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Quantitative Strategy
The Quant View

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Navigating Through Rising Interest Rates: Impact for Quant Strategies

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Refocus on the rising interest rates

In this research report, we examine stock return sensitivities (betas) to interest rate changes. We first leverage Principal Component Analysis (PCA) to summarize interest rate movements using three metrics: Shift, Twist and Butterfly. We then estimate sensitivities to these new metrics using a machine learning technique called ridge regression. As we show, sectors such as financials and energy companies are benefiting from the rising rates whereas consumer staples, utilities and real estate companies are losing ground.

Serious impact on quant strategies

We continue to recognize that a significant proportion of the return dispersion can be explained by interest rate factors in recent years, even after controlling for other style factors. The ex-ante correlation estimates indicate that popular quantitative strategies such as low volatility, momentum, and dividend yield have sizable negative exposures to the rising rates, which commands equity investors' attention to control exposure to interest rate risk.

Source: Getty Images

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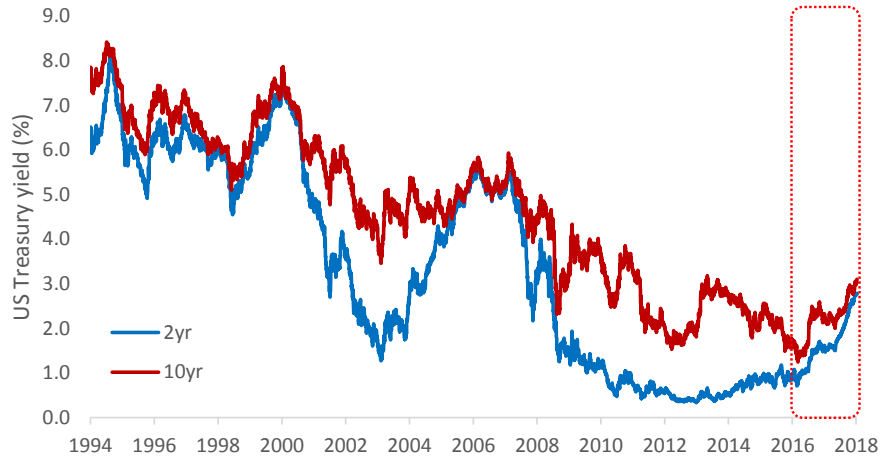
Decomposing the yield curve

After years of loose monetary policy, the possibility of rising interest rates is generating greater attention from equity investors. Figure 1 shows the U.S. 2-year and 10-year Treasury yields, which have been on the rise since 2016. As we continue to see strong data from the U.S. in 2018, the Fed may continue to raise interest rates.

Figure 1: U.S. Treasury yields



Source: Bloomberg Finance LP, Deutsche Bank

Our primary focus centers upon the impact that yield curve changes and tighter monetary policy will have on stock performance, and how to shield portfolios from potentially adverse effects. Following the same methodology in our earlier paper (see Alvarez, et al [2017]), we leverage the PCA technique to decompose the yield curve dynamics. This technique greatly reduces the dimensionality of the yield curve and models the changes in the level, steepness and curvature, which are referred to as the shift, twist and butterfly effects.

- Shift: The parallel change in the level of the curve whereby the yields for all maturities change in the same direction.
- Twist: The change of the spread between short-term and long-term yields. It captures the change in the slope or steepness of the yield curve.
- Butterfly: The short-term and long-term yields change in the same direction by greater magnitude than medium-term yields. The variable captures the change in the curvature of the yield curve.

Yield curve factor construction

The data we use to model yield curve dynamics is extracted from interest rate swaps across eight different maturities: 2yr, 3yr, 4yr, 5yr, 7yr, 10yr, 20yr and 30yr. The data spans January 2009 to May 2018. To reduce noise and problems associated with asynchronous or short-term lead-lag relationships, we base the analysis on week-over-week changes[1].

The PCA is computed on a rolling basis, using a 3-year look-back window of weekly interest rate changes. At each point in time, the first three principal components from the PCA are used to define the shift, twist and butterfly factors, respectively.

Yield curve factor characteristics

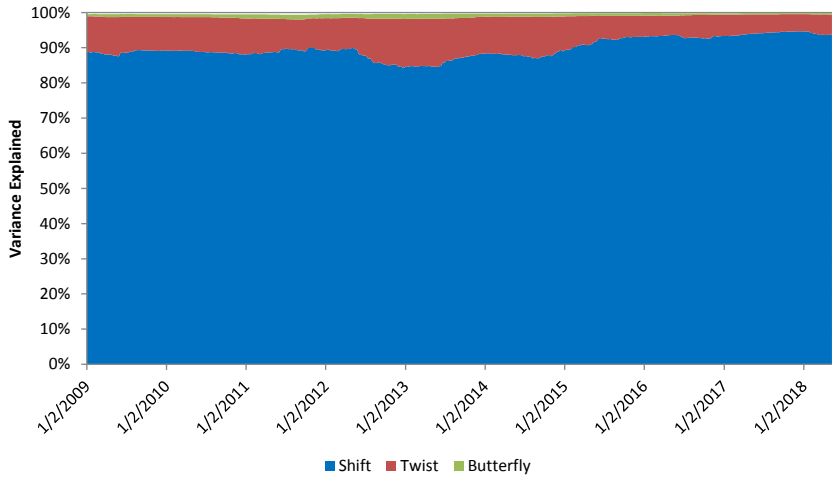
The principal component factors derived from the PCA are linear combinations of the underlying variables from the input data, and it is customary for the factors to be ordered according to their explanatory power. For example, the first principal component corresponds to the linear combination of the variables that explains the greatest proportion of variability across the data.

In 2018, the Shift factor explains around 94% of the variability (see Figure 2), followed by the Twist factor whose explanatory power is around 5%, and finally the Butterfly factor explains close to 1%. The proportion explained by the Shift factor has been growing steadily over the past three years, indicating that the parallel shift is dominating the dynamics of interest rate changes.

In aggregate, these first three principal components capture more than 99% of the variability across the data, essentially reducing the dimensionality of the data from eight interest rate change variables to three interpretable factors.

1 We used Friday to Friday weekly data.

Figure 2: Time series of the variance explained by the first three principal components



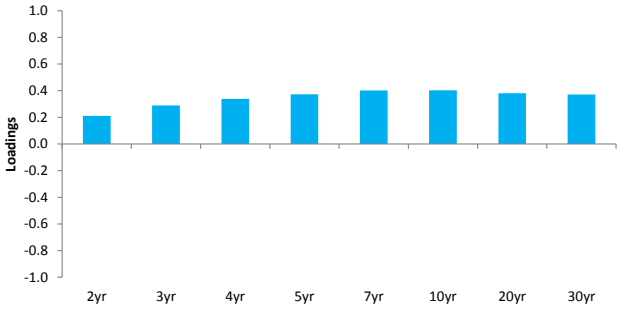
Source: Bloomberg Finance LP, Deutsche Bank

Composition of the yield curve factors

Mathematically, each principal component factor is made up by a weighted sum of the underlying variables from the input data. To gain a better understanding of the factors and assign to them a more intuitive and economic interpretation, analysts often characterize principal components in terms of the underlying variables.

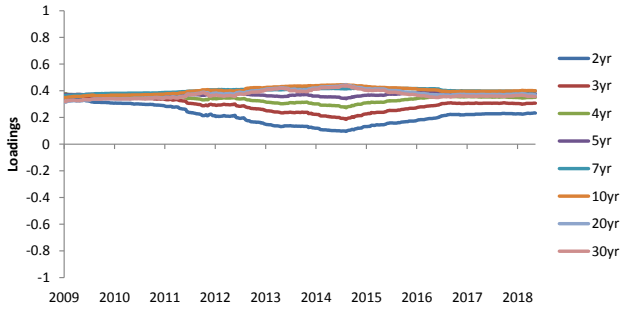
Figures 3, 5 and 7 show the average loadings of the three interest rate factors to each tenor while Figures 4, 6 and 8 trace the loadings through time. We find that the loadings have been steady from 2017 to 2018.

Figure 3: Average loadings of the shift component



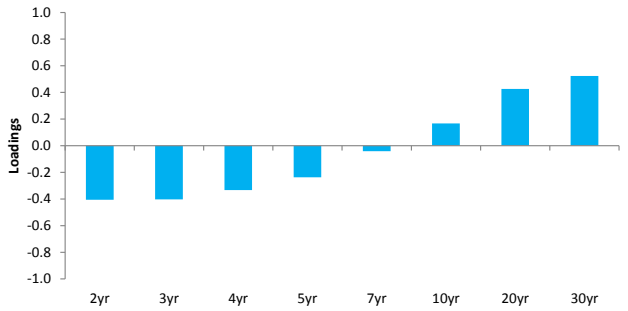
Source: Bloomberg Finance LP, Deutsche Bank

Figure 4: Loadings of shift component



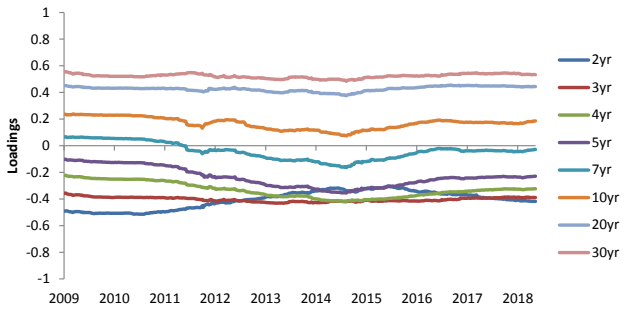
Source: Bloomberg Finance LP, Deutsche Bank

Figure 5: Average loadings of the twist component



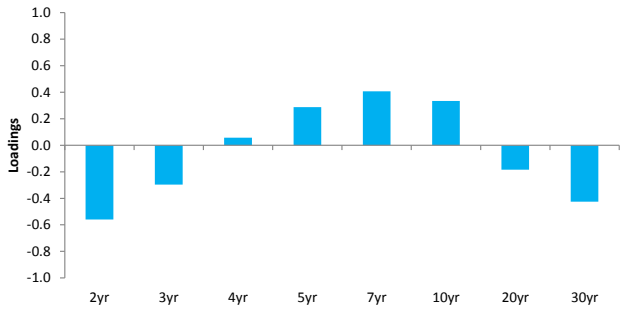
Source: Bloomberg Finance LP, Deutsche Bank

Figure 6: Loadings of twist component



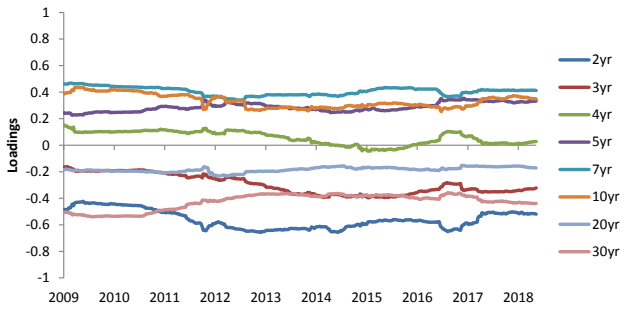
Source: Bloomberg Finance LP, Deutsche Bank

Figure 7: Average loadings of the butterfly component



Source: Bloomberg Finance LP, Deutsche Bank

Figure 8: Loadings of butterfly component



Source: Bloomberg Finance LP, Deutsche Bank

Ridge regression beta and dispersion of industry beta

The sensitivities are computed using multivariate regression that includes the equity market return to control for general market effects that may exhibit correlation with interest rate changes through time. Specifically, the sensitivities are the estimates of the beta coefficients in the following model:

$$R_{i,t} = \beta_t^m R_t^m + \beta_{i,t}^{shift} shift_t + \beta_{i,t}^{twist} twist_t + \beta_{i,t}^{fly} fly_t + \beta_{i,t}^0 + \varepsilon_{i,t}$$

- $R_{i,t}$ is the return of stock i at time t
- β_t^m is stock i's beta to the market at time t
- R_t^m is the Russell 1000 total index return at time t
- $\beta_{i,t}^{shift}$ is stock i's beta to the first principal component
- $\beta_{i,t}^{twist}$ is stock i's beta to the second principal component
- $\beta_{i,t}^{fly}$ is stock i's beta to the third principal component
- $shift_t$ Is the first principal component computed from the PCA of 2yr, 3yr, 4yr, 5yr, 7yr, 10yr, 20yr and 30yr swap rate changes for the past three years at time t
- $\beta_{i,t}^0$ is the intercept
- $\varepsilon_{i,t}$ is the regression residual term of stock i at time t

In our previous research (see Alvarez, et al [2017]), we suggested using a machine learning technique called ridge regression to estimate sensitivities to changes in interest rates. We showed that ridge regression improves the out-of-sample precision of the beta estimates by reducing their standard errors with the L2 regularization. We validated the out-of-sample beta efficacy by demonstrating that ridge regression beta can provide better cross-sectional stock returns predictions versus the OLS betas.

OLS Regression:

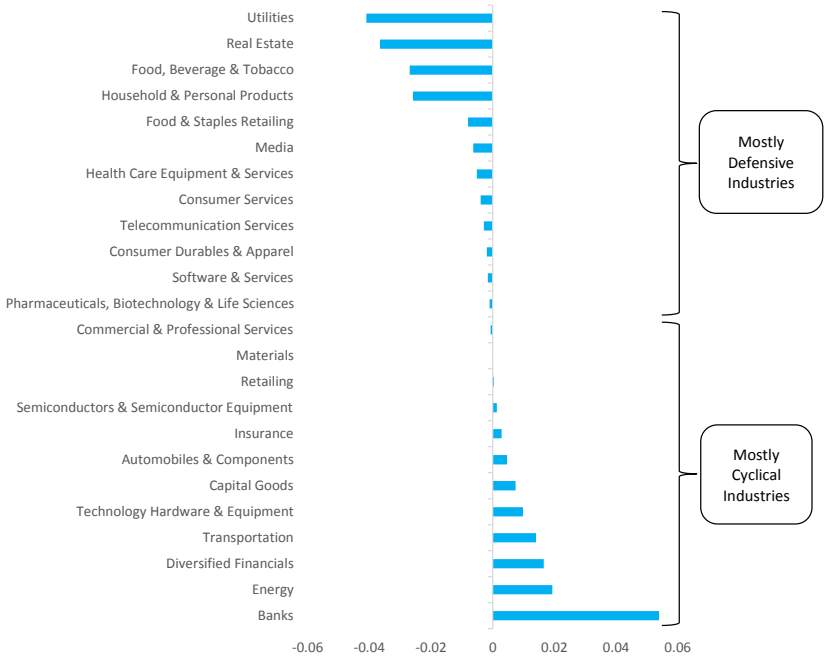
$$\hat{\beta}^{ols} = \arg\min_{\beta} \{\sum_{i=1}^{N} (y_i - \beta_0 - \sum_{j=1}^{p} x_{ij}\beta_j)^2\}$$

Ridge Regression:

$$\hat{\beta}^{ridge} = \arg\min_{\beta} \{\sum_{i=1}^{N} (y_i - \beta_0 - \sum_{j=1}^{p} x_{ij}\beta_j)^2 + \lambda \sum_{j=1}^{p} \beta_j^2\}$$

Following the betas derived via ridge regression, we plot Figure 9 to show the median Shift beta for all industries in the Russell 1000 as of May 2018.

Figure 9: Ranking of Shift ridge regression beta by industry as of May 2018

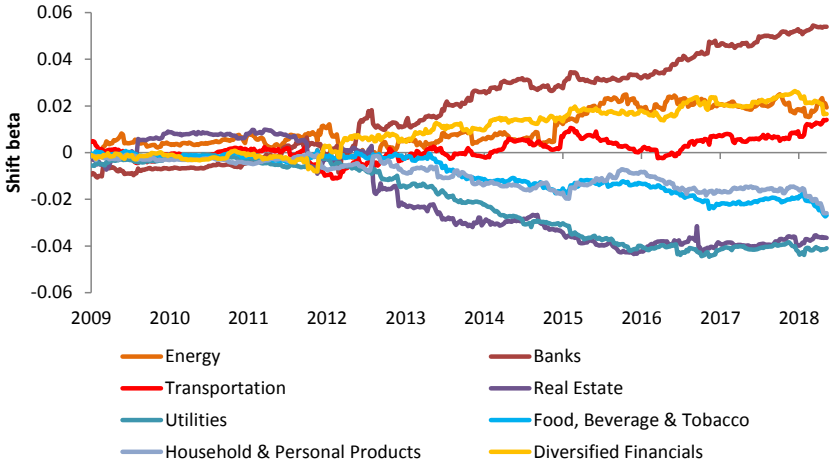


Source: Bloomberg Finance LP, Compustat, Deutsche Bank

Our findings reported in Figure 9 are consistent with those shown in our previous paper as industries that stand to lose most from an increase in rates are mostly defensive industries (with negative Shift betas), while those that are expected to benefit are mostly cyclical industries.

Figure 10 shows the time series of the betas of the top and bottom four industries. As we show, the dispersion of industry betas widens since 2017, leading to larger performance dispersion among industries due to the rising rates. It is noteworthy that banks and transportation companies are gaining momentum in the rising rate environment, whereas Tobacco and Household Products firms are losing more ground in recent periods.

Figure 10: Shift ridge regression beta by selected industries



Source: Bloomberg Finance LP, Compustat, Deutsche Bank

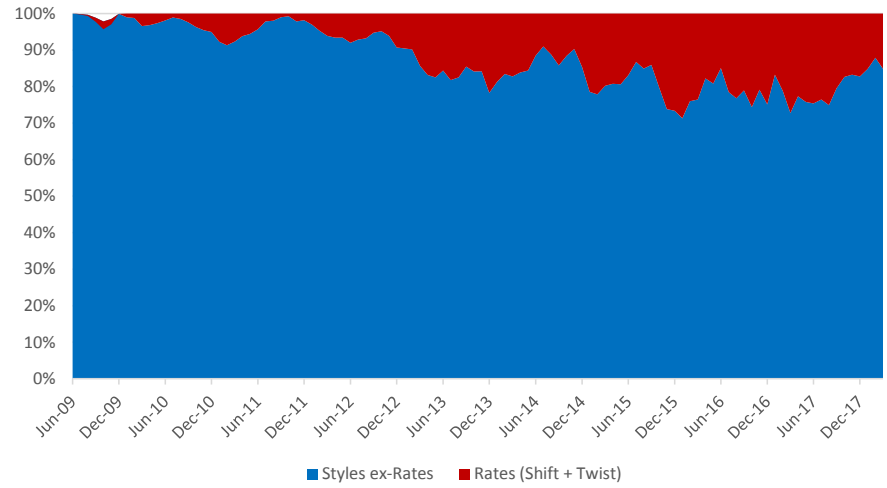
Taking a fresh look

Impact on cross-sectional return dispersion

Active investors' ability to extract alpha is dependent on cross-sectional variation in stock returns, which is a sufficient statistic for an opportunity set available for stock selection. Following our prior research, we re-examine how cross-sectional return dispersion is explained by stock sensitivity to the interest rate factors. In particular, we control for a more comprehensive selection of style factors including size, momentum, dividend yield, leverage, volatility, reversal, Merton's distance to default, free cash flow yield.

As we show in Figure 11, the interest rate factors capture a significant proportion of return dispersion in recent years.

Figure 11: Proportion of cross-sectional return dispersion explained by style ex-rates factors versus interest rate factors (Russell 1000 universe)

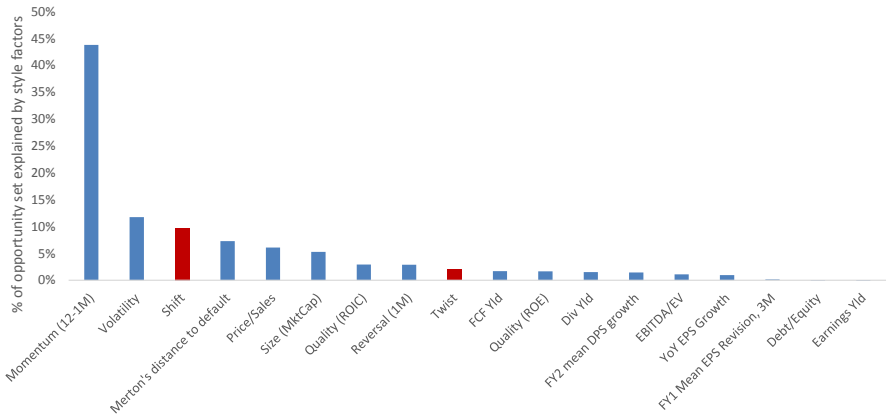


Source: Bloomberg Finance LP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Deutsche Bank

Figure 12 reports a breakdown of the exposure and returns attributable to each style factor in the attribution for May 2018 reveals more details:

- Momentum (12-1M) explains the largest proportion of the return dispersion
- Shift factor is ranked as the 3rd largest factor, only behind Momentum (12-1M) and Volatility
- Twist factor explains similar amounts of return dispersion as free cash flow yield and Reversal (1M)

Figure 12: Proportion of opportunity set explained by style factors as of May 2018



Source: Bloomberg Finance LP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Deutsche Bank

In recent years, the proportion of sector-free return dispersion explained by the interest rate factors can reach 30%, even after controlling for yield-related factors such as leverage and dividend yield. We continue to think the present strength of the interest rate factor is alarming; especially when its impact is similar to headline risk factors such as volatility and momentum.

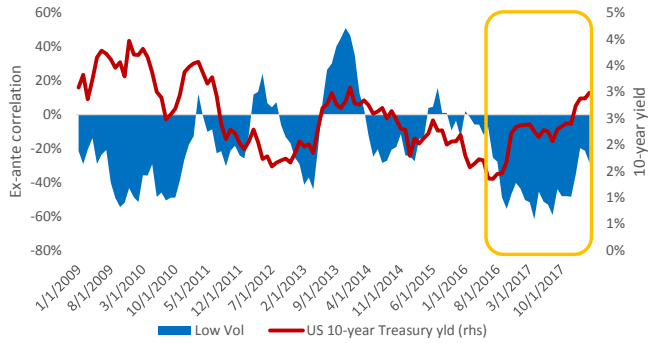
Positioning of quantitative strategies if interest rates rise

Turning our focus towards quantitative strategies, we analyze the exposure and impact that interest rate sensitivity has had on quantitative factors that have been traditionally used in alpha models and make up the basis to many "smart beta" or "risk factor" products.

In our earlier report in 2017, we have shown interest rate sensitivity can have a material impact on quantitative strategies and can account for a significant portion of the underperformance in quantitative strategies during the second half of 2016.

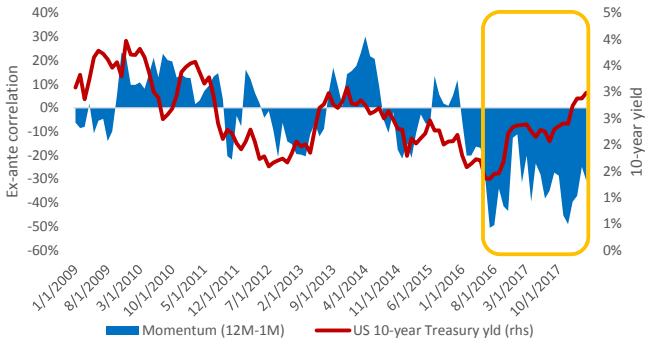
Unfortunately, these effects also persisted in both 2017 and 2018. As we show from Figure 13 to Figure 16, the ex-ante correlations between some popular quant factors such as low volatilities, momentum, and dividend yield and the interest rate Shift factor remain negative, which commands equity investors' attention to control exposure to interest rate risk.

Figure 13: Ex-ante correlation between Low Vol and interest rate Shift factor



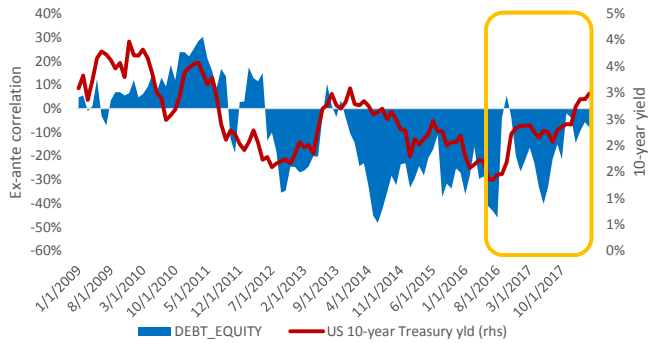
Source: Bloomberg Finance LP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Deutsche Bank

Figure 14: Ex-ante correlation between Momentum and interest rate Shift factor



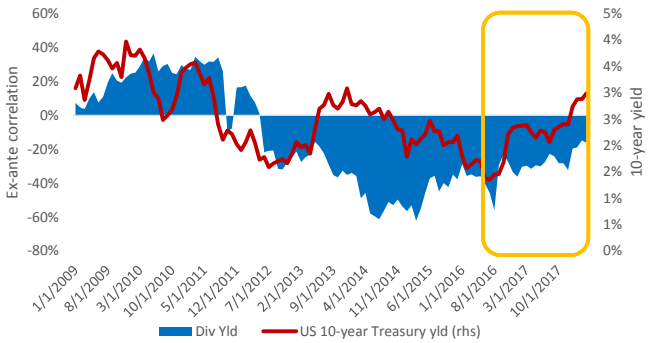
Source: Bloomberg Finance LP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Deutsche Bank

Figure 15: Ex-ante correlation between Debt-to-Equity (Leverage) and interest rate Shift factor



Source: Bloomberg Finance LP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Deutsche Bank

Figure 16: Ex-ante correlation between Dividend Yield and interest rate Shift factor



Source: Bloomberg Finance LP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Deutsche Bank

Conclusion

In this report, we take a fresh look at the stock return sensitivities (betas) to interest rate changes using the Principal Component Analysis (PCA) to decompose interest rate dynamics and ridge regression to measure betas. As we show, interest rate betas are becoming more dispersed among industries, indicating more significant performance differentiations driven by the rising rates. Additionally, we observe a significant proportion of the return dispersion can be explained by the interest rate factors in the recent years, even after controlling for a comprehensive selection of style factors. We find that popular quantitative strategies such as low volatility, momentum, and dividend yield have sizable negative exposures to the rising rates. With the Fed's latest quarter-point interest rate increase, the seventh such hike in two years, we think it’s eminent for investors to take interest rate risks into consideration.

Bibliography

Alvarez M., Mesomeris, S., Zhao, G., and Elledge, D. [2017], "Strategic Positioning for Rising Rates", Deutsche Bank Quantitative Strategy, March 23, 2017.

Macro update

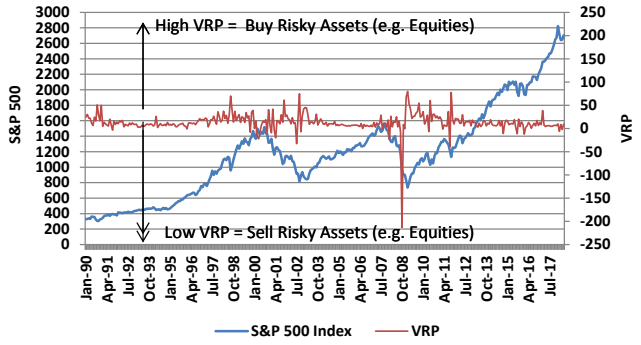
Turning our attention to the bigger picture, we also take the opportunity to update our favorite top-down market indicators.

Our favorite market timing indicator

Our Variance Risk Premium (VRP) indicator is a contrarian indicator that measures market overreaction and underreaction to realized risk. In simple terms, VRP is the difference between options-implied risk (i.e., the VIX index) and realized risk (i.e., the actual risk in the market, historically measured over the last month). If VRP is high, we see this as a buying opportunity for risky assets, like equities and high-yield bonds. Why? Our reasoning is as follows: when VRP is high, VIX has typically shot up dramatically (i.e., the market is in panic mode). At the same time, realized risk has probably also risen, but not to the same extent. In other words, the market has overreacted relative to what the actual realized data is telling us. Our research shows that such episodes are good buying opportunities for risky assets on about a three-month horizon. On the other hand, when VRP is low, it tends to be a complacency indicator – investors are failing to price rising realized risk into the market, and as a result, we favor selling risky assets like equities.

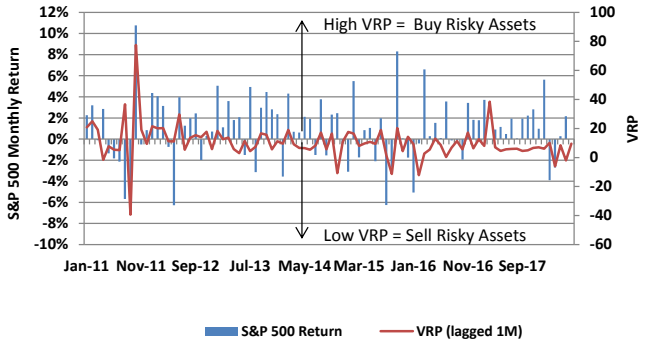
Our VRP indicator is at 9.5, less than the long-term average of 14. This reading signals slightly bearish sentiment. Generally, we pay attention to the VRP when it hits extreme levels (like +/- 2 standard deviations, or between -6 and 34).

Figure 17: Variance Risk Premium (VRP)



Source: Bloomberg Finance LP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Worldscope, Deutsche Bank

Figure 18: Recent VRP (lagged) and market returns

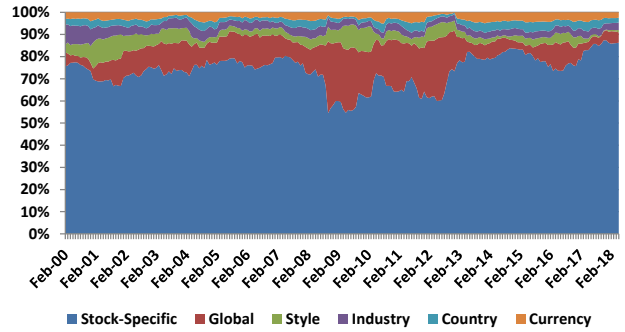


Source: Bloomberg Finance LP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Worldscope, Deutsche Bank

The opportunity set for investors

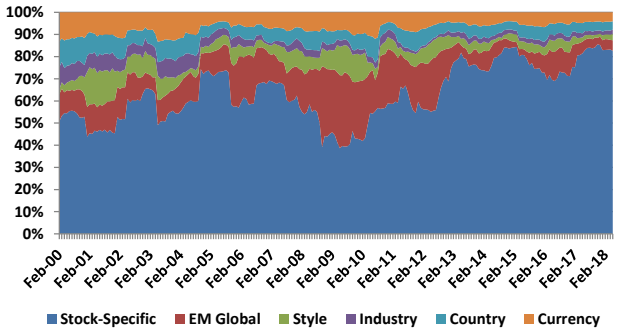
Another metric that we watch closely is the so-called "opportunity set" for investors. Think of this as the total alpha on the table. Our main interest is to understand what is driving that opportunity, because this can allow us to position our strategies to 'pick the juiciest fruit in the orchard.' In Figure 19, we show the opportunity set for global equity investors, and in Figure 20, we show the same for Emerging Market equity investors.

Figure 19: Global opportunity set



Source: Bloomberg Finance LP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Worldscope, Deutsche Bank

Figure 20: Emerging Markets opportunity set



Source: Bloomberg Finance LP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Worldscope, Deutsche Bank

The key result is the size of the blue portion relative to the other colors. The blue area represents the opportunity explained by stock selection, whereas we can think of the other colors as representing the opportunity from top-down calls, like picking the right countries, industries and styles. When the financial crisis occurred in 2008, we moved into a much more macro-dominated world. As a result, the portion of overall opportunity that could be explained by individual company characteristics (e.g. valuation, growth profile and earnings quality, etc.) shrunk sharply. For example, few investors cared if a stock looked good on fundamentals if it was exposed to Europe. Such an environment was challenging for quants and non-quants alike, since both camps tend to use stock-specific information to differentiate between stocks.

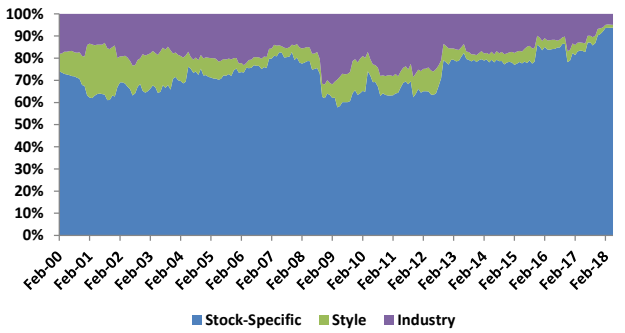
The small-cap opportunity set

In Figure 21, we show the opportunity set for the large-cap universe, and in Figure 22, we show the opportunity set for the small-cap universe.

Figure 21: Large-cap opportunity set

Source: Bloomberg Finance LP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Worldscope, Deutsche Bank

Figure 22: Small- cap opportunity set



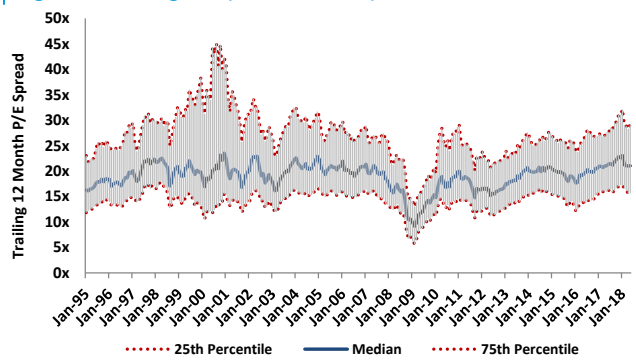
Source: Bloomberg Finance LP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Worldscope, Deutsche Bank

Both charts show that bottom-up stock picking is making a strong comeback. The blue area in both charts has reached levels last seen in 2007. The crucial observation is that the relative opportunity coming from stock selection is higher for small-cap stocks. In other words, this universe is particularly fruitful for managers with skill in picking individual stocks. We note that the relative opportunity set has remained fairly steady during the past month for small caps.

Valuation spreads

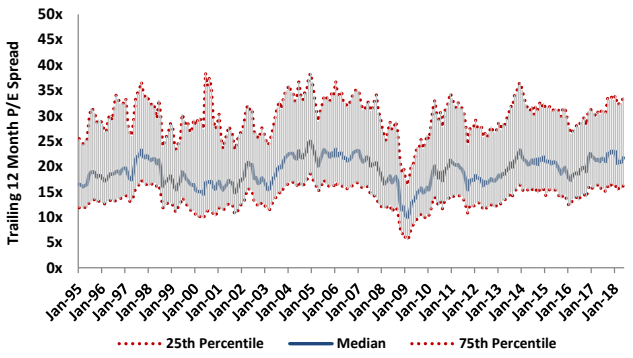
Similar to the opportunity set, valuation spreads allow investors to gauge the level of stock selection opportunity in the market. Widening valuation spreads typically indicate more stock-level differentiation, and consequently, a better environment for stock selection. On the other hand, narrowing valuation spreads are indicative of lower levels of stock differentiation. Figure 23 and Figure 24 show the median 25th percentile and 75th percentile of trailing price to earnings for the Russell 1000 and 2000 index constituents. Interestingly, we see that valuation spreads are wider on a more consistent basis for small-cap stocks. This reinforces the earlier evidence we saw in the opportunity set – the small-cap space is rich with opportunity for skilled stock pickers.

Figure 23: Large cap valuation spreads



Source: Bloomberg Finance LP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Worldscope, Deutsche Bank

Figure 24: Small cap valuation spreads

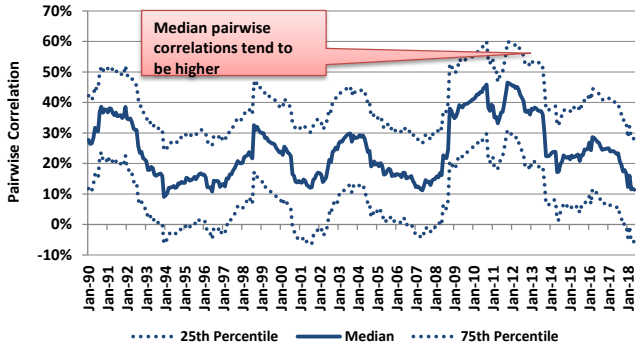


Source: Bloomberg Finance LP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Worldscope, Deutsche Bank

Keeping an eye on correlations

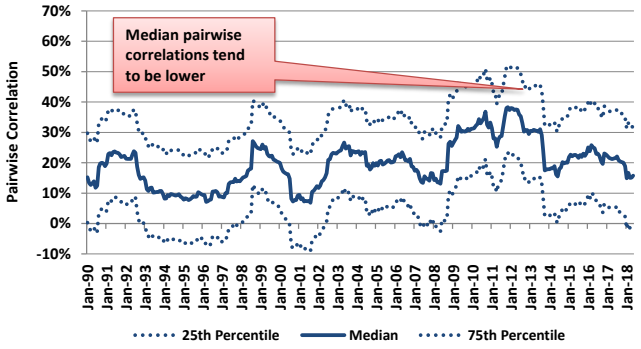
The median pairwise correlation among stocks in the market is closely related to the opportunity set and valuation spreads. This is calculated by taking every possible pair of stocks and computing the correlation of their monthly returns based on the past 24 months of data, and then taking the median across all the pairs. Figure 25 shows the median pairwise correlation for large caps. In general, median pairwise correlations for small-cap stocks (shown in Figure 26) tend to be lower when compared to large-cap stocks. This tells us that small-cap names tend to trade more on their own merits, rather than being driven by common factors.

Figure 25: Median pairwise correlation for large caps



Source: Bloomberg Finance LP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Worldscope, Deutsche Bank

Figure 26: Median pairwise correlation for small caps



Source: Bloomberg Finance LP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Worldscope, Deutsche Bank

The DB Quant Dashboard

Which styles have been working around the world?

The DB Quant Dashboard is an easy-to-use 'cheat sheet' that shows which styles have been working in key markets around the world. We track cumulative factor performance year-to-date. For those who prefer the previous tabular format (which includes more factors), those results can be found in Appendix A.

For more details see our website

For the most recent weekly factor performance, as well as factor performance delineated by different universes (e.g., large cap, small cap) and regions, please contact us at DBEQS.Americas@db.com to be added to our Weekly Dashboard distribution list

Figure 27: Global YTD cumulative factor performance (Q10-Q1 return spread)

Source: Bloomberg Finance LP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Worldscope, Deutsche Bank

Bottom-up stock selection

QCD US stock selection model

- The QCD model is our flagship stock selection model for US equities.
- The model incorporates a number of unique features, including dynamic factor selection, a non-linear TREE component, as well as active style and sector rotation.
- For complete details on the model, please see Luo et al, QCD Model: DB Quant Handbook, 22 July 2010.

Current stock recommendations

Figure below shows the best 20 Buy and Sell ideas from today's model. We note that a complete ranking for all Russell 300 stocks is available in a spreadsheet format. If you would like to get a copy of the spreadsheet, please contact us at DBEQS.Americas@db.com

Figure 28: Current QCD model stock recommendations

BEST BUY IDEAS (SECTOR NEUTRAL)

Ticker	Name	CUSIP	GICS Sector	QCD Score (higher is better long)
WD	WALKER & DUNLOP INC	93148P102	Financials	16.8%
INTU	INTUIT INC	461202103	Information Technology	16.2%
CTXS	CITRIX SYSTEMS INC	177376100	Information Technology	15.9%
ABC	AMERISOURCEBERGEN CORP	03073E105	Health Care	15.6%
MCK	MCKESSON CORP	58155Q103	Health Care	15.4%
ESNT	ESSENT GROUP LTD	G3198U102	Financials	13.6%
DPZ	DOMINO'S PIZZA INC	25754A201	Consumer Discretionary	12.1%
BCC	BOISE CASCADE CO	09739D100	Materials	10.1%
BRSS	GLOBAL BRASS & COPPER HLDGS	37953G103	Industrials	9.8%
CBRE	CBRE GROUP INC	12504L109	Real Estate	9.8%
DENN	DENNYS CORP	24869P104	Consumer Discretionary	9.8%
NSP	INSPERITY INC	45778Q107	Industrials	9.6%
SCHN	SCHNITZER STEEL INDS -CL A	806882106	Materials	8.3%
JLL	JONES LANG LASALLE INC	48020Q107	Real Estate	7.7%
TMUS	T-MOBILE US INC	872590104	Telecommunication Services	6.7%
VG	VONAGE HOLDINGS CORP	92886T201	Telecommunication Services	6.6%
NJR	NEW JERSEY RESOURCES CORP	646025106	Utilities	5.6%
UGI	UGI CORP	902681105	Utilities	5.3%
VLO	VALERO ENERGY CORP	91913Y100	Energy	1.0%
PSX	PHILLIPS 66	718546104	Energy	0.8%
ADM	ARCHER-DANIELS-MIDLAND CO	039483102	Consumer Staples	0.8%
USNA	USANA HEALTH SCIENCES INC	90328M107	Consumer Staples	0.6%

BEST SELL IDEAS (SECTOR NEUTRAL)

Ticker	Name	CUSIP	GICS Sector	QCD Score (lower is better short)
JONE	JONES ENERGY INC	48019R108	Energy	-25.4%
GST	GASTAR EXPLORATION INC	36729W202	Energy	-22.5%
ICON	ICONIX BRAND GROUP INC	451055107	Consumer Discretionary	-21.2%
RAD	RITE AID CORP	767754104	Consumer Staples	-18.0%
ENT	GLOBAL EAGLE ENTERTAINMENT	37951D102	Consumer Discretionary	-16.8%
CARA	CARA THERAPEUTICS INC	140755109	Health Care	-15.8%
MBI	MBIA INC	55262C100	Financials	-15.6%
WIN	WINDSTREAM HOLDINGS INC	97382A200	Telecommunication Services	-14.6%
PRTA	PROTHENA CORP PLC	G72800108	Health Care	-14.5%
SFS	SMART & FINAL STORES INC	83190B101	Consumer Staples	-13.7%
LC	LENDINGCLUB CORP	52603A109	Financials	-12.0%
FTR	FRONTIER COMMUNICATIONS CORP	35906A306	Telecommunication Services	-11.6%
NM	NAVIOS MARITIME HOLDINGS INC	Y62196103	Industrials	-11.2%
DDR	DDR CORP	23317H102	Real Estate	-10.8%
CLNS	COLONY NORTHSTAR INC	19625W104	Real Estate	-10.2%
PCYO	PURE CYCLE CORP	746228303	Utilities	-9.4%
WATT	ENERGOUS CORP	29272C103	Industrials	-9.0%
AP	AMPCO-PITTSBURGH CORP	032037103	Materials	-8.6%
MTSI	M/ACOM TECHNOLOGY SOLUTIONS	55405Y100	Information Technology	-8.0%
TERP	TERRAFORM POWER INC	88104R209	Utilities	-7.8%
TAHO	TAHOE RESOURCES INC	873868103	Materials	-7.7%
DBD	DIEBOLD NIXDORF INC	253651103	Information Technology	-6.9%

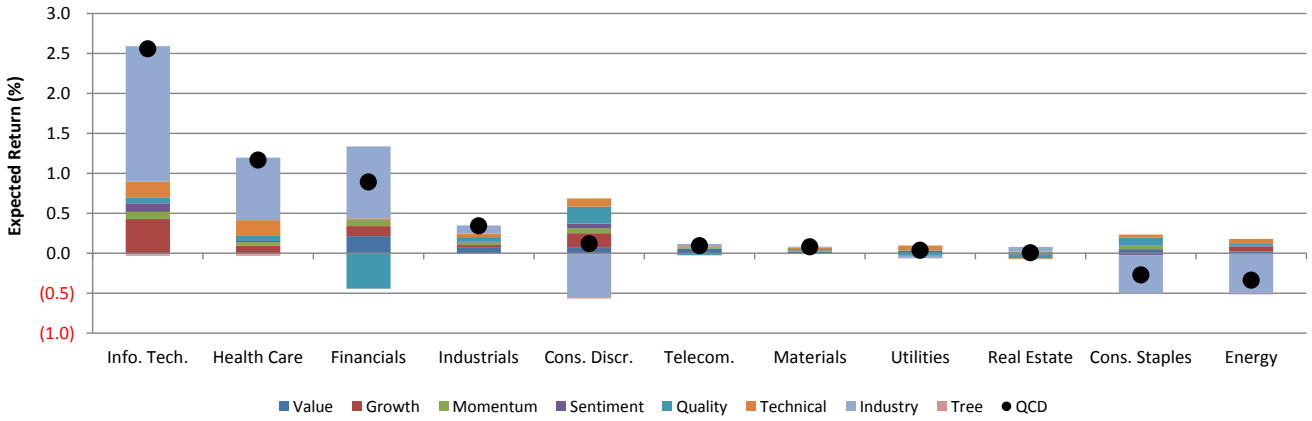
Source: Bloomberg Finance LP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Worldscope, Deutsche Bank

The recommendations in the table above may or may not reflect those of Deutsche Bank's fundamental analysts, given the different criteria used in evaluating the stocks

Current sector recommendations

The QCD model also implicitly makes sector predictions. Figure below shows the current ranking of the 10 GICS Level 1 Sectors, ranked from best (most likely to outperform this month) to worst (least likely to outperform). The bars show the key drivers for each call.

Figure 29: Current QCD sector recommendations



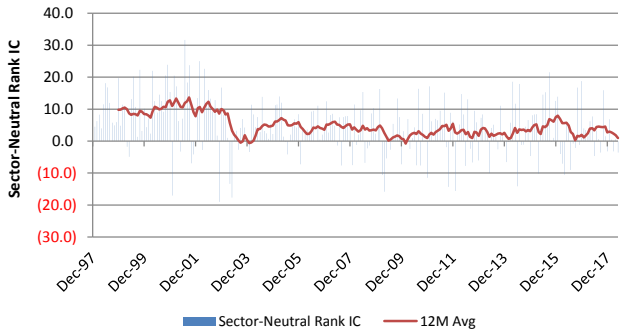
Source: Bloomberg Finance LP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Worldscope, Deutsche Bank

Model performance

Figures below show the pure signal performance, measured as a monthly sector-neutral rank information coefficient (IC), and the performance of a model portfolio, after costs, based on a realistically-optimized, market-neutral strategy.

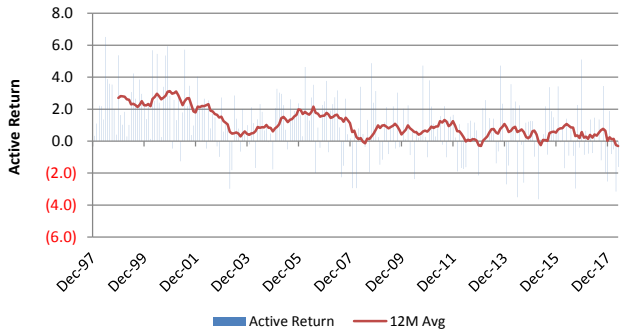
Past performance is no guarantee of future results. Transaction costs can vary. Additional information is available upon request.

Figure 30: Model performance, sector-neutral rank IC



Source: Bloomberg Finance LP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Worldscope, Deutsche Bank

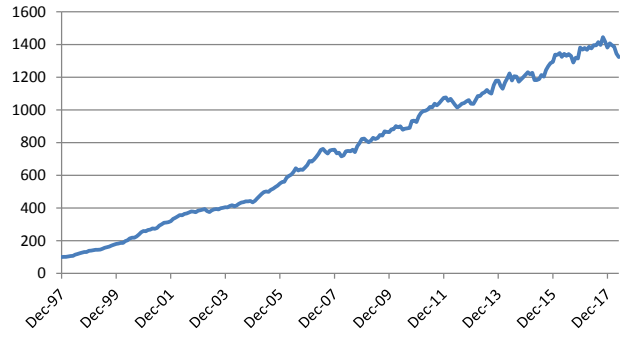
Figure 31: Model portfolio active return, after costs



Source: Bloomberg Finance LP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Worldscope, Deutsche Bank

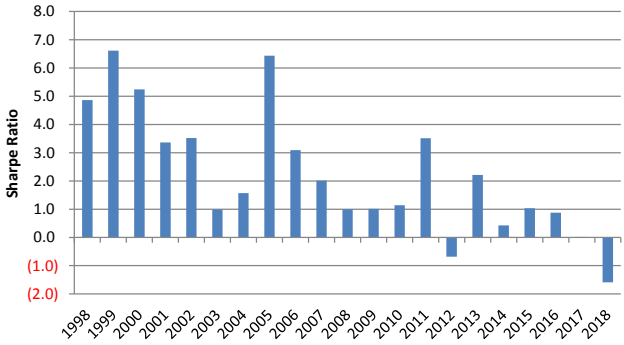
Figures below show the cumulative performance of the optimized strategy, and the annualized Sharpe Ratio (after costs) by calendar year.

Figure 32: Model portfolio cumulative, after costs



Source: Bloomberg Finance LP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Worldscope, Deutsche Bank

Figure 33: Annualized Sharpe Ratio, after costs



Source: Bloomberg Finance LP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Worldscope, Deutsche Bank

N-LASR global stock selection model

- The N-LASR model is our flagship stock selection model for global equities.
- The model is based on a machine learning algorithm called AdaBoost, and is designed to adaptively learn which factors to use, often in a non-linear way.
- For complete details on the model, please see Wang et al, Signal Processing: The Rise of the Machines, 5 June 2012.

Current stock recommendations

Figure below shows the best 20 Buy and sell ideas from today's model. We note that a complete ranking for all global stocks is available in a spreadsheet format. If you would like to get a copy of the spreadsheet, please contact us at DBEQS.Americas@db.com

Figure 34: Current N-LASR model stock recommendations

BEST BUY IDEAS

Ticker	Name	SEDOL	Country	N-LASR Score (higher is better long)
RMS FP	Hermes Intl	525397	France	2.86
CSGP	COSTAR GROUP INC	2262864	USA	2.65
7453 JT	Ryohin Keikaku Co	675845	Japan	2.64
AOT TB	Airports of Thailand PCL	BDFLHW	Thailand	2.62
ISRG	INTUITIVE SURGICAL INC	2871301	USA	2.61
REY IM	Reply SpA	BZ1DZ9	Italy	2.44
3613 HK	Beijing Tong Ren Tang Chinese Medicine Compar	B7TWG0	Hong Kong	2.43
4967 JT	Kobayashi Pharmaceutical Co	614945	Japan	2.41
058470 KS	Leeno Industrial Inc	643013	Korea	2.39
FORTUM FH	Fortum Oyj	557955	Finland	2.39
1448 HK	Fu Shou Yuan International Group Ltd	BH4TZ7	China	2.37
4927 JT	Pola Orbis Holdings Inc	B5N4QN	Japan	2.34
DLN LN	Derwent London Plc	26527	UK	2.33
ILMN	ILLUMINA INC	2613990	USA	2.26
TCS IB	Tata Consultancy Services Ltd	B01NPJ	India	2.25
MONC IM	Moncler SpA	BGLP23	Italy	2.23
GRN ID	Green Reit plc	BBR67J	Ireland	2.23
092730 KS	NeoPharm Co. Ltd.	B1LJQC	Korea	2.21
WKP LN	Workspace Group	B67G5X	UK	2.20
MC FP	LVMH-Moet Vuitton	406141	France	2.20

BEST SELL IDEAS

Ticker	Name	SEDOL	Country	N-LASR Score (lower is better short)
SCG	SCANA CORP	2545844	USA	-2.48
MYR AU	Myer Holdings Ltd	B50YPZ	Australia	-2.48
UNBK IB	Union Bank of India	657963	India	-2.44
ILFT IB	IL&FS Transportation Networks Ltd	B3PHKL	India	-2.42
AF FP	Air France	491603	France	-2.39
FRO NO	Frontline Ltd.	BDDJSX	Norway	-2.32
INBK IB	Indian Bank	B1SFSX	India	-2.31
NYNY	EMPIRE RESORTS INC	BD97994	USA	-2.30
2406 TT	Gigastorage Corp	624696	Taiwan	-2.25
SUPER TB	Super Energy Corporation PCL	BFZLRZ	Thailand	-2.21
RNAVAL IB	Reliance Naval and Engineering Ltd	B2NXD2	India	-2.21
BOI IB	Bank of India	609978	India	-2.19
1090 HK	Da Ming International Holdings Ltd	B5PGG2	China	-2.17
JPIN IB	Jaypee Infratech Ltd	B3SWPN	India	-2.16
787 HK	Global Brands Group Holding	BNN6B8	Hong Kong	-2.14
MFRISCOA MM	Minera Frisco SAB de CV	B3QHKH	Mexico	-2.12
6997 JT	Nippon Chemi-Con Corp	664035	Japan	-2.11
7280 JT	Mitsuba Corp	659638	Japan	-2.09
TKA GY	ThyssenKrupp AG	563692	Germany	-2.07
7241 JT	Futaba Industrial Co	635774	Japan	-2.07

Source: Bloomberg Finance LP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Worldscope, Deutsche Bank

The recommendations in the table above may or may not reflect those of DB's fundamental analysts, given the different criteria used in evaluating the stocks.

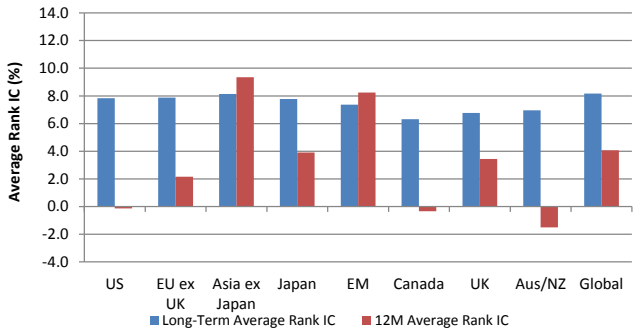
Model performance

Figures below show the average pure signal performance, measured as a monthly rank information coefficient (IC) in different regions and the performance of a

Past performance is no guarantee of future results. Transaction costs can vary. Additional information is available upon request.

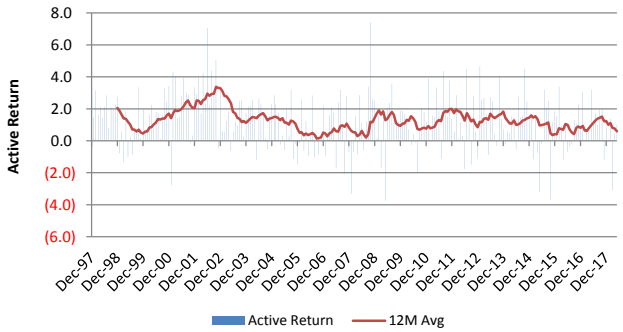
global model portfolio after costs, based on a realistically-optimized, market-neutral strategy.

Figure 35:Regional model performance, average rank IC



Source: Bloomberg Finance LP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Worldscope, Deutsche Bank

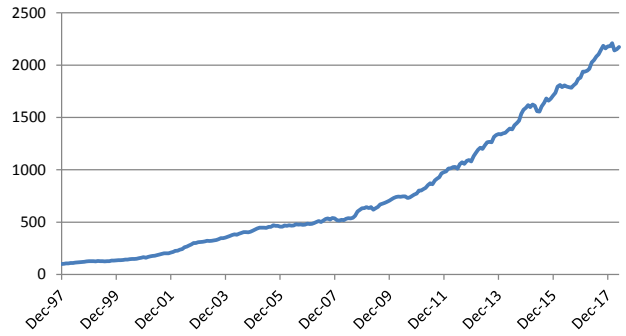
Figure 36: Global portfolio active return, after costs



Source: Bloomberg Finance LP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Worldscope, Deutsche Bank

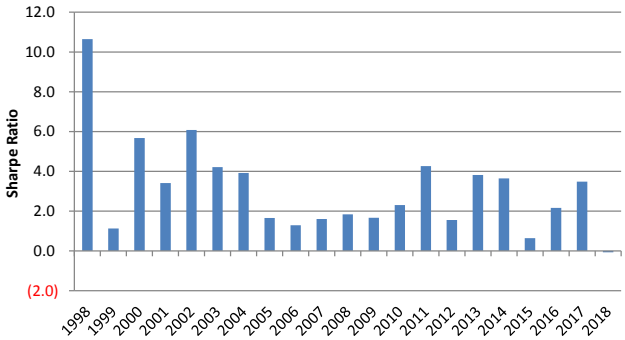
Figures below show the cumulative performance of the optimized strategy, and the annualized Sharpe Ratio (after costs) by calendar year.

Figure 37: Global portfolio cumulative, after costs



Source: Bloomberg Finance LP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Worldscope, Deutsche Bank

Figure 38: Annualized Sharpe Ratio, after costs



Source: Bloomberg Finance LP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Worldscope, Deutsche Bank

Top-down country rotation

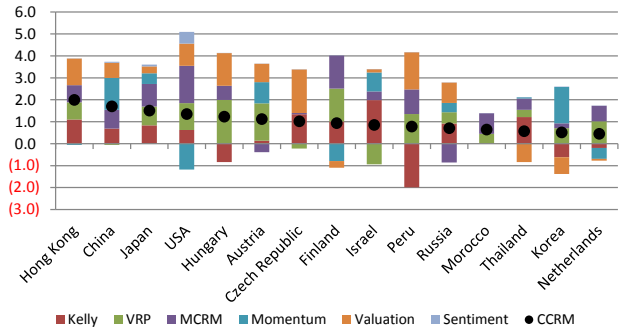
CCRM country rotation model

- Our Composite Country Rotation Model (CCRM) uses three sets of inputs to dynamically rotate between countries in the MSCI All Country World Index.
- The inputs include top-down macro signals (e.g. VRP, Kelly's Tail Risk), aggregate bottom-up fundamental signals (e.g. country-level valuation and momentum) and lead-lag signals, based on economic trade linkages.
- For complete details on the model, please see Luo et al, Signal Processing: New Insights in Country Rotation, 9 February 2012.

Current recommendations

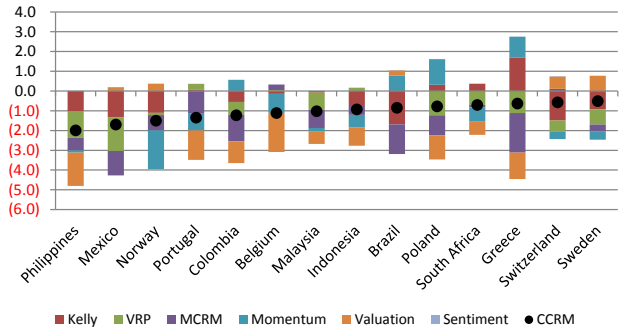
Figures below show the top and bottom third of countries, as ranked currently by our CCRM model. The bars show what is driving these calls.

Figure 39: Top tercile countries



Source: Bloomberg Finance LP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Worldscope, Deutsche Bank

Figure 40: Bottom tercile countries

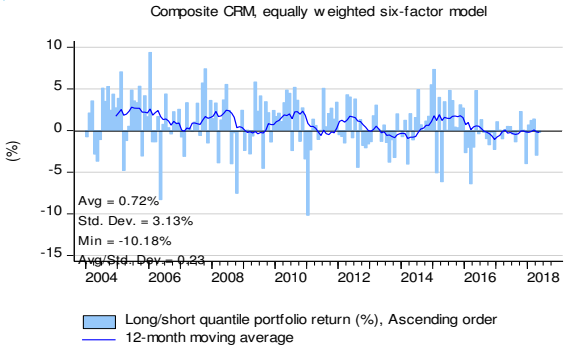


Source: Bloomberg Finance LP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Worldscope, Deutsche Bank

Model performance

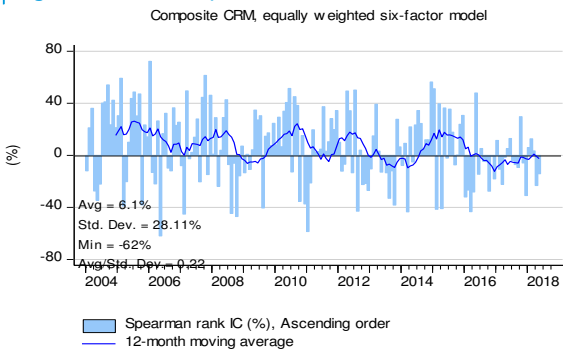
Figures below show the performance of the model over time.

Figure 41: Long/Short portfolio return (%)



Source: Bloomberg Finance LP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Worldscope, Deutsche Bank

Figure 42: Model performance with rank IC



Source: Bloomberg Finance LP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Worldscope, Deutsche Bank

Top-down asset allocation

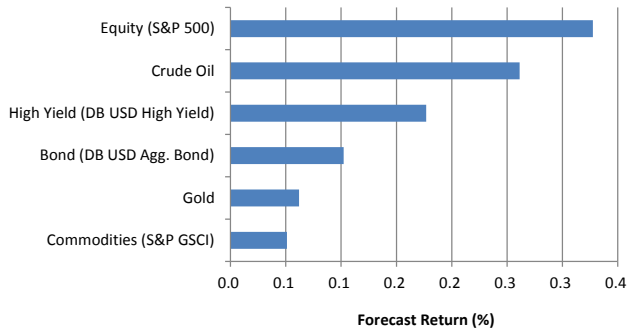
Quant Tactical Asset Allocation (QTAA) model

- Our Quantitative Tactical Asset Allocation (QTAA) model uses a model-of-models methodology to rotate between six asset classes.
- The model uses a wide range of fundamental and market-based factors as inputs, and dynamically selects a subset of those factors to use at each point in time.
- For complete details on the model, please see Luo et al, Signal Processing: Quant Tactical Asset Allocation, 19 September 2011.

Current recommendations and performance

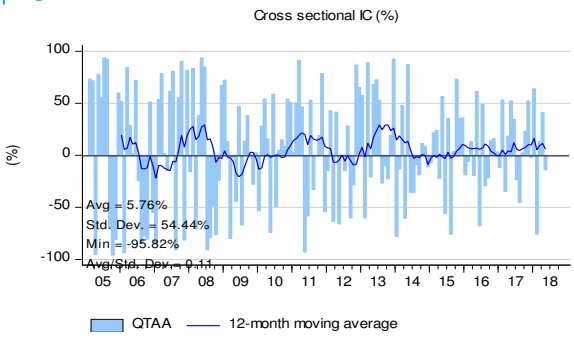
Figures below show the current ranking of our six asset classes, ranked from best to worst in terms of month-ahead forecast returns and the monthly performance of the QTAA model over time.

Figure 43:Current QTAA forecasts



Source: Bloomberg Finance LP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Worldscope, Deutsche Bank

Figure 44: Performance of QTAA model



Source: Bloomberg Finance LP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Worldscope, Deutsche Bank

Top-down style rotation

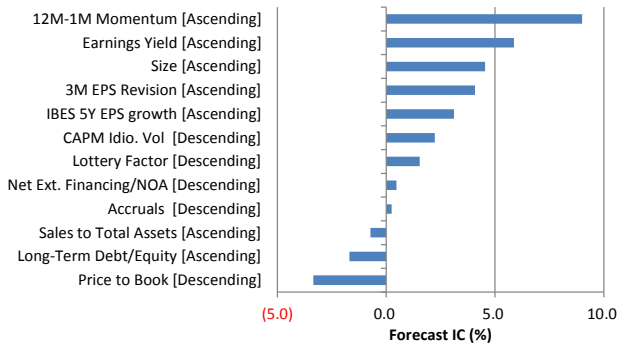
Style rotation model

- Our Style Rotation model dynamically rotates between 12 "typical" quant factors.
- The model uses market-based and macroeconomic inputs to predict month-ahead factor returns using a backward stepwise linear regression model.
- For complete details on the model, please see Luo et al, Signal Processing: Style Rotation, 7 September 2010.

Current recommendations and performance

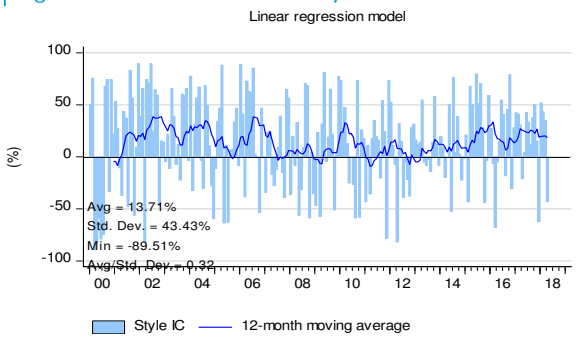
Figures below show the current ranking of our 12 factors, ranked from best to worst in terms of month-ahead forecast performance and the monthly performance of the Style Rotation model over time.

Figure 45: Current Style Rotation forecasts



Source: Bloomberg Finance LP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Worldscope, Deutsche Bank

Figure 46: Performance of style rotation model



Source: Bloomberg Finance LP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Worldscope, Deutsche Bank

Appendix A: Factor performance

Figure 47: US factor performance, measured as rank IC (Russell 3000 universe)

Factor Name	Direction[1]	Current # of Stocks	Average IC (%) Last M	12M Avg	3Y Avg	Since Inception Avg	Std Dev	Avg / Std Dev	Max	Min	p-value[2]	# of Months	Avg # of Stocks	Hit Rate (%)	Serial Corr (%)[3]
1. Value															
1 Dividend yield, trailing 12M	Ascending	2,930	(9.71)	(1.65)	2.30	2.75	13.93	0.20	42.59	(33.26)	0.00	365	2,889	54.52	98.23
2 Expected dividend yield	Ascending	2,930	(10.39)	(1.69)	2.46	2.99	14.43	0.21	44.46	(33.89)	0.00	365	2,889	53.97	98.88
3 Price-to-operating EPS, trailing 12M, Basic	Descending	2,101	(5.94)	0.54	0.39	2.42	10.36	0.23	30.82	(32.28)	0.00	289	2,328	56.75	93.70
4 Operating earnings yield, trailing 12M, Basic	Ascending	2,903	(8.86)	0.25	3.14	4.58	12.45	0.37	47.24	(33.30)	0.00	289	2,885	62.28	95.62
5 Earnings yield, forecast FY1 mean	Ascending	2,764	(12.66)	(0.16)	3.50	4.34	11.93	0.36	48.88	(34.61)	0.00	365	2,571	63.01	94.75
6 Earnings yield, forecast FY2 mean	Ascending	2,758	(11.68)	0.25	3.20	3.79	11.60	0.33	47.02	(34.31)	0.00	365	2,485	63.29	94.38
7 Earnings yield x IBES 5Y growth	Ascending	1,321	(5.13)	2.63	0.79	1.66	10.08	0.17	41.11	(26.63)	0.01	289	1,835	59.52	93.28
8 Sector-rel Operating earnings yield, trailing 12M, Basic	Ascending	2,820	(4.41)	0.42	2.54	4.16	8.13	0.51	28.96	(14.90)	0.00	289	2,882	68.51	95.26
9 Hist-rel Operating earnings yield, trailing 12M, Basic	Ascending	2,383	3.42	0.59	0.81	1.44	6.32	0.23	20.73	(18.74)	0.00	195	2,115	61.03	95.96
10 Operating cash flow yield (income stmt def)	Ascending	2,930	(11.39)	(0.54)	1.74	3.79	10.74	0.35	47.14	(32.67)	0.00	365	2,889	62.74	95.06
11 Cash flow yield, FY1 mean	Ascending	1,693	(12.83)	(1.61)	(1.44)	2.18	16.89	0.13	66.06	(54.29)	0.02	335	921	55.52	94.50
12 Free cash flow yield	Ascending	2,831	(6.41)	0.81	3.07	4.69	7.83	0.60	31.93	(22.64)	0.00	328	2,571	74.09	94.38
13 Price-to-sales, trailing 12M	Descending	2,840	(9.22)	(0.70)	(1.44)	1.41	10.91	0.13	30.02	(41.46)	0.01	365	2,812	55.34	98.67
14 Price-to-book	Descending	2,778	(4.57)	(1.31)	(0.01)	0.60	10.82	0.06	26.28	(35.75)	0.29	365	2,775	48.22	96.00
15 EBITDA/EV	Ascending	2,902	(9.28)	(0.33)	1.72	3.85	9.75	0.39	39.32	(27.15)	0.00	365	2,839	64.66	91.99
16 Price-to-book adj for ROE, sector adj	Descending	2,536	(0.88)	(2.38)	(1.15)	0.32	8.62	0.04	22.50	(33.21)	0.48	365	2,461	48.49	95.72
2. Growth															
17 Hist 5Y operating EPS growth	Descending	2,832	(2.54)	0.02	1.33	1.31	8.44	0.16	30.58	(22.70)	0.01	277	2,757	55.60	95.23
18 Hist 5Y operating EPS acceleration	Ascending	2,832	1.20	0.49	1.25	0.92	6.31	0.15	25.31	(16.13)	0.02	277	2,757	56.32	92.90
19 IBES 5Y EPS growth	Ascending	2,284	2.79	1.21	1.75	1.12	7.86	0.14	21.65	(27.86)	0.01	365	2,300	56.71	98.08
20 IBES 5Y EPS growth/stability	Ascending	2,284	0.85	2.17	2.62	1.60	7.64	0.21	20.64	(19.20)	0.00	365	2,300	58.63	98.38
21 IBES LTG EPS mean	Descending	1,620	(6.76)	(3.41)	(0.85)	1.36	14.91	0.09	37.64	(52.38)	0.08	365	2,091	48.77	97.10
22 IBES FY2 mean DPS growth	Ascending	2,145	(12.49)	(0.71)	2.30	1.32	8.37	0.16	24.12	(21.96)	0.03	192	1,689	53.13	84.34
23 IBES FY1 mean EPS growth	Ascending	2,743	0.05	3.32	2.21	1.20	7.21	0.17	20.76	(24.42)	0.00	365	2,544	61.92	88.73
24 Year-over-year quarterly EPS growth	Ascending	2,902	(1.27)	0.94	1.87	2.47	6.74	0.37	23.85	(21.12)	0.00	289	2,892	65.74	79.29
25 IBES FY1 mean CFPS growth	Descending	1,561	(2.20)	(1.00)	(1.73)	0.13	10.37	0.01	38.08	(42.07)	0.84	292	714	50.00	92.18
26 IBES SUE, amortized	Ascending	2,579	1.27	1.26	2.09	1.06	6.23	0.17	20.62	(16.30)	0.00	304	1,375	56.58	72.98
3. Price Momentum and Reversal															
27 Total return, 1D	Descending	2,930	(1.15)	1.23	2.59	4.70	7.13	0.66	16.33	(33.75)	0.00	365	2,890	76.71	1.93
28 Total return, 21D (1M)	Descending	2,926	(1.28)	2.58	0.16	1.77	10.61	0.17	29.03	(43.69)	0.00	365	2,889	56.44	1.10
29 Maximum daily return in last 1M (lottery factor)	Descending	2,921	(10.19)	0.46	4.19	5.02	14.60	0.34	39.13	(56.07)	0.00	365	2,780	63.84	50.88
30 21D volatility of volume/price	Descending	2,926	(3.27)	(0.37)	0.51	0.38	6.55	0.06	24.16	(21.49)	0.26	365	2,881	51.51	52.73
31 Total return, 252D (12M)	Ascending	2,847	6.56	2.35	1.42	2.97	13.98	0.21	39.62	(57.00)	0.00	365	2,801	62.74	89.66
32 12M-1M total return	Ascending	2,847	6.90	3.05	1.66	3.75	13.16	0.28	37.65	(49.06)	0.00	365	2,801	63.29	88.23
33 Price-to-52 week high	Ascending	2,846	(1.09)	0.29	3.47	3.17	17.42	0.18	49.63	(62.50)	0.00	365	2,091	61.10	84.40
34 Total return, 1260D (60M)	Ascending	2,288	(0.02)	1.27	2.29	1.38	10.92	0.13	25.63	(35.41)	0.02	353	2,253	56.94	97.27
4. Sentiment															
35 IBES LTG Mean EPS Revision, 3M	Ascending	1,586	(5.57)	(0.28)	(0.08)	0.77	3.80	0.20	11.16	(12.06)	0.00	365	2,063	60.82	59.02
36 IBES FY1 Mean EPS Revision, 3M	Ascending	2,721	(3.50)	0.57	0.94	2.72	8.25	0.33	29.96	(33.00)	0.00	365	2,513	65.75	72.15
37 IBES FY1 EPS up/down ratio, 3M	Ascending	2,711	(1.27)	1.37	1.21	2.87	7.68	0.37	27.54	(24.41)	0.00	365	2,390	67.12	78.94
38 Expectation gap, short-term - long-term	Descending	2,073	(6.34)	(0.60)	0.48	1.14	5.35	0.21	11.80	(19.91)	0.00	365	2,128	57.53	91.10
39 IBES FY1 Mean CFPS Revision, 3M	Ascending	1,604	(2.45)	1.06	1.47	2.00	14.77	0.14	69.38	(75.04)	0.01	334	854	63.17	61.44
40 IBES FY1 Mean SAL Revision, 3M	Ascending	2,708	(3.02)	2.49	2.16	1.38	7.82	0.18	27.43	(24.32)	0.00	264	2,280	61.74	68.28
41 IBES FY1 Mean FFO Revision, 3M	Ascending	171	(10.35)	1.63	2.60	2.48	19.59	0.13	71.43	(80.00)	0.02	337	98	56.68	68.18
42 IBES FY1 Mean DPS Revision, 3M	Ascending	1,332	6.45	0.85	1.06	0.82	5.03	0.16	14.91	(17.55)	0.03	189	1,098	59.79	63.63
43 IBES FY1 Mean ROE Revision, 3M	Ascending	2,083	0.66	2.00	1.61	1.03	6.29	0.16	23.70	(22.19)	0.03	189	1,854	59.79	60.95
44 Recommendation, mean	Descending	2,772	4.53	1.39	(0.02)	0.77	7.43	0.10	21.85	(19.41)	0.08	294	2,692	57.48	94.83
45 Mean recommendation revision, 3M	Descending	2,756	0.69	0.26	0.08	1.02	3.91	0.26	19.86	(11.55)	0.00	291	2,678	62.20	60.68
46 Target price implied return	Descending	2,753	(2.92)	(0.88)	2.13	0.24	16.05	0.01	60.74	(39.59)	0.82	230	2,526	47.83	81.05
47 Mean target price revision, 3M	Ascending	2,737	8.47	2.22	1.45	2.22	12.45	0.18	30.14	(41.94)	0.01	227	2,513	61.67	74.54
5. Quality															
48 ROE, trailing 12M	Ascending	2,765	(10.19)	0.18	2.71	3.75	10.10	0.37	33.42	(29.52)	0.00	289	2,854	65.05	94.33
49 Return on invested capital (ROIC)	Ascending	2,892	(8.48)	0.94	3.45	4.08	10.23	0.40	33.02	(31.24)	0.00	289	2,869	68.51	96.20
50 Sales to total assets (asset turnover)	Ascending	2,837	0.98	1.40	(0.29)	1.37	8.56	0.16	22.78	(22.02)	0.00	365	2,824	55.34	99.45
51 Operating profit margin	Ascending	2,834	5.17	2.32	3.42	1.36	5.61	0.24	16.98	(14.17)	0.00	365	2,743	60.55	97.95
52 Current ratio	Descending	2,199	(16.23)	(2.39)	(0.03)	1.62	10.12	0.16	31.95	(38.66)	0.00	365	2,244	53.97	97.56
53 Long-term debt/equity	Ascending	2,766	(9.71)	(2.82)	(1.21)	0.65	9.35	0.07	35.65	(28.14)	0.19	365	2,759	49.04	97.10
54 Altman's z-score	Ascending	2,102	9.97	3.16	3.25	0.66	9.19	0.07	31.74	(30.44)	0.17	365	2,161	51.23	97.85
55 Merton's distance to default	Ascending	2,547	(2.81)	1.22	4.47	3.48	12.13	0.29	35.09	(41.45)	0.00	365	2,347	65.48	94.50
56 Ohlson default model	Descending	2,157	2.07	1.39	2.98	2.34	6.54	0.36	16.95	(25.59)	0.00	328	2,140	67.68	98.11
57 Accruals (Sloan 1996 def)	Descending	2,113	(2.42)	(0.12)	(0.96)	0.28	4.22	0.07	12.07	(15.48)	0.21	365	2,142	53.42	87.99
58 Firm-specific discretionary accruals	Descending	1,102	(2.67)	(0.34)	(1.25)	0.19	3.67	0.05	10.45	(12.89)	0.36	305	1,954	53.44	66.71
59 Hist 5Y operating EPS stability, coef of determination	Ascending	2,832	(0.35)	1.80	0.92	0.93	4.89	0.19	20.01	(12.27)	0.00	277	2,757	52.71	97.07
60 IBES 5Y EPS stability	Descending	2,284	(4.00)	1.13	2.42	1.33	8.27	0.16	25.00	(34.33)	0.00	365	2,300	54.79	98.92
61 IBES FY1 EPS dispersion	Descending	2,764	(3.71)	0.42	3.98	1.84	9.43	0.20	31.67	(28.25)	0.00	365	2,571	60.00	83.10
62 Payout on trailing operating EPS	Ascending	2,101	(4.36)	(2.27)	0.36	0.64	12.98	0.05	38.55	(30.91)	0.34	365	2,205	48.77	97.32
63 YoY change in # of shares outstanding	Descending	2,864	(13.43)	(0.51)	1.40	2.50	8.83	0.28	19.53	(46.21)	0.00	365	2,787	59.73	92.50
64 YoY change in debt outstanding	Descending	2,356	0.06	(1.13)	(0.80)	0.08	4.07	0.02	13.07	(10.40)	0.72	365	2,226	53.97	89.35
65 Net external financing/net operating assets	Ascending	2,913	(6.96)	(0.56)	0.81	2.26	8.47	0.27	44.61	(21.76)	0.00	365	2,855	60.00	94.58
66 Piotroski's F-score	Ascending	2,930	(7.23)	(0.08)	2.13	2.84	8.07	0.35	29.20	(27.83)	0.00	365	2,891	67.40	88.66
67 Mohanram's G-score	Ascending	533	3.57	2.21	2.50	2.53	9.92	0.26	35.27	(32.14)	0.00	277	417	57.76	95.53
6. Technicals															
68 # of days to cover short	Descending	2,613	(4.39)	1.40	2.13	2.20	7.32	0.30	33.80	(25.16)	0.00	365	2,032	59.73	91.90
69 CAPM beta, 5Y monthly	Descending	4,041	(3.69)	(0.62)	1.34	0.97	12.75	0.08	40.19	(42.70)	0.18	306	3,042	50.65	96.47
70 CAPM idosyncratic vol, 1Y daily	Descending	2,992	(13.05)	(0.76)	5.19	5.16	17.63	0.29	42.60	(60.80)	0.00	353	2,907	61.76	98.80
71 Realized vol, 1Y daily	Descending	2,847	(14.80)	(1.07)	5.03	5.01	18.31	0.27	42.69	(59.63)	0.00	365	2,805	60.82	98.60
72 Skewness, 1Y daily	Descending	2,847	(3.47)	(1.79)	0.72	1.10	5.36	0.21	13.93	(22.86)	0.00	365	2,805	55.89	89.85
73 Kurtosis, 1Y daily	Descending	2,847	(1.60)	(0.49)	0.93	1.37	5.60	0.25	15.28	(15.82)	0.00	365	2,805	61.64	91.52
74 Idiosyncratic vol surprise	Descending	2,863	1.39	(1.59)	0.48	2.57	7.67	0.34	22.66	(33.71)	0.00	352	2,867	64.49	87.85
75 Normalized abnormal volume	Ascending	2,922	(4.93)	(0.02)	1.27	2.15	6.37	0.34	23.10	(16.38)	0.00	365	2,883	64.66	64.50
76 Float turnover, 12M	Descending	3,055	(5.20)	(0.92)	3.37	0.53	10.95	0.05	23.54	(31.61)	0.36	354	2,837	48.87	99.23
77 Moving average crossover, 15W-36W	Ascending	2,855	6.06	2.17	1.62	2.13	13.07	0.16	46.29	(55.07)	0.00	365	2,585	59.45	91.04
78 Log float-adj capitalization	Ascending	2,928	(9.52)	(1.37)	(0.38)	3.09	11.07	0.28	29.53	(40.68)	0.00	365	2,886	61.10	99.46
79 # of month in the database	Ascending	2,930	(3.84)	(0.96)	1.22	2.07	8.56	0.24	35.61	(23.86)	0.00	365	2,889	56.16	99.99
80 DB composite options factor	Ascending	1,782	0.27	1.91	0.10	1.09	3.68	0.30	13.99	(13.88)	0.00	202	1,935	63.86	26.20

Note:

1 Direction indicates how the factor scores are sorted. Ascending order means higher factors scores are likely to be associated with higher subsequent stock returns, and vice versa for descending order.

2 P-value indicates the statistical significance of the factor's performance. A smaller p-value suggests that is it more likely the factor's performance is different from zero.

3 This is the autocorrelation of the factor scores over time. Higher serial correlation indicates lower portfolio turnover based on the factor.

Source: Bloomberg Finance LP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Worldscope, Deutsche Bank

Figure 48: Global factor performance, measured as rank IC (S&P BMI World universe)

Factor Name	Direction[1]	Current # of Stocks	Average IC (%)			Since Inception									
			Last M	12M Avg	3Y Avg	Avg	Std Dev	Avg / Std Dev	Max	Min	p-value[2]	# of Months	Avg # of Stocks	Hit Rate (%)	Serial Corr (%)[3]
1. Value															
1 Dividend yield, trailing 12M	Ascending	10,971	(4.11)	1.79	4.10	4.12	9.98	0.41	36.88	(23.89)	0.00	341	8,482	64.52	97.86
2 Dividend yield, FY1	Ascending	8,369	(8.33)	(0.02)	2.27	3.82	10.25	0.37	32.17	(22.90)	0.00	284	5,848	62.68	98.24
3 Dividend yield, FY2	Ascending	8,269	(9.73)	(0.03)	2.17	3.66	10.33	0.35	33.19	(24.39)	0.00	274	5,827	62.41	98.24
4 Price/Earnings	Descending	9,089	(7.75)	0.12	0.93	3.48	12.35	0.28	39.66	(50.73)	0.00	334	6,739	59.28	96.37
5 Price-to-FY0 EPS	Descending	8,798	(9.92)	(1.84)	(0.36)	2.35	9.99	0.24	28.98	(37.08)	0.00	341	6,417	58.94	96.51
6 Earnings yield, FY0	Ascending	10,042	(8.78)	(0.53)	1.68	3.63	8.79	0.41	31.67	(18.68)	0.00	341	7,438	62.46	96.43
7 Earnings yield, forecast FY1 mean	Ascending	9,122	(12.08)	0.25	1.99	4.25	10.40	0.41	35.35	(22.20)	0.00	341	6,874	62.76	95.76
8 Earnings yield, forecast FY2 mean	Ascending	8,894	(13.65)	(0.12)	1.46	3.81	11.36	0.33	37.31	(31.50)	0.00	341	6,711	60.12	95.90
9 Cash flow yield, FY0	Ascending	6,943	(10.32)	(1.53)	0.20	3.09	6.65	0.47	26.42	(11.80)	0.00	217	5,513	68.66	97.36
10 Cash flow yield, FY1 mean	Ascending	6,414	(12.61)	(1.25)	(0.45)	1.47	9.50	0.15	31.42	(32.01)	0.01	273	4,889	54.21	95.98
11 Price/Sales	Descending	10,482	(11.45)	(0.72)	1.19	1.37	9.14	0.15	26.48	(31.59)	0.01	341	7,954	55.72	99.26
12 Price/Book	Descending	10,558	(10.09)	(1.33)	0.02	0.89	10.25	0.09	31.56	(37.54)	0.11	341	8,008	54.55	98.44
13 Est Book-to-price, median	Ascending	7,944	(11.75)	(1.71)	(0.66)	0.55	9.70	0.06	30.37	(26.29)	0.40	225	6,024	51.11	98.27
14 EBITDA to EV	Ascending	3,133	(10.50)	(0.37)	2.29	3.89	10.65	0.37	36.69	(26.20)	0.00	341	5,036	63.05	95.62
15 Sales/EV	Ascending	10,413	(6.54)	0.47	2.17	1.95	7.49	0.26	24.81	(20.06)	0.00	341	7,903	63.05	99.05
2. Growth															
16 IBES 5Y EPS growth	Ascending	9,005	4.75	2.12	1.89	1.25	5.88	0.21	19.09	(21.86)	0.00	341	6,626	60.70	98.03
17 EPS Growth	Ascending	9,813	5.71	1.70	1.48	2.03	6.42	0.32	29.72	(28.97)	0.00	325	7,365	65.23	87.97
18 IBES LTG EPS mean	Descending	4,291	(4.19)	(2.60)	(0.59)	1.05	11.28	0.09	28.22	(40.36)	0.09	341	4,281	51.03	96.50
19 IBES FY1 mean EPS growth	Ascending	8,916	3.38	2.33	0.50	0.39	5.80	0.07	14.44	(20.10)	0.21	341	6,717	54.55	88.60
20 IBES FY1 mean CFPS growth	Descending	4,963	(2.67)	(0.91)	0.16	1.44	4.00	0.36	7.47	(11.39)	0.00	217	4,285	61.75	91.64
21 IBES FY2 mean DPS growth	Ascending	8,247	(11.29)	(0.13)	0.88	2.09	10.18	0.21	38.85	(31.49)	0.00	283	5,708	58.66	88.31
22 Asset growth	Descending	10,449	(7.69)	(1.10)	0.38	0.57	7.95	0.07	21.57	(27.36)	0.19	341	7,767	51.91	93.71
3. Price Momentum and Reversal															
23 Total return, 1D	Descending	10,996	7.11	1.51	1.91	3.41	7.01	0.49	21.94	(41.58)	0.00	341	8,580	71.26	1.80
24 Weekly Total Return	Descending	10,996	4.03	2.17	2.12	2.71	8.37	0.32	30.60	(33.64)	0.00	341	8,579	63.93	1.32
25 Total return, 21D (1M)	Ascending	10,994	(5.34)	(2.41)	(0.30)	0.11	10.81	0.01	27.69	(44.07)	0.85	341	8,574	52.79	3.92
26 Total return, 252D (12M)	Ascending	10,719	7.04	5.26	2.77	4.18	13.85	0.30	41.64	(46.50)	0.00	341	8,361	66.86	90.62
27 12M-1M total return	Ascending	10,719	8.86	6.10	3.18	4.74	13.37	0.35	40.96	(42.52)	0.00	341	8,361	68.62	88.94
28 Total return, 1260D (60M)	Ascending	9,199	5.58	2.25	2.05	1.59	13.35	0.12	40.32	(44.84)	0.03	341	6,872	58.65	97.72
4. Sentiment															
29 IBES LTG Mean EPS Revision, 1M	Ascending	4,273	1.73	0.48	0.27	0.64	2.57	0.25	7.26	(8.59)	0.00	341	4,246	61.88	1.18
30 IBES LTG Mean EPS Revision, 3M	Ascending	4,235	0.36	0.59	0.46	0.80	3.34	0.24	11.05	(10.26)	0.00	341	4,192	61.29	60.62
31 IBES FY1 EPS up/down ratio, 1M	Ascending	5,928	5.45	2.90	1.75	3.48	5.32	0.65	17.76	(13.76)	0.00	341	4,593	75.37	34.20
32 IBES FY1 EPS up/down ratio, 3M	Ascending	8,289	6.57	3.25	2.24	3.52	5.66	0.62	17.92	(12.36)	0.00	341	6,197	74.49	78.22
33 IBES FY1 Mean EPS Revision, 1M	Ascending	8,974	4.67	2.38	1.40	2.71	4.96	0.55	16.50	(12.79)	0.00	341	6,723	71.55	23.30
34 IBES FY1 Mean EPS Revision, 3M	Ascending	8,879	6.32	3.19	2.02	3.26	6.44	0.51	19.37	(20.12)	0.00	341	6,627	73.02	73.81
35 IBES FY1 Mean CFPS Revision, 3M	Ascending	6,167	2.58	1.85	1.40	2.30	5.24	0.44	15.81	(23.83)	0.00	263	4,700	75.29	63.43
36 IBES FY1 Mean DPS Revision, 1M	Ascending	6,880	2.97	2.33	1.56	1.72	4.16	0.41	12.65	(16.63)	0.00	282	4,810	72.70	10.97
37 IBES FY1 Mean DPS Revision, 3M	Ascending	6,804	7.48	2.65	1.96	2.22	5.55	0.40	19.08	(24.51)	0.00	280	4,750	71.79	65.90
38 IBES FY1 Mean FFO Revision, 1M	Ascending	8,127	3.69	2.46	1.45	2.08	3.96	0.53	11.73	(8.89)	0.00	209	5,122	76.08	13.51
39 IBES FY1 Mean FFO Revision, 3M	Ascending	7,963	5.73	3.52	2.06	2.77	5.55	0.50	16.27	(14.53)	0.00	206	5,024	73.30	67.83
40 IBES FY1 Mean ROE Revision, 1M	Ascending	8,980	3.05	2.45	1.55	1.75	4.06	0.43	13.70	(10.51)	0.00	261	6,109	68.58	15.39
41 IBES FY1 Mean ROE Revision, 3M	Ascending	8,884	3.91	2.92	2.06	2.21	5.05	0.44	15.70	(13.58)	0.00	259	5,985	69.11	69.40
42 Target price implied return	Descending	8,969	1.83	(0.18)	1.10	1.05	13.28	0.08	55.58	(36.25)	0.24	225	6,941	54.22	82.88
43 Recommendation, mean	Descending	9,221	3.90	1.02	0.04	1.60	6.52	0.25	17.41	(16.84)	0.00	294	7,566	63.95	94.74
44 Mean recommendation revision, 3M	Descending	9,178	(0.68)	0.59	0.32	1.64	2.84	0.58	10.01	(10.13)	0.00	291	7,541	71.82	60.24
5. Quality															
45 Return on Equity	Ascending	10,349	0.39	2.15	3.30	4.06	9.47	0.43	30.68	(34.69)	0.00	293	8,112	68.94	97.18
46 return on capital	Ascending	10,447	(0.00)	1.76	3.11	4.22	11.50	0.37	49.47	(34.02)	0.00	341	7,495	66.28	98.00
47 Return on Assets	Ascending	10,562	16.48	3.21	3.69	4.63	12.62	0.37	44.20	(30.31)	0.00	341	7,615	64.81	98.07
48 Asset Turnover	Ascending	10,497	26.08	3.83	2.94	2.72	15.83	0.17	44.64	(51.55)	0.00	341	8,008	58.36	99.86
49 Gross margin	Ascending	9,939	6.80	1.79	1.38	1.72	5.56	0.31	16.60	(13.45)	0.00	341	7,347	63.05	98.95
50 EBITDA margin	Ascending	10,496	19.16	2.53	2.56	3.83	13.23	0.29	42.97	(41.30)	0.00	341	8,032	59.82	96.65
51 Berry Ratio	Ascending	8,603	(0.56)	0.56	1.00	2.50	8.90	0.28	29.57	(20.79)	0.00	341	5,810	58.94	97.91
52 IBES FY1 EPS dispersion	Descending	9,122	7.31	0.87	1.98	0.83	9.48	0.09	32.68	(25.37)	0.11	341	6,874	52.49	88.01
53 IBES 5Y EPS growth/stability	Ascending	9,003	5.09	2.74	2.16	1.58	5.77	0.27	18.66	(20.47)	0.00	341	6,626	61.00	98.29
54 YoY change in debt outstanding	Descending	8,855	(1.39)	(0.41)	0.11	0.22	3.68	0.06	11.51	(11.34)	0.27	341	6,658	53.67	91.51
55 Current ratio	Descending	8,798	(12.16)	(1.93)	(0.11)	0.51	8.43	0.06	27.86	(27.01)	0.26	341	6,564	49.27	98.54
56 Long-term debt/equity	Ascending	10,359	(3.71)	0.09	0.57	0.75	6.24	0.12	22.37	(18.17)	0.03	341	7,915	54.55	98.90
57 Merton's distance to default	Ascending	9,054	0.98	1.97	3.63	2.85	10.82	0.26	31.19	(31.18)	0.00	341	6,854	61.00	93.18
58 Capex to Dep	Descending	8,596	12.73	1.69	1.09	1.50	6.50	0.23	22.38	(19.93)	0.00	341	5,707	60.41	97.12
6. Technicals															
59 Realized vol, 1Y daily	Descending	10,711	(2.51)	2.73	5.91	5.20	14.43	0.36	29.45	(44.64)	0.00	341	8,366	62.76	98.96
60 Skewness, 1Y daily	Descending	10,711	2.62	1.60	3.15	1.74	5.18	0.34	15.03	(32.98)	0.00	341	8,366	65.40	90.09
61 Moving average crossover, 15W-36W	Ascending	10,673	8.11	4.45	2.69	2.98	13.86	0.21	37.15	(45.46)	0.00	341	7,497	63.64	91.34
62 Normalized abnormal volume	Ascending	10,955	4.55	3.69	3.53	2.50	6.28	0.40	20.47	(14.71)	0.00	341	8,373	63.64	66.85

Note:

1 Direction indicates how the factor scores are sorted. Ascending order means higher factors scores are likely to be associated with higher subsequent stock returns, and vice versa for descending order.

2 P-value indicates the statistical significance of the factor's performance. A smaller p-value suggests that is it more likely the factor's performance is different from zero.

3 This is the autocorrelation of the factor scores over time. Higher serial correlation indicates lower portfolio turnover based on the factor.

Source: Bloomberg Finance LP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Worldscope, Deutsche Bank

Appendix 1

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