premium). **Under Review (UR)** Stocks may be flagged as UR by the analyst, indicating that the stock's price target and/or rating are subject to possible change in the near term, usually in response to an event that may affect the investment case or valuation. **Short-Term Ratings** reflect the expected near-term (up to three months) performance of the stock and do not reflect any change in the fundamental view or investment case. **Equity Price Targets** have an investment horizon of 12 months.

**EXCEPTIONS AND SPECIAL CASES:** **UK and European Investment Fund ratings and definitions are:** **Buy:** Positive on factors such as structure, management, performance record, discount; **Neutral:** Neutral on factors such as structure, management, performance record, discount; **Sell:** Negative on factors such as structure, management, performance record, discount. **Core Banding Exceptions (CBE):** Exceptions to the standard +/-6% bands may be granted by the Investment Review Committee (IRC). Factors considered by the IRC include the stock's volatility and the credit spread of the respective company's debt. As a result, stocks deemed to be very high or low risk may be subject to higher or lower bands as they relate to the rating. When such exceptions apply, they will be identified in the Company Disclosures table in the relevant research piece.

Research analysts contributing to this report who are employed by any non-US affiliate of UBS Securities LLC are not registered/qualified as research analysts with FINRA. Such analysts may not be associated persons of UBS Securities LLC and therefore are not subject to the FINRA restrictions on communications with a subject company, public appearances, and trading securities held by a research analyst account. The name of each affiliate and analyst employed by that affiliate contributing to this report, if any, follows.

**UBS Limited:** David Jessop, Nick Baltas, Claire Jones, Josie Gerken, Desi Ivanova; **UBS Australia:** Paul Winter

Unless otherwise indicated, please refer to the Valuation and Risk sections within the body of this report. For a complete set of disclosure statements associated with the companies discussed in this report, including information on valuation and risk, please contact UBS Securities LLC, 1285 Avenue of Americas, New York, NY 10019, USA, Attention: Investment Research.



# Compendium Disclosure

---

For a complete set of disclosure statements associated with the companies discussed in this report, including information on valuation and risk, please contact:

UBS Securities LLC,  
1285 Avenue of Americas,  
New York, NY 10019, USA.

Attention: Publishing Administration

# Global Disclaimer

---

This document has been prepared by UBS Limited, an affiliate of UBS AG. UBS AG, its subsidiaries, branches and affiliates are referred to herein as UBS.

Global Research is provided to our clients through UBS Neo and, in certain instances, UBS.com (each a "System"). It may also be made available through third party vendors and distributed by UBS and/or third parties via e-mail or alternative electronic means. The level and types of services provided by Global Research to a client may vary depending upon various factors such as a client's individual preferences as to the frequency and manner of receiving communications, a client's risk profile and investment focus and perspective (e.g., market wide, sector specific, long-term, short-term, etc.), the size and scope of the overall client relationship with UBS and legal and regulatory constraints.

All Global Research is available on UBS Neo. Please contact your UBS sales representative if you wish to discuss your access to UBS Neo.

When you receive Global Research through a System, your access and/or use of such Global Research is subject to this Global Research Disclaimer and to the terms of use governing the applicable System.

When you receive Global Research via a third party vendor, e-mail or other electronic means, your use shall be subject to this Global Research Disclaimer and to UBS's Terms of Use/Disclaimer (<http://www.ubs.com/global/en/legalinfo2/disclaimer.html>). By accessing and/or using Global Research in this manner, you are indicating that you have read and agree to be bound by our Terms of Use/Disclaimer. In addition, you consent to UBS processing your personal data and using cookies in accordance with our Privacy Statement (<http://www.ubs.com/global/en/legalinfo2/privacy.html>) and cookie notice (<http://www.ubs.com/global/en/homepage/cookies/cookie-management.html>).

**If you receive Global Research, whether through a System or by any other means, you agree that you shall not copy, revise, amend, create a derivative work, transfer to any third party, or in any way commercially exploit any UBS research provided via Global Research or otherwise, and that you shall not extract data from any research or estimates provided to you via Global Research or otherwise, without the prior written consent of UBS.**

This document is for distribution only as may be permitted by law. It is not directed to, or intended for distribution to or use by, any person or entity who is a citizen or resident of or located in any locality, state, country or other jurisdiction where such distribution, publication, availability or use would be contrary to law or regulation or would subject UBS to any registration or licensing requirement within such jurisdiction. It is published solely for information purposes; it is not an advertisement nor is it a solicitation or an offer to buy or sell any financial instruments or to participate in any particular trading strategy. No representation or warranty, either expressed or implied, is provided in relation to the accuracy, completeness or reliability of the information contained in this document ("the Information"), except with respect to Information concerning UBS. The Information is not intended to be a complete statement or summary of the securities, markets or developments referred to in the document. UBS does not undertake to update or keep current the Information. Any opinions expressed in this document may change without notice and may differ or be contrary to opinions expressed by other business areas or groups of UBS. Any statements contained in this report attributed to a third party represent UBS's interpretation of the data, information and/or opinions provided by that third party either publicly or through a subscription service, and such use and interpretation have not been reviewed by the third party.

Nothing in this document constitutes a representation that any investment strategy or recommendation is suitable or appropriate to an investor's individual circumstances or otherwise constitutes a personal recommendation. Investments involve risks, and investors should exercise prudence and their own judgement in making their investment decisions. The financial instruments described in the document may not be eligible for sale in all jurisdictions or to certain categories of investors. Options, derivative products and futures are not suitable for all investors, and trading in these instruments is considered risky. Mortgage and asset-backed securities may involve a high degree of risk and may be highly volatile in response to fluctuations in interest rates or other market conditions. Foreign currency rates of exchange may adversely affect the value, price or income of any security or related instrument referred to in the document. For investment advice, trade execution or other enquiries, clients should contact their local sales representative.

The value of any investment or income may go down as well as up, and investors may not get back the full (or any) amount invested. Past performance is not necessarily a guide to future performance. Neither UBS nor any of its directors, employees or agents accepts any liability for any loss (including investment loss) or damage arising out of the use of all or any of the Information.

Any prices stated in this document are for information purposes only and do not represent valuations for individual securities or other financial instruments. There is no representation that any transaction can or could have been effected at those prices, and any prices do not necessarily reflect UBS's internal books and records or theoretical model-based valuations and may be based on certain assumptions. Different assumptions by UBS or any other source may yield substantially different results.

This document and the Information are produced by UBS as part of its research function and are provided to you solely for general background information. UBS has no regard to the specific investment objectives, financial situation or particular needs of any specific recipient. In no circumstances may this document or any of the Information be used for any of the following purposes:

- (i) valuation or accounting purposes;
- (ii) to determine the amounts due or payable, the price or the value of any financial instrument or financial contract; or
- (iii) to measure the performance of any financial instrument.

By receiving this document and the Information you will be deemed to represent and warrant to UBS that you will not use this document or any of the Information for any of the above purposes or otherwise rely upon this document or any of the Information.

UBS has policies and procedures, which include, without limitation, independence policies and permanent information barriers, that are intended, and upon which UBS relies, to manage potential conflicts of interest and control the flow of information within divisions of UBS and among its subsidiaries, branches and affiliates. For further information on the ways in which UBS manages conflicts and maintains independence of its research products, historical performance information and certain additional disclosures concerning UBS research recommendations, please visit [www.ubs.com/disclosures](http://www.ubs.com/disclosures).

Research will initiate, update and cease coverage solely at the discretion of UBS Investment Bank Research Management, which will also have sole discretion on the timing and frequency of any published research product. The analysis contained in this document is based on numerous assumptions. All material information in relation to published research reports, such as valuation methodology, risk statements, underlying assumptions (including sensitivity analysis of those assumptions), ratings history etc. as required by the Market Abuse Regulation, can be found on NEO. Different assumptions could result in materially different results.

The analyst(s) responsible for the preparation of this document may interact with trading desk personnel, sales personnel and other parties for the purpose of gathering, applying and interpreting market information. UBS relies on information barriers to control the flow of information contained in one or more areas within UBS into other areas, units, groups or affiliates of UBS. The compensation of the analyst who prepared this document is determined exclusively by research management and senior management (not including investment banking). Analyst compensation is not based on investment banking revenues; however, compensation may relate to the revenues of UBS Investment Bank as a whole, of which investment banking, sales and trading are a part, and UBS's subsidiaries, branches and affiliates as a whole.

For financial instruments admitted to trading on an EU regulated market: UBS AG, its affiliates or subsidiaries (excluding UBS Securities LLC) acts as a market maker or liquidity provider (in accordance with the interpretation of these terms in the UK) in the financial instruments of the issuer save that where the activity of liquidity provider is carried out in accordance with the definition given to it by the laws and regulations of any other EU jurisdictions, such information is separately disclosed in this document. For financial instruments admitted to trading on a non-EU regulated market: UBS may act as a market maker save that where this activity is carried out in the US in accordance with the definition given to it by the relevant laws and regulations, such activity will be specifically disclosed in this document. UBS may have issued a warrant the value of which is based on one or more of the financial instruments referred to in the document. UBS and its affiliates and employees may have long or short positions, trade as principal and buy and sell in instruments or derivatives identified herein; such transactions or positions may be inconsistent with the opinions expressed in this document.

# Global Disclaimer (continued)

---

**United Kingdom and the rest of Europe:** Except as otherwise specified herein, this material is distributed by UBS Limited to persons who are eligible counterparties or professional clients. UBS Limited is authorised by the Prudential Regulation Authority and regulated by the Financial Conduct Authority and the Prudential Regulation Authority. **France:** Prepared by UBS Limited and distributed by UBS Limited and UBS Securities France S.A. UBS Securities France S.A. is regulated by the ACPR (Autorité de Contrôle Prudentiel et de Résolution) and the Autorité des Marchés Financiers (AMF). Where an analyst of UBS Securities France S.A. has contributed to this document, the document is also deemed to have been prepared by UBS Securities France S.A. **Germany:** Prepared by UBS Limited and distributed by UBS Limited and UBS Europe SE. UBS Europe SE is regulated by the Bundesanstalt für Finanzdienstleistungsaufsicht (BaFin). **Spain:** Prepared by UBS Limited and distributed by UBS Limited and UBS Securities España SV, SA. UBS Securities España SV, SA is regulated by the Comisión Nacional del Mercado de Valores (CNMV). **Turkey:** Distributed by UBS Limited. No information in this document is provided for the purpose of offering, marketing and sale by any means of any capital market instruments and services in the Republic of Turkey. Therefore, this document may not be considered as an offer made or to be made to residents of the Republic of Turkey. UBS AG is not licensed by the Turkish Capital Market Board under the provisions of the Capital Market Law (Law No. 6362). Accordingly, neither this document nor any other offering material related to the instruments/services may be utilized in connection with providing any capital market services to persons within the Republic of Turkey without the prior approval of the Capital Market Board. However, according to article 15 (d) (ii) of the Decree No. 32, there is no restriction on the purchase or sale of the securities abroad by residents of the Republic of Turkey. **Poland:** Distributed by UBS Limited (spolka z ograniczoną odpowiedzialnością) Oddział w Polsce regulated by the Polish Financial Supervision Authority. Where an analyst of UBS Limited (spolka z ograniczoną odpowiedzialnością) Oddział w Polsce. **Russia:** Prepared and distributed by UBS Bank (OOO). **Switzerland:** Distributed by UBS AG to persons who are institutional investors only. UBS AG is regulated by the Swiss Financial Market Supervisory Authority (FINMA). **Italy:** Prepared by UBS Limited and distributed by UBS Limited and UBS Limited, Italy Branch. Where an analyst of UBS Limited, Italy Branch has contributed to this document, the document is also deemed to have been prepared by UBS Limited, Italy Branch. **South Africa:** Distributed by UBS South Africa (Pty) Limited (Registration No. 1995/011140/07), an authorised user of the JSE and an authorised Financial Services Provider (FSP 7328). **Israel:** This material is distributed by UBS Limited. UBS Limited is authorised by the Prudential Regulation Authority and regulated by the Financial Conduct Authority and the Prudential Regulation Authority. UBS Securities Israel Ltd is a licensed Investment Marketeer that is supervised by the Israeli Securities Authority (ISA). UBS Limited and its affiliates incorporated outside Israel are not licensed under the Israeli Advisory Law. UBS Limited is not covered by insurance as required from a licensee under the Israeli Advisory Law. UBS may engage among others in issuance of Financial Assets or in distribution of Financial Assets of other issuers for fees or other benefits. UBS Limited and its affiliates may prefer various Financial Assets to which they have or may have Affiliation (as such term is defined under the Israeli Advisory Law). Nothing in this Material should be considered as investment advice under the Israeli Advisory Law. This Material is being issued only to and/or directed only at persons who are Eligible Clients within the meaning of the Israeli Advisory Law, and this material must not be relied on or acted upon by any other persons. **Saudi Arabia:** This document has been issued by UBS AG (and/or any of its subsidiaries, branches or affiliates), a public company limited by shares, incorporated in Switzerland with its registered offices at Aeschenvorstadt 1, CH-4051 Basel and Bahnhofstrasse 45, CH-8001 Zurich. This publication has been approved by UBS Saudi Arabia (a subsidiary of UBS AG), a Saudi closed joint stock company incorporated in the Kingdom of Saudi Arabia under commercial register number 1010257812 having its registered office at Tatweer Towers, P.O. Box 75724, Riyadh 11588, Kingdom of Saudi Arabia. UBS Saudi Arabia is authorized and regulated by the Capital Market Authority to conduct securities business under license number 08113-37. **Dubai:** The information distributed by UBS AG Dubai Branch is intended for Professional Clients only and is not for further distribution within the United Arab Emirates. **United States:** Distributed to US persons by either UBS Securities LLC or by UBS Financial Services Inc., subsidiaries of UBS AG; or by a group, subsidiary or affiliate of UBS AG that is not registered as a US broker-dealer (a ‘**non-US affiliate**’) to major US institutional investors only. UBS Securities LLC or UBS Financial Services Inc. accepts responsibility for the content of a document prepared by another non-US affiliate when distributed to US persons by UBS Securities LLC or UBS Financial Services Inc. All transactions by a US person in the securities mentioned in this document must be effected through UBS Securities LLC or UBS Financial Services Inc., and not through a non-US affiliate. UBS Securities LLC is not acting as a municipal advisor to any municipal entity or obligated person within the meaning of Section 15B of the Securities Exchange Act (the “Municipal Advisor Rule”), and the opinions or views contained herein are not intended to be, and do not constitute, advice within the meaning of the Municipal Advisor Rule. **Canada:** Distributed by UBS Securities Canada Inc., a registered investment dealer in Canada and a Member-Canadian Investor Protection Fund, or by another affiliate of UBS AG that is registered to conduct business in Canada or is otherwise exempt from registration. **Mexico:** This report has been distributed and prepared by UBS Casa de Bolsa, S.A. de C.V., UBS Grupo Financiero, an entity that is part of UBS Grupo Financiero, S.A. de C.V. and is an affiliate of UBS AG. This document is intended for distribution to institutional or sophisticated investors only. Research reports only reflect the views of the analysts responsible for the reports. Analysts do not receive any compensation from persons or entities different from UBS Casa de Bolsa, S.A. de C.V., UBS Grupo Financiero, or different from entities belonging to the same financial group or business group of such. For Spanish translations of applicable disclosures, please see [www.ubs.com/disclosures](http://www.ubs.com/disclosures). **Brazil:** Except as otherwise specified herein, this material is prepared by UBS Brasil CCTVM S.A. to persons who are eligible investors residing in Brazil, which are considered to be: (i) financial institutions, (ii) insurance firms and investment capital companies, (iii) supplementary pension entities, (iv) entities that hold financial investments higher than R\$300,000.00 and that confirm the status of qualified investors in written, (v) investment funds, (vi) securities portfolio managers and securities consultants duly authorized by Comissão de Valores Mobiliários (CVM), regarding their own investments, and (vii) social security systems created by the Federal Government, States, and Municipalities. **Hong Kong:** Distributed by UBS Securities Asia Limited and/or UBS AG, Hong Kong Branch. **Singapore:** Distributed by UBS Securities Pte. Ltd. [MCI (P) 007/09/2016 and Co. Reg. No.: 198500648C] or UBS AG, Singapore Branch. Please contact UBS Securities Pte. Ltd., an exempt financial adviser under the Singapore Financial Advisers Act (Cap. 110); or UBS AG, Singapore Branch, an exempt financial adviser under the Singapore Financial Advisers Act (Cap. 110) and a wholesale bank licensed under the Singapore Banking Act (Cap. 19) regulated by the Monetary Authority of Singapore, in respect of any matters arising from, or in connection with, the analysis or document. The recipients of this document represent and warrant that they are accredited and institutional investors as defined in the Securities and Futures Act (Cap. 289). **Japan:** Distributed by UBS Securities Japan Co., Ltd. to professional investors (except as otherwise permitted). Where this document has been prepared by UBS Securities Japan Co., Ltd., UBS Securities Japan Co., Ltd. is the author, publisher and distributor of the document. Distributed by UBS AG, Tokyo Branch to Professional Investors (except as otherwise permitted) in relation to foreign exchange and other banking businesses when relevant. **Australia:** Clients of UBS AG: Distributed by UBS AG (Holder of Australian Financial Services License No. 231087). Clients of UBS Securities Australia Ltd: Distributed by UBS Securities Australia Ltd (Holder of Australian Financial Services License No. 231098). This Document contains general information and/or general advice only and does not constitute personal financial product advice. As such, the Information in this document has been prepared without taking into account any investor's objectives, financial situation or needs, and investors should, before acting on the Information, consider the appropriateness of the Information, having regard to their objectives, financial situation and needs. If the Information contained in this document relates to the acquisition, or potential acquisition of a particular financial product by a 'Retail' client as defined by section 761G of the Corporations Act 2001 where a Product Disclosure Statement would be required, the retail client should obtain and consider the Product Disclosure Statement relating to the product before making any decision about whether to acquire the product. The UBS Securities Australia Limited Financial Services Guide is available at: [www.ubs.com/cs-research-fsg](http://www.ubs.com/cs-research-fsg). **New Zealand:** Distributed by UBS New Zealand Ltd. UBS New Zealand Ltd is not a registered bank in New Zealand. The information and recommendations in this publication are provided for general information purposes only. To the extent that any such information or recommendations constitute financial advice, they do not take into account any person's particular financial situation or goals. We recommend that recipients seek advice specific to their circumstances from their financial advisor. **Korea:** Distributed in Korea by UBS Securities Pte. Ltd., Seoul Branch. This document may have been edited or contributed to from time to time by affiliates of UBS Securities Pte. Ltd., Seoul Branch. **Malaysia:** This material is authorized to be distributed in Malaysia by UBS Securities Malaysia Sdn. Bhd (Capital Markets Services License No.: CMSLA/0063/2007). This material is intended for professional/institutional clients only and not for distribution to any retail clients. **India:** Distributed by UBS Securities India Private Ltd. (Corporate Identity Number U67120MH1996PTC097299) 2/F, 2 North Avenue, Maker Maxity, Bandra Kurla Complex, Bandra (East), Mumbai (India) 400051. Phone: +912261556000. It provides brokerage services bearing SEBI Registration Numbers: NSE (Capital Market Segment): INB230951431, NSE (F&O Segment) INF230951431, NSE (Currency Derivatives Segment) INE230951431, BSE (Capital Market Segment) INB010951437; merchant banking services bearing SEBI Registration Number: INM000010809 and Research Analyst services bearing SEBI Registration Number: INH00001204. UBS AG, its affiliates or subsidiaries may have debt holdings or positions in the subject Indian company/companies. Within the past 12 months, UBS AG, its affiliates or subsidiaries may have received compensation for non-investment banking securities-related services and/or non-securities services from the subject Indian company/companies. The subject company/companies may have been a client/clients of UBS AG, its affiliates or subsidiaries during the 12 months preceding the date of distribution of the research report with respect to investment banking and/or non-investment banking securities-related services and/or non-securities services. With regard to information on associates, please refer to the Annual Report at: [http://www.ubs.com/global/en/about\\_ubs/investor\\_relations/annualreporting.html](http://www.ubs.com/global/en/about_ubs/investor_relations/annualreporting.html)

The disclosures contained in research documents produced by UBS Limited shall be governed by and construed in accordance with English law.

UBS specifically prohibits the redistribution of this document in whole or in part without the written permission of UBS and UBS accepts no liability whatsoever for the actions of third parties in this respect. Images may depict objects or elements that are protected by third party copyright, trademarks and other intellectual property rights. © UBS 2016. The key symbol and UBS are among the registered and unregistered trademarks of UBS. All rights reserved.

# Contact information

---

**UBS Limited**

5 Broadgate  
London  
EC2M 2QS

Tel: +44-207-567 8000

[www.ubs.com](http://www.ubs.com)

